AMERICAN ACADEMY OF PEDIATRICS

Policy of the American Academy of Pediatrics

Pediatric Clinical Practice Guidelines & Policies

A Compendium of Evidence-based Research for Pediatric Practice

18th Edition

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18th Edition

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

Clinical practice guidelines have long provided physicians with evidence-based decision-making tools for managing common pediatric conditions. Policy statements issued and endorsed by the American Academy of Pediatrics (AAP) are developed to provide physicians with a quick reference guide to the AAP position on child health care issues. We have combined these 2 authoritative resources into 1 comprehensive manual/eBook resource to provide easy access to important clinical and policy information.

This manual contains

- Clinical practice guidelines from the AAP, plus related recommendation summaries, *ICD-10-CM* coding information, and AAP patient education handouts
- Clinical practice guidelines endorsed by the AAP, including abstracts where applicable
- Policy statements, clinical reports, and technical reports issued or endorsed through December 2017, including abstracts where applicable
- Full text of all 2017 AAP policy statements, clinical reports, and technical reports

The eBook, which is available via the code on the inside cover of this manual, builds on content of the manual and points to the full text of all AAP

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

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

Additional information about AAP policy can be found in a variety of professional publications such as

Guidelines for Air and Ground Transport of Neonatal and Pediatric Patients, 4th Edition

Pediatric Nutrition, 7th Edition

Guidelines for Perinatal Care, 8th Edition

Pediatric Environmental Health, 3rd Edition

Care of the Young Athlete, 2nd Edition

Red Book®, 31st Edition, and *Red Book® Online* (http://redbook.solutions.aap.org)

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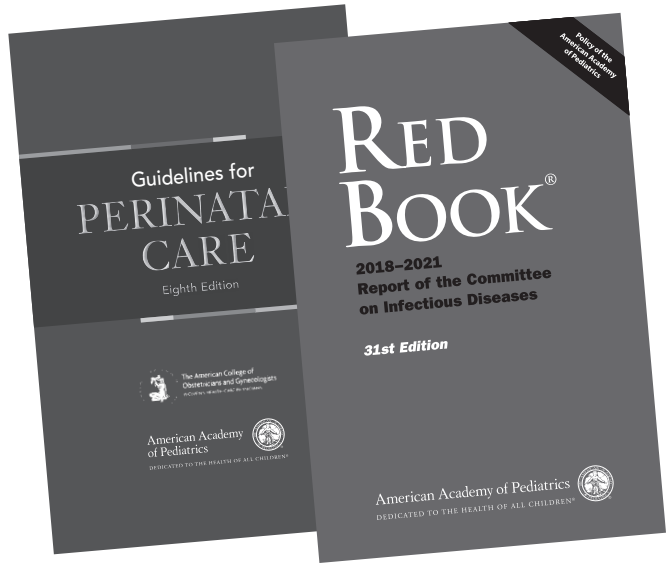

All policy statements, clinical reports, and technical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time. Please check the American Academy of Pediatrics Web site at www.aap.org for up-to-date reaffirmations,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

AMERICAN ACADEMY OF PEDIATRICS

The American Academy of Pediatrics (AAP) and its member pediatricians dedicate their efforts and resources to the health, safety, and well-being of infants, children, adolescents, and young adults. The AAP has approximately 66,000 members in the United States, Canada, and Latin America. Members include pediatricians, pediatric medical subspecialists, and pediatric surgical specialists.

Core Values. ***We believe***

- In the inherent worth of all children; they are our most enduring and vulnerable legacy.
- Children deserve optimal health and the highest quality health care.
- Pediatricians, pediatric medical subspecialists, and pediatric surgical specialists are the best qualified to provide child health care.
- Multidisciplinary teams including patients and families are integral to delivering the highest quality health care.

The AAP is the organization to advance child health and well-being and the profession of pediatrics.

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

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

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FOREWORD

To promote the practice of evidence-based medicine, the American Academy of Pediatrics (AAP) provides physicians with evidence-based guidelines for managing common pediatric conditions. The AAP has an established organizational process and methodology for the development of these clinical practice guidelines.

The evidence-based approach to developing clinical practice guidelines requires systematically defining the problem and identifying interventions and health outcomes. Extensive literature reviews and data syntheses provide the basis for guideline recommendations. Clinical practice guidelines also undergo a thorough peer-review process prior to publication and are periodically reviewed to ensure that they are based on the most current data available.

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

This manual contains clinical practice guidelines, technical reports, and technical report summaries developed and published by the AAP. Each one contains a summary of data reviewed, results of data analysis, complete evidence tables, and a bibliography of articles included in the review. This manual also contains abstracts and introductions for evidence-based clinical practice guidelines from other organizations that the AAP has endorsed. The AAP is committed to systematically evaluating these documents and disseminating appropriate documents to its membership. Clinical practice guidelines will continually be added to this compendium as they are released or updated. We encourage you to look forward to these future guidelines. Additionally, this edition includes the full text of all policy statements, clinical reports, and technical reports published in 2017 by the AAP as well as abstracts of all active AAP and endorsed policy statements and reports. Policy statements, where possible, should include the quality of evidence and strength of recommendations using a generally acceptable grading system. Both intellectual transparency and financial transparency are essential and should appear in all clinical practice guidelines, as well as policy statements, clinical reports, and technical reports. The companion eBook points to all active AAP and endorsed policy statements and reports published prior to 2017.

If you have any questions about current or future clinical practice guidelines, please contact Kymika Okechukwu, senior manager of evidence-based medicine initiatives at the AAP, at 630/626-6317 or via e-mail at kokechukwu@aap.org.

To order copies of patient education resources that accompany each guideline, please call the AAP at 866/843-2271 or visit http://shop.aap.org/books.

Wayne H. Franklin, MD, MPH, MMM, FAAP
Chairperson, Council on Quality Improvement and Patient Safety

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

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 1 for more information.

CLINICAL PRACTICE GUIDELINE

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

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

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

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

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

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

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

abstract


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

Summary of key action statements:

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

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

INTRODUCTION

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

Expanded Age Range

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

Expanded Scope

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

A Process of Care for Diagnosis and Treatment

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

provides a single algorithm to guide the clinical process.

Integration With the Task Force on Mental Health

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

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

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

METHODOLOGY

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

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

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

The diagnostic issues were focused on 5 areas:

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

The treatment issues were focused on 3 areas:

1. What new information is available

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

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

Evidence-Review Process for Diagnosis

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

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

Evidence-Review Process for Treatment

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

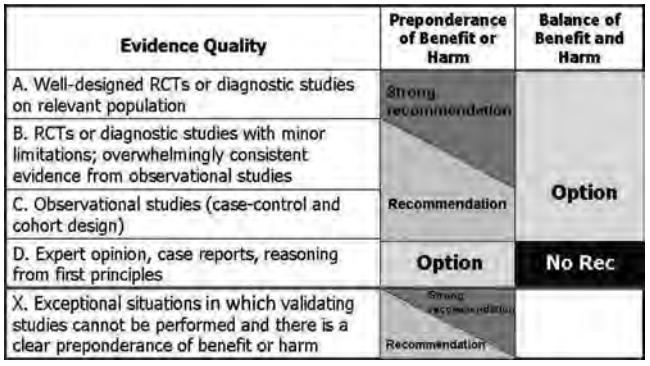

FIGURE 1

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

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

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

ABOUT THIS GUIDELINE

Key Action Statements

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

Context

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

Implementation: A Process-of-Care Algorithm

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

Implementation: Preparing the Practice

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

Note

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

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

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

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

Evidence Profile

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

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

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

Evidence Profile

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

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

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

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

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

Special Circumstances: Adolescents

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

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

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

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

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

Evidence Profile

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

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

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

Special Circumstances: Adolescents

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

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

Evidence Profile

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

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

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

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

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

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

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

Evidence Profile

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

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

Evidence Profile

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

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

Evidence Profile

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

Medication

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

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

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

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

Special Circumstances: Preschool-aged Children

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

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

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

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

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

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

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

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

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

Special Circumstances: Adolescents

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

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

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

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

Behavior Therapy

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

TABLE 1 Evidence-Based Behavioral Treatments for ADHD

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

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

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

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

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

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

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

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

School Programming and Supports

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

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

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

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

Evidence Profile

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

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

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

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

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

CONCLUSION

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

AREAS FOR FUTURE RESEARCH

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

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

electroencephalographic biofeedback;

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

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

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

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

Action Statement Summary

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

Key Action Statement 1

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

Key Action Statement 2

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

Key Action Statement 3

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

Key Action Statement 4

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

Key Action Statement 5

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

Key Action Statement 5a

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

Key Action Statement 5b

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

Key Action Statement 5c

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

Key Action Statement 6

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

Coding Quick Reference for ADHD
ICD-10-CM
F90.0 Attention-deficit hyperactivity disorder, predominantly inattentive type
F90.1 Attention-deficit hyperactivity disorder, predominantly hyperactive type

ADHD Coding Fact Sheet for Primary Care Physicians

Current Procedural Terminology (*CPT*®) (Procedure) Codes

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

Physician E/M Services

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

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

[a] A new patient is one who has not received any professional services (face-to-face services) rendered by physicians and other qualified health care professionals who may report E/M services using 1 or more specific *CPT* codes from the physician/qualified health care professional, or another physician/qualified health care professional of the exact same specialty and subspecialty who belongs to the same group practice, within the past 3 years.

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

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

[d] For more information on consultation code changes for 2010, see www.aap.org/en-us/professional-resources/practice-transformation/getting-paid/Coding-at-the-AAP/Pages/ADHD-Coding-Fact-Sheet.aspx.

\+ Codes are *add-on codes*, meaning they are reported separately in addition to the appropriate code for the service provided.
* Indicates a *CPT*-approved telemedicine service.

Reporting E/M Services Using "Time"

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

ADHD Follow-up During a Routine Preventive Medicine Service

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

Physician Non–face-to-face Services

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

99340 30 minutes or more

99358 Prolonged physician services without direct patient contact; first hour

+99359 each additional 30 min. (+ *use in conjunction with* **99358**)

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

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

99442 11–20 minutes of medical discussion

99443 21–30 minutes of medical discussion

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

Care Management Services

Codes are selected according to the amount of time spent by clinical staff providing care coordination activities. *CPT* clearly defines which activities are care coordination activities. To report chronic care management codes, you must

1. Provide 24/7 access to physicians or other qualified health care professionals or clinical staff.
2. Use a standardized methodology to identify patients who require chronic complex care coordination services.
3. Have an internal care coordination process/function whereby a patient identified as meeting the requirements for these services starts receiving them in a timely manner.
4. Use a form and format in the medical record that is standardized within the practice.
5. Be able to engage and educate patients and caregivers, as well as coordinate care among all service professionals, as appropriate for each patient.

99490 Chronic care management services, at least 20 minutes of clinical staff time directed by a physician or other qualified health care professional, per calendar month, with the following required elements:

- multiple (two or more) chronic conditions expected to last at least 12 months, or until the death of the patient;
- chronic conditions place the patient at significant risk of death, acute exacerbation/decompensation, or functional decline;
- comprehensive care plan established, implemented, revised, or monitored.

Chronic care management services are provided when medical needs or psychosocial needs (or both types of needs) of the patient require establishing, implementing, revising, or monitoring the care plan. If 20 minutes is not met within a calendar month, you do not report chronic care management. Refer to *CPT* for more information.

Psychiatry

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

Psychiatric Diagnostic or Evaluative Interview Procedures

90791 Psychiatric diagnostic interview examination evaluation

90792 Psychiatric diagnostic evaluation with medical services

Psychotherapy

***90832** Psychotherapy, 30 min with patient;

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

***90834** Psychotherapy, 45 min with patient;

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

***90837** Psychotherapy, 60 min with patient;

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

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

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

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

* Indicates a *CPT*-approved telemedicine service.

— Patients who require the involvement of other third parties such as child welfare agencies, schools, or probation officers

***90846** Family psychotherapy (without patient present), 50 min

***90847** Family psychotherapy (conjoint psychotherapy) (with patient present), 50 min

Other Psychiatric Services/Procedures

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

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

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

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

Psychological Testing

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

96102 Psychological testing (includes psychodiagnostic assessment of emotionality, intellectual abilities, personality and psychopathology, e.g., MMPI, Rorschach, WAIS), with *qualified health care professional* interpretation and report, administered by technician, per hour of technician time, face-to-face

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

96110 Developmental screening, with scoring and documentation, per standardized instrument (Do not use for ADHD screens or assessments)

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

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

96127 Brief emotional/behavioral assessment (eg, depression inventory, attention-deficit/hyperactivity disorder [ADHD] scale), with scoring and documentation, per standardized instrument

97127 Therapeutic interventions that focus on cognitive function (eg, attention, memory, reasoning, executive function, problem solving, and/or pragmatic functioning) and compensatory strategies to manage the performance of an activity (eg, managing time or schedules, initiating, organizing and sequencing tasks), direct (one-on-one) patient contact

Nonphysician Provider (NPP) Services

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

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

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

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

***96151** re-assessment

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

***96153** group (2 or more patients)

***96154** family (with the patient present)

96155 family (without the patient present)

Non–face-to-face Services: NPP

98966 Telephone assessment and management service provided by a qualified nonphysician health care professional to an established patient, parent or guardian not originating from a related assessment and management service provided within the previous seven days nor leading to an assessment and management service or procedure within the next 24 hours or soonest available appointment; 5–10 minutes of medical discussion

98967 11–20 minutes of medical discussion

98968 21–30 minutes of medical discussion

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

* Indicates a *CPT*-approved telemedicine service.

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

Miscellaneous Services

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

Clinical Staff

99484 Care management services for *behavioral health conditions*, at least 20 minutes of clinical staff time, directed by a physician or other qualified health care professional, per calendar month, with the following required elements:
- initial assessment or follow-up monitoring, including the use of applicable validated rating scales;
- behavioral health care planning in relation to behavioral/ psychiatric health problems, including revision for patients who are not progressing or whose status changes;
- facilitating and coordinating treatment such as psychotherapy, pharmacotherapy, counseling and/ or psychiatric consultation; and
- continuity of care with a designated member of the care team.
- Do not report in conjunction with psychiatric collaborative care management codes (**99492**, **99493**, **99494**) for the same calendar month.

99492 Initial psychiatric collaborative care management, first 70 minutes in the first calendar month of behavioral health care manager activities, in consultation with a psychiatric consultant, and directed by the treating physician or other qualified health care professional, with the following required elements:
- outreach to and engagement in treatment of a patient directed by the treating physician or other qualified health care professional;
- initial assessment of the patient, including administration of validated rating scales, with the development of an individualized treatment plan;
- review by the psychiatric consultant with modifications of the plan if recommended;
- entering patient in a registry and tracking patient follow-up and progress using the registry, with appropriate documentation, and participation in weekly caseload consultation with the psychiatric consultant; and
- provision of brief interventions using evidence-based techniques such as behavioral activation, motivational interviewing, and other focused treatment strategies.

99493 Subsequent psychiatric collaborative care management, first 60 minutes in a subsequent month of behavioral health care manager activities, in consultation with a psychiatric consultant, and directed by the treating physician or other qualified health care professional, with the following required elements:
- tracking patient follow-up and progress using the registry, with appropriate documentation;
- participation in weekly caseload consultation with the psychiatric consultant;
- ongoing collaboration with and coordination of the patient's mental health care with the treating physician or other qualified health care professional and any other treating mental health providers;
- additional review of progress and recommendations for changes in treatment, as indicated, including medications, based on recommendations provided by the psychiatric consultant;
- provision of brief interventions using evidence-based techniques such as behavioral activation, motivational interviewing, and other focused treatment strategies;
- monitoring of patient outcomes using validated rating scales; and
- relapse prevention planning with patients as they achieve remission of symptoms and/or other treatment goals and are prepared for discharge from active treatment.

+99494 Initial or subsequent psychiatric collaborative care management, each additional 30 minutes in a calendar month of behavioral health care manager activities, in consultation with a psychiatric consultant, and directed by the treating physician or other qualified health care professional (Use **99494** in conjunction with **99492**, **99493**)

ICD-10-CM Codes

- Use as many diagnosis codes that apply to document the patient's complexity and report the patient's symptoms or adverse environmental circumstances (or both).
- Once a definitive diagnosis is established, report any appropriate definitive diagnosis codes as the primary codes, plus any other symptoms that the patient is exhibiting as secondary diagnoses that are not part of the usual disease course or are considered incidental.
- ***ICD-10-CM* codes are only valid on or after October 1, 2015.**

Depressive Disorders

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

Anxiety Disorders

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

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

Feeding and Eating Disorders/Elimination Disorders

F50.89 Eating disorders, other
F50.9 Eating disorder, unspecified
F98.0 Enuresis not due to a substance or known physiological condition
F98.1 Encopresis not due to a substance or known physiological condition
F98.3 Pica (infancy or childhood)

Impulse Disorders

F63.9 Impulse disorder, unspecified

Trauma- and Stressor-Related Disorders

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

Neurodevelopmental/Other Developmental Disorders

F70 Mild intellectual disabilities
F71 Moderate intellectual disabilities
F72 Severe intellectual disabilities
F73 Profound intellectual disabilities
F79 Unspecified intellectual disabilities
F80.0 Phonological (speech) disorder (speech-sound disorder)
F80.1 Expressive language disorder
F80.2 Mixed receptive-expressive language disorder
F80.4 Speech and language developmental delay due to hearing loss (code also hearing loss)
F80.81 Stuttering
F80.82 Social pragmatic communication disorder
F80.89 Other developmental disorders of speech and language
F80.9 Developmental disorder of speech and language, unspecified
F81.0 Specific reading disorder
F81.2 Mathematics disorder
F81.89 Other developmental disorders of scholastic skills
F82 Developmental coordination disorder
F84.0 Autistic disorder (Autism spectrum disorder)
F88 Specified delays in development; other
F89 Unspecified delay in development
F81.9 Developmental disorder of scholastic skills, unspecified

Behavioral/Emotional Disorders

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

Other

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

Substance-Related and Addictive Disorders

If a provider documents multiple patterns of use, only 1 should be reported. Use the following hierarchy: use–abuse–dependence (eg, if use and dependence are documented, only code for dependence).

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

0 anxiety disorder

2 sleep disorder

8 other disorder

9 unspecified disorder

Alcohol

F10.10 Alcohol abuse, uncomplicated (alcohol use disorder, mild)
F10.14 Alcohol abuse with alcohol-induced mood disorder
F10.159 Alcohol abuse with alcohol-induced psychotic disorder, unspecified
F10.18- Alcohol abuse with alcohol-induced
F10.19 Alcohol abuse with unspecified alcohol-induced disorder
F10.20 Alcohol dependence, uncomplicated
F10.21 Alcohol dependence, in remission

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.
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F10.24 Alcohol dependence with alcohol-induced mood disorder
F10.259 Alcohol dependence with alcohol-induced psychotic disorder, unspecified
F10.28- Alcohol dependence with alcohol-induced
F10.29 Alcohol dependence with unspecified alcohol-induced disorder
F10.94 Alcohol use, unspecified with alcohol-induced mood disorder
F10.959 Alcohol use, unspecified with alcohol-induced psychotic disorder, unspecified
F10.98- Alcohol use, unspecified with alcohol-induced
F10.99 Alcohol use, unspecified with unspecified alcohol-induced disorder

Cannabis

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

Sedatives

F13.10 Sedative, hypnotic or anxiolytic abuse, uncomplicated (sedative, hypnotic, or anxiolytic use disorder, mild)
F13.129 Sedative, hypnotic or anxiolytic abuse with intoxication, unspecified
F13.14 Sedative, hypnotic or anxiolytic abuse with sedative, hypnotic or anxiolytic-induced mood disorder
F13.18- Sedative, hypnotic or anxiolytic abuse with sedative, hypnotic or anxiolytic-induced
F13.21 Sedative, hypnotic or anxiolytic dependence, in remission
F13.90 Sedative, hypnotic or anxiolytic use, unspecified, uncomplicated
F13.94 Sedative, hypnotic or anxiolytic use, unspecified with sedative, hypnotic or anxiolytic-induced mood disorder
F13.98- Sedative, hypnotic or anxiolytic use, unspecified with sedative, hypnotic or anxiolytic-induced
F13.99 Sedative, hypnotic or anxiolytic use, unspecified with unspecified sedative, hypnotic or anxiolytic-induced disorder

Stimulants (eg, caffeine, amphetamines)

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

Nicotine (eg, cigarettes)

F17.200 Nicotine dependence, unspecified, uncomplicated (tobacco use disorder, mild, moderate or severe)
F17.201 Nicotine dependence, unspecified, in remission
F17.203 Nicotine dependence, unspecified, with withdrawal
F17.20- Nicotine dependence, unspecified, with
F17.210 Nicotine dependence, cigarettes, uncomplicated
F17.211 Nicotine dependence, cigarettes, in remission
F17.213 Nicotine dependence, cigarettes, with withdrawal
F17.218- Nicotine dependence, cigarettes, with

Symptoms, Signs, and Ill-defined Conditions

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

G47.9 Sleep disorder, unspecified
H90.0 Conductive hearing loss, bilateral
H90.11 Conductive hearing loss, unilateral, right ear, with unrestricted hearing on the contralateral side
H90.12 Conductive hearing loss, unilateral, left ear, with unrestricted hearing on the contralateral side
H90.A1- Conductive hearing loss, unilateral, with restricted hearing on the contralateral side
H90.A2- Sensorineural hearing loss, unilateral, with restricted hearing on the contralateral side
H90.A3- Mixed conductive and sensorineural hearing loss, unilateral, with restricted hearing on the contralateral side
(Codes under category **H90** require a 6th digit: 1–right ear, 2–left ear)
K11.7 Disturbance of salivary secretions
K59.00 Constipation, unspecified
N39.44 Nocturnal enuresis
R10.0 Acute abdomen pain
R11.11 Vomiting without nausea
R11.2 Nausea with vomiting, unspecified

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R19.7 Diarrhea, unspecified
R21 Rash, NOS
R25.0 Abnormal head movements
R25.1 Tremor, unspecified
R25.3 Twitching, NOS
R25.8 Other abnormal involuntary movements
R25.9 Unspecified abnormal involuntary movements
R27.8 Other lack of coordination (excludes ataxia)
R27.9 Unspecified lack of coordination
R41.83 Borderline intellectual functioning
R42 Dizziness
R48.0 Alexia/dyslexia, NOS
R51 Headache
R62.0 Delayed milestone in childhood
R62.52 Short stature (child)
R63.3 Feeding difficulties
R63.4 Abnormal weight loss
R63.5 Abnormal weight gain
R68.2 Dry mouth, unspecified
T56.0X1A Toxic effect of lead and its compounds, accidental (unintentional), initial encounter

Z Codes

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

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

Z13.89 Encounter for screening for other disorder
Z55.0 Illiteracy and low-level literacy
Z55.2 Failed school examinations
Z55.3 Underachievement in school
Z55.4 Educational maladjustment and discord with teachers and classmates
Z55.8 Other problems related to education and literacy
Z55.9 Problems related to education and literacy, unspecified
(**Z55** codes exclude those conditions reported with **F80–F89**)
Z60.4 Social exclusion and rejection
Z60.8 Other problems related to social environment
Z60.9 Problem related to social environment, unspecified
Z62.0 Inadequate parental supervision and control
Z62.21 Foster care status (child welfare)
Z62.6 Inappropriate (excessive) parental pressure
Z62.810 Personal history of physical and sexual abuse in childhood
Z62.811 Personal history of psychological abuse in childhood
Z62.820 Parent-biological child conflict
Z62.821 Parent-adopted child conflict
Z62.822 Parent-foster child conflict
Z63.72 Alcoholism and drug addiction in family
Z63.8 Other specified problems related to primary support group
Z65.3 Problems related to legal circumstances
Z71.89 Counseling, other specified
Z71.9 Counseling, unspecified
Z72.0 Tobacco use
Z77.011 Contact with and (suspected) exposure to lead
Z79.899 Other long term (current) drug therapy
Z81.0 Family history of intellectual disabilities (conditions classifiable to **F70–F79**)
Z81.8 Family history of other mental and behavioral disorders
Z83.2 Family history of diseases of the blood and blood-forming organs (anemia) (conditions classifiable to **D50–D89**)
Z86.2 Personal history of diseases of the blood and blood-forming organs
Z86.39 Personal history of other endocrine, nutritional, and metabolic disease
Z86.59 Personal history of other mental and behavioral disorders
Z86.69 Personal history of other diseases of the nervous system and sense organs
Z87.09 Personal history of other diseases of the respiratory system
Z87.19 Personal history of other diseases of the digestive system
Z87.798 Personal history of other (corrected) congenital malformations
Z87.820 Personal history of traumatic brain injury
Z91.128 Patient's intentional underdosing of medication regimen for other reason (report drug code)
Z91.138 Patient's unintentional underdosing of medication regimen for other reason (report drug code)
Z91.14 Patient's other noncompliance with medication regimen
Z91.19 Patient's noncompliance with other medical treatment and regimen
Z91.411 Personal history of adult psychological abuse

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

The following continuum model from *Coding for Pediatrics 2018* has been devised to express the various levels of service for ADHD. This model demonstrates the cumulative effect of the key criteria for each level of service using a single diagnosis as the common denominator. It also shows the importance of other variables, such as patient age, duration and severity of illness, social contexts, and comorbid conditions, that often have key roles in pediatric cases.

Quick Reference for Codes Used in Continuum for ADHD—Established Patients[a]

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

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

Adapted from American Academy of Pediatrics. *Coding for Pediatrics 2018: A Manual for Pediatric Documentation and Payment*. 23rd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2018.

Continuum Model for Attention-Deficit/Hyperactivity Disorder			
***CPT*® Code Vignette**	**History**	**Physical Examination**	**Medical Decision-making**
99211[a] Nurse visit to follow up growth or blood pressure prior to renewing prescription for psychoactive drugs	1. Chief complaint 2. Brief HPI, existing medications, and desired/undesired effects	1. Weight, blood pressure 2. Overall appearance	1. Refill existing prescription.
99212 Follow-up visit to recheck prior weight loss in patient with established ADHD otherwise stable on stimulant medication	**Problem focused** 1. Chief complaint 2. Brief HPI, existing medications, and desired/undesired effects	**Problem focused** 1. Weight, blood pressure 2. Overall appearance	**Straightforward** 1. Refill existing prescription.
99213 (Typical time: 15 min) 3- to 6-month follow-up of child with ADHD who is presently doing well using medication and without other problems OR May be reported based on time if more than 50% of the face-to-face encounter is spent in counseling and/or coordination of care	**Expanded problem focused** 1. Reason for the visit 2. Review of medications 3. Effect of medication on appetite, mood, sleep 4. Quality of schoolwork (eg, review report cards) 5. Absence of tics 6. Problem-pertinent ROS	**Expanded problem focused** 1. General multisystem examination or single organ system examination with special reference to neurologic examination	**Low complexity** 1. Review rating scale results and feedback materials from teacher. 2. Discuss 6-month treatment plan with adjustment of medication. 3. Plan for further monitoring.
99214 (Typical time: 25 min) Follow-up evaluation of an established patient with ADHD with failure to improve on medication and/or weight loss OR May be reported based on time if more than 50% of the face-to-face encounter is spent in counseling and/or coordination of care	**Detailed** All data implicit in **99213** expanded plus pertinent review of PFSH and extended ROS, including gastrointestinal and psychiatric	**Detailed** 1. General multisystem examination or detailed single organ system examination of neurologic system	**Moderate complexity** 1. Review rating scale results and feedback materials from teacher. 2. Discussion of possible interventions, including, but not limited to a. Educational intervention b. Alteration in medications c. Obtaining drug levels d. Psychiatric intervention e. Behavioral modification program

Continuum Model for Attention-Deficit/Hyperactivity Disorder (*continued*)			
***CPT*® Code Vignette**	**History**	**Physical Examination**	**Medical Decision-making**
99215 (Typical time: 40 min) Initial evaluation of an established patient experiencing difficulty in classroom, home, or social situation and suspected of having ADHD This could be billed as a consultation if the established patient is referred by school for opinion or advice (not transfer of care) and the criteria for reporting a consultation are met. May be reported based on time if more than 50% of the face-to-face encounter is spent in counseling and/or coordination of care	**Comprehensive** 1. Chief complaint 2. History of the problem, extended 3. Complete PFSH 4. Complete ROS	**Comprehensive** 1. General multisystem examination with special attention to neurologic examination and mental health status	**High complexity** Review of Vanderbilt scales, school record, any other formal evaluations completed to date; discussion of differential diagnoses; possible interventions including, but not limited to 1. Educational interventions 2. Initiation of medications 3. Obtaining drug levels or ruling out substance abuse, if appropriate 4. Laboratory tests as indicated (eg, complete blood cell count and iron studies, serum lead levels) 5. Psychological and/or psychiatric interventions 6. Behavioral modification program 7. Consideration of neurology consultation 8. Coordination of care services with school, family, and other providers

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; CPT, Current Procedural Terminology; *HPI, history of present illness; PFSH, past, family, and social history; ROS, review of systems.*

[a] *There are no required key components for code* ***99211****; however, the nurse must document his or her history, physical examination, and assessment to support medical necessity.*

Understanding ADHD:

Information for Parents About Attention-Deficit/Hyperactivity Disorder

Almost all children have times when their behavior veers out of control. However, for some children, these kinds of behaviors are more than an occasional problem.

Children with attention-deficit/hyperactivity disorder (ADHD) have behavioral problems that are so frequent and severe that they interfere with their ability to live normal lives. An impulsive nature may put them in actual physical danger. They may speed about in constant motion, make noise nonstop, refuse to wait their turn, and crash into everything around them. At other times, they may drift as if in a daydream, unable to pay attention or finish what they start. Those who have trouble paying attention usually have trouble learning.

Left untreated, ADHD in some children will continue to cause serious, lifelong problems, such as poor grades in school, run-ins with the law, failed relationships, and the inability to keep a job. Children with ADHD often have trouble getting along with siblings and other children at school, at home, and in other settings. They may be labeled "bad kids" or "space cadets."

If your child has ADHD, effective treatment is available. Your child's doctor can offer a long-term treatment plan to help your child lead a happy and healthy life. As a parent, you have a very important role in this treatment. Here is more information from the American Academy of Pediatrics about ADHD and how you can help your child.

> **NOTE:** To make reading this publication easier, the pronoun *he* is used to describe a child or teen.

What is ADHD?

ADHD is a condition of the brain that makes it difficult for children to control their behavior. It is one of the most common chronic conditions of childhood. It affects 6% to 12% of school-aged children. ADHD is diagnosed about 3 times more often in boys than in girls. The condition affects behavior in specific ways. See section, *What are the symptoms of ADHD?*

What are the symptoms of ADHD?

ADHD includes 3 groups of behavioral symptoms: inattention, hyperactivity, and impulsivity. See Table 1.

Are there different types of ADHD?

Children with ADHD may have one or more of the symptoms listed in Table 1. The symptoms are usually classified as the following types of ADHD:

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

Table 1. Symptoms of ADHD

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

How can I tell if my child has ADHD?

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

Sometimes a teacher is the first to notice inattention, hyperactivity, and/or impulsivity and will inform the parents.

Keep Safety in Mind

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

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

Maybe questions from your child's doctor raised the issue. At well-child visits, your child's doctor may ask

- How is your child doing in school?
- Are there any problems with learning that you or your child's teachers have seen?
- Is your child happy in school?
- Is your child having problems completing class work or homework?
- Are you concerned with any behavioral problems in school, at home, or when your child is playing with friends?

Your answers to these questions may lead to further evaluation for ADHD.

If your child has shown symptoms of ADHD on a regular basis for more than 6 months, discuss this with his doctor.

How is ADHD diagnosed?

Your child's doctor will determine whether he has ADHD by using standard guidelines developed by the American Academy of Pediatrics specifically for children 4 to 18 years of age.

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

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

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

Here are guidelines used to confirm a diagnosis of ADHD.

- Some symptoms occur in 2 or more settings, such as home, school, and social situations, and cause some impairment.
- In a child 4 to 17 years of age, 6 or more symptoms must be identified.
- In a teen 17 years and older, 5 or more symptoms must be identified.
- Symptoms significantly impair your child's ability to function in some daily activities, such as doing schoolwork, maintaining relationships with parents and siblings, building relationships with friends, or having the ability to function in groups such as sports teams.

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

Your child's doctor may refer your child to a pediatric subspecialist or mental health clinician if there are concerns in any of the following areas:

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

How can parents help with the diagnosis?

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

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

How will my child's school be involved?

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

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

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

How will others who care for my child be involved?

Other caregivers may also provide important information about your child's behavior. Former teachers, religious and scout leaders, or coaches may have valuable input. If your child is homeschooled,

it is especially important to assess his behavior in settings outside of the home.

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

In some cases, other mental health care professionals, such as child psychologists or psychiatrists, may also need to be involved in gathering information for the diagnosis.

What are coexisting conditions?

As part of the diagnosis, your child's doctor will look for other conditions that cause the same types of symptoms as ADHD. Your child may simply have a different condition or ADHD combined with another condition (a *coexisting* condition). Most children with a diagnosis of ADHD have at least one additional condition.

Common coexisting conditions include

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

Are there other tests for ADHD?

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

Many theories have been presented, but studies have shown that the following evaluations add little value in diagnosing the disorder:

- Screening for thyroid problems
- Computerized continuous performance tests
- Brain imaging studies, such as computed tomography (CT) scans and magnetic resonance imaging (MRI)
- Electroencephalography (EEG) or brain-wave testing

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

What causes ADHD?

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

Research to date has shown

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

There is little evidence that ADHD is caused by

- Eating too much sugar
- Food additives or food colorings
- Allergies
- Immunizations

How is ADHD treated?

Once the diagnosis is confirmed, the outlook for most children who receive treatment for ADHD is encouraging. There is no specific cure for ADHD, but there are many treatment options available, and some children learn to compensate for the difficulties as they mature.

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

- A long-term management plan with
  - — Target outcomes for behavior
  - — Follow-up activities
  - — Monitoring

- Education about ADHD
- Teamwork among doctors, parents, teachers, caregivers, other health care professionals, and the child
- Behavioral therapy, including parent training
- Individual and family counseling
- Medication

Treatment for ADHD is based on the same principles that are used to treat other chronic conditions, like asthma or diabetes. Long-term planning for many children is needed because these conditions are not curable. However, some children learn to compensate once they are adults. Families must manage chronic conditions on an ongoing basis. In the case of ADHD, schools and other caregivers must also be involved in managing the condition.

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

What are target outcomes?

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

Here are examples of target outcomes.

- Improved relationships with parents, siblings, teachers, and friends — for example, fewer arguments with brothers or sisters or being invited more often to friends' houses or parties.
- Better schoolwork practices — for example, completing all classwork or homework assignments.
- More independence in self-care or homework — for example, getting ready for school in the morning without supervision.
- Improved self-esteem, such as feeling that he can get his work done.
- Fewer disruptive behaviors — for example, decreasing the number of times he refuses to obey rules.
- Safer behavior in the community — for example, being careful when crossing streets.

The target outcomes should be

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

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

What is behavioral therapy?

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

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

Table 2. Behavioral Therapy Techniques

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

Behavioral therapy has 3 basic principles.

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

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

Table 2 shows specific behavioral therapy techniques that can be effective with children who have ADHD.

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

How can I help my child control his behavior?

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

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

Ask your child's doctor to help you find parent training, counseling, and support groups in your community. See the *Resources* section.

What you can do

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

How can my child's school help?

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

Classroom management techniques may include

- Keeping a set routine and schedule for activities
- Using a system of clear rewards and consequences, such as a point system or token economy (see Table 2)
- Sending daily or weekly report cards or behavioral charts to parents to inform them about the child's progress
- Seating the child near the teacher
- Using small groups for activities
- Encouraging students to pause a moment before answering questions
- Keeping assignments short or breaking them into sections
- Supervising the child closely and giving frequent, positive cues to stay on task
- Changing where and how tests are given so students can succeed — for example, allowing students to take tests in a less distracting environment or allowing more time to complete tests

Your child's school should work with you and your child's doctor to develop strategies to assist your child in the classroom.

When a child has ADHD that is severe enough to interfere with his ability to learn, 2 federal laws offer help. These laws require public schools to provide or cover costs of evaluating the educational needs of the affected child and providing the needed services.

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

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

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

What types of medication relieve ADHD symptoms?

For most children, stimulant medications are a safe and effective way to relieve ADHD symptoms. Just as glasses focus a person's eyesight so they can see better, these medications help children with ADHD focus their thoughts better and ignore distractions. This makes them more able to pay attention and control their behavior.

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

Two forms of stimulants are available: immediate release (short acting) and extended release (intermediate acting and long acting). (See Table 3.) Immediate-release medications are usually taken every 4 hours, when needed. They are the cheapest of the medications. Extended-release medications are usually taken once in the morning.

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

Nonstimulants can be tried when stimulant medications don't work or if they cause bothersome side effects.

Table 3. Common ADHD Medications

Type of Medication	Brand Name	Generic Name	Duration
Short-acting amphetamine stimulants	Adderall	Mixed amphetamine salts	4 to 6 hours
	Dexedrine	Dextroamphetamine	4 to 6 hours
Short-acting methylphenidate stimulants	Focalin	Dexmethylphenidate	3 to 5 hours
	Methylin	Methylphenidate (tablet, liquid, and chewable tablets)	3 to 5 hours
	Ritalin	Methylphenidate	3 to 5 hours
Mildly extended-release methylphenidate stimulants	Metadate ER	Methylphenidate	4 to 6 hours
	Methylin ER	Methylphenidate	4 to 6 hours
Intermediate-acting extended-release methylphenidate stimulants	Focalin XR	Dexmethylphenidate	6 to 8 hours
	Metadate CD	Methylphenidate	6 to 8 hours
	Ritalin LA	Methylphenidate	6 to 8 hours
Long-acting extended-release amphetamine stimulants	Adderall XR	Mixed amphetamine salts	8 to 12 hours
	Adzenys XR-ODT	Amphetamine	8 to 12 hours
	Dyanavel XR	Amphetamine (liquid)	8 to 12 hours
	Vyvanse	Lisdexamfetamine	8 to 12 hours
Long-acting extended-release methylphenidate stimulants	Concerta	Methylphenidate	10 to 12 hours
	Daytrana	Methylphenidate (skin patch)	11 to 12 hours
	Quillivant XR	Methylphenidate (liquid)	10 to 12 hours
α-Adrenergic agents (nonstimulants)	Intuniv	Guanfacine	24 hours
	Kapvay	Clonidine	12 hours
Selective norepinephrine reuptake inhibitors (nonstimulants)	Strattera	Atomoxetine	24 hours

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

Which medication is best for my child?

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

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

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

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

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

What side effects can stimulants cause?

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

The most common side effects include

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

Some less common side effects include

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

Very rare side effects include

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

The same sleep problems do not exist for atomoxetine, but initially, this medication may make your child sleepy or upset his stomach. There have been very rare cases of atomoxetine needing to be stopped because it was causing liver damage. Rarely, atomoxetine increased thoughts of suicide. Extended-release guanfacine or clonidine can cause drowsiness, fatigue, or decreased blood pressure.

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

Most side effects can be relieved by

- Changing the medication dosage
- Adjusting the schedule of medication
- Using a different stimulant or trying a nonstimulant (see Table 3)

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

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

How do I know if my child's treatment plan is working?

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

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

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

What if my child does not reach his target outcomes?

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

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

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

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

How can I help my child during the teen years?

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

Parents play an important role in helping their teens become independent. Encourage your teen to help himself with strategies such as

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

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

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

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

Talk with your teen's doctor if your teen shows signs of severe problems, such as depression, drug abuse, or gang-related activities.

What about other types of treatments?

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

The following methods have no scientific evidence to prove that they work:

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

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

Frequently Asked Questions

Q: Will my child outgrow ADHD? What about a cure?

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

There is no cure for ADHD at this time. However, research is ongoing to learn more about the role of the brain in ADHD, long-term outcomes for people with ADHD, and the best ways to treat the disorder.

Q: Why do so many children have ADHD?

A: The number of children getting treatment for ADHD has risen. It is not clear whether more children have ADHD or more children are receiving a diagnosis of ADHD. Also, more children with ADHD are getting treatment for a longer period. ADHD is one of the most common and most studied conditions of childhood. Because of more awareness and better ways of diagnosing and treating this disorder, more children are being helped. It may also be the case that school performance has become more important because of the higher technical demand of many jobs, and ADHD often interferes with a child's ability to function in school.

Q: Are schools putting children on ADHD medication?

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

Q: Can children get high on stimulant medications?

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

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

Q: Will use of stimulant medications lead to illegal drug or alcohol use?

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

Resources

Here is a list of ADHD support groups and resources. Also, your child's doctor may know about resources in your community.

CHADD–The National Resource Center on ADHD
800/233-4050
www.chadd.org

ADDA (Attention Deficit Disorder Association)
www.add.org

Center for Parent Information and Resources
www.parentcenterhub.org

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

Tourette Association of America
888/4-TOURET (486-8738)
www.tourette.org

From Your Doctor

medicines for ADHD questions from teens who have ADHD

Q: What can I do besides taking medicines?

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

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

Q: How can medicines help me?

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

Q: Are medicines safe?

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

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

Q: Will medicines change my personality?

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

Q: Will medicines affect my growth?

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

Q: Do I need to take medicines at school?

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

Q: Does taking medicines make me a drug user?

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

Q: Will I have to take medicines forever?

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

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

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

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what is ADHD? questions from teens

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

Q: What causes ADHD?

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

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

Q: How can you tell if someone has ADHD?

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

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

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

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

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

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

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

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

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

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

Q: Is ADHD more common in boys?

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

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

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

From your doctor

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Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 1 for more information.

- *Executive Summary*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 1 for more information.

CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants

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abstract

This is the first clinical practice guideline from the American Academy of Pediatrics that specifically applies to patients who have experienced an apparent life-threatening event (ALTE). This clinical practice guideline has 3 objectives. First, it recommends the replacement of the term ALTE with a new term, brief resolved unexplained event (BRUE). Second, it provides an approach to patient evaluation that is based on the risk that the infant will have a repeat event or has a serious underlying disorder. Finally, it provides management recommendations, or key action statements, for lower-risk infants. The term BRUE is defined as an event occurring in an infant younger than 1 year when the observer reports a sudden, brief, and now resolved episode of ≥1 of the following: (1) cyanosis or pallor; (2) absent, decreased, or irregular breathing; (3) marked change in tone (hyper- or hypotonia); and (4) altered level of responsiveness. A BRUE is diagnosed only when there is no explanation for a qualifying event after conducting an appropriate history and physical examination. By using this definition and framework, infants younger than 1 year who present with a BRUE are categorized either as (1) a lower-risk patient on the basis of history and physical examination for whom evidence-based recommendations for evaluation and management are offered or (2) a higher-risk patient whose history and physical examination suggest the need for further investigation and treatment but for whom recommendations are not offered. This clinical practice guideline is intended to foster a patient- and family-centered approach to care, reduce unnecessary and costly medical interventions, improve patient outcomes, support implementation, and provide direction for future research. Each key action statement indicates a level of evidence, the benefit-harm relationship, and the strength of recommendation.

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INTRODUCTION

This clinical practice guideline applies to infants younger than 1 year and is intended for pediatric clinicians. This guideline has 3 primary objectives. First, it recommends the replacement of the term apparent life-threatening event (ALTE) with a new term, brief resolved unexplained event (BRUE). Second, it provides an approach to patient evaluation that is based on the risk that the infant will have a recurring event or has a serious underlying disorder. Third, it provides evidence-based management recommendations, or key action statements, for lower-risk patients whose history and physical examination are normal. It does not offer recommendations for higher-risk patients whose history and physical examination suggest the need for further investigation and treatment (because of insufficient evidence or the availability of clinical practice guidelines specific to their presentation). This clinical practice guideline also provides implementation support and suggests directions for future research.

The term ALTE originated from a 1986 National Institutes of Health Consensus Conference on Infantile Apnea and was intended to replace the term "near-miss sudden infant death syndrome" (SIDS).[1] An ALTE was defined as "an episode that is frightening to the observer and that is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging. In some cases, the observer fears that the infant has died."[2] Although the definition of ALTE eventually enabled researchers to establish that these events are separate entities from SIDS, the clinical application of this classification, which describes a constellation of observed, subjective, and nonspecific symptoms, has raised significant challenges for clinicians and parents in the evaluation and care of these infants.[3] Although a broad range of disorders can present as an ALTE (eg, child abuse, congenital abnormalities, epilepsy, inborn errors of metabolism, and infections), for a majority of infants who appear well after the event, the risk of a serious underlying disorder or a recurrent event is extremely low.[2]

CHANGE IN TERMINOLOGY AND DIAGNOSIS

The imprecise nature of the original ALTE definition is difficult to apply to clinical care and research.[3] As a result, the clinician is often faced with several dilemmas. First, under the ALTE definition, the infant is often, but not necessarily, asymptomatic on presentation. The evaluation and management of symptomatic infants (eg, those with fever or respiratory distress) need to be distinguished from that of asymptomatic infants. Second, the reported symptoms under the ALTE definition, although often concerning to the caregiver, are not intrinsically life-threatening and frequently are a benign manifestation of normal infant physiology or a self-limited condition. A definition needs enough precision to allow the clinician to base clinical decisions on events that are characterized as abnormal after conducting a thorough history and physical examination. For example, a constellation of symptoms suggesting hemodynamic instability or central apnea needs to be distinguished from more common and less concerning events readily characterized as periodic breathing of the newborn, breath-holding spells, dysphagia, or gastroesophageal reflux (GER). Furthermore, events defined as ALTEs are rarely a manifestation of a more serious illness that, if left undiagnosed, could lead to morbidity or death. Yet, the perceived potential for recurring events or a serious underlying disorder often provokes concern in caregivers and clinicians.[2,4,5] This concern can compel testing or admission to the hospital for observation, which can increase parental anxiety and subject the patient to further risk and does not necessarily lead to a treatable diagnosis or prevention of future events. A more precise definition could prevent the overuse of medical interventions by helping clinicians distinguish infants with lower risk. Finally, the use of ALTE as a diagnosis may reinforce the caregivers' perceptions that the event was indeed "life-threatening," even when it most often was not. For these reasons, a replacement of the term ALTE with a more specific term could improve clinical care and management.

In this clinical practice guideline, a more precise definition is introduced for this group of clinical events: brief resolved unexplained event (BRUE). The term BRUE is intended to better reflect the transient nature and lack of clear cause and removes the "life-threatening" label. The authors of this guideline recommend that the term ALTE no longer be used by clinicians to describe an event or as a diagnosis. Rather, the term BRUE should be used to describe events occurring in infants younger than 1 year of age that are characterized by the observer as "brief" (lasting <1 minute but typically <20–30 seconds) and "resolved" (meaning the patient returned to baseline state of health after the event) and with a reassuring history, physical examination, and vital signs at the time of clinical evaluation by trained medical providers (Table 1). For example, the presence of respiratory symptoms or fever would preclude classification of an event as a BRUE. BRUEs are also "unexplained," meaning that a clinician is unable to explain the cause of the event after

an appropriate history and physical examination. Similarly, an event characterized as choking or gagging associated with spitting up is not included in the BRUE definition, because clinicians will want to pursue the cause of vomiting, which may be related to GER, infection, or central nervous system (CNS) disease. However, until BRUE-specific codes are available, for billing and coding purposes, it is reasonable to apply the ALTE International Classification of Diseases, 9th Revision, and International Classification of Diseases, 10th revision, codes to patients determined to have experienced a BRUE (see section entitled "Dissemination and Implementation").

TABLE 1 BRUE Definition and Factors for Inclusion and Exclusion

	Includes	Excludes
Brief	Duration <1 min; typically 20–30 s	Duration ≥1 min
Resolved	Patient returned to his or her baseline state of health after the event	At the time of medical evaluation:
	Normal vital signs	Fever or recent fever
	Normal appearance	Tachypnea, bradypnea, apnea
		Tachycardia or bradycardia
		Hypotension, hypertension, or hemodynamic instability
		Mental status changes, somnolence, lethargy
		Hypotonia or hypertonia
		Vomiting
		Bruising, petechiae, or other signs of injury/trauma
		Abnormal weight, growth, or head circumference
		Noisy breathing (stridor, sturgor, wheezing)
		Repeat event(s)
Unexplained	Not explained by an identifiable medical condition	Event consistent with GER, swallow dysfunction, nasal congestion, etc
		History or physical examination concerning for child abuse, congenital airway abnormality, etc
Event Characterization		
Cyanosis or pallor	Central cyanosis: blue or purple coloration of face, gums, trunk	Acrocyanosis or perioral cyanosis
	Central pallor: pale coloration of face or trunk	Rubor
Absent, decreased, or irregular breathing	Central apnea	Periodic breathing of the newborn
	Obstructive apnea	Breath-holding spell
	Mixed obstructive apnea	
Marked change in tone (hyper- or hypotonia)	Hypertonia	Hypertonia associated with crying, choking, or gagging due to GER or feeding problems
	Hypotonia	Tone changes associated with breath-holding spell
		Tonic eye deviation or nystagmus
		Tonic-clonic seizure activity
		Infantile spasms
Altered responsiveness	Loss of consciousness	Loss of consciousness associated with breath-holding spell
	Mental status change	
	Lethargy	
	Somnolence	
	Postictal phase	

BRUE DEFINITION

Clinicians should use the term BRUE to describe an event occurring in an infant <1 year of age when the observer reports a sudden, brief, and now resolved episode of ≥1 of the following:

- **cyanosis or pallor**
- **absent, decreased, or irregular breathing**
- **marked change in tone (hyper- or hypotonia)**
- **altered level of responsiveness**

Moreover, clinicians should diagnose a BRUE only when there is no explanation for a qualifying event after conducting an appropriate history and physical examination (Tables 2 and 3).

Differences between the terms ALTE and BRUE should be noted. First, the BRUE definition has a strict age limit. Second, an event is only a BRUE if there is no other likely explanation. Clinical symptoms such as fever, nasal congestion, and increased work of breathing may indicate temporary airway obstruction from viral infection. Events characterized as choking after vomiting may indicate a gastrointestinal cause, such as GER. Third, a BRUE diagnosis is based on the clinician's characterization of features of the event and not on a caregiver's perception that the event was life-threatening. Although such perceptions are understandable and important to address, such risk can only be assessed after the event has been objectively characterized by a clinician. Fourth, the clinician should determine whether the infant had episodic cyanosis or pallor, rather than just determining whether "color change" occurred. Episodes of rubor or redness are not consistent with BRUE, because they are common in healthy infants. Fifth, BRUE expands the respiratory criteria beyond "apnea" to include absent breathing, diminished breathing, and other breathing irregularities. Sixth, instead of the less specific criterion of "change in muscle tone," the clinician should determine whether there was marked change in tone, including

hypertonia or hypotonia. Seventh, because choking and gagging usually indicate common diagnoses such as GER or respiratory infection, their presence suggests an event was not a BRUE. Finally, the use of "altered level of responsiveness" is a new criterion, because it can be an important component of an episodic but serious cardiac, respiratory, metabolic, or neurologic event.

For infants who have experienced a BRUE, a careful history and physical examination are necessary to characterize the event, assess the risk of recurrence, and determine the presence of an underlying disorder (Tables 2 and 3). The recommendations provided in this guideline focus on infants with a lower risk of a subsequent event or serious underlying disorder (see section entitled "Risk Assessment: Lower- Versus Higher-Risk BRUE"). In the absence of identifiable risk factors, infants are at lower risk and laboratory studies, imaging studies, and other diagnostic procedures are unlikely to be useful or necessary. However, if the clinical history or physical examination reveals abnormalities, the patient may be at higher risk and further evaluation should focus on the specific areas of concern. For example,

- possible child abuse may be considered when the event history is reported inconsistently or is incompatible with the child's developmental age, or when, on physical examination, there is unexplained bruising or a torn labial or lingual frenulum;
- a cardiac arrhythmia may be considered if there is a family history of sudden, unexplained death in first-degree relatives; and
- infection may be considered if there is fever or persistent respiratory symptoms.

TABLE 2 Historical Features To Be Considered in the Evaluation of a Potential BRUE

Features To Be Considered
Considerations for possible child abuse:
Multiple or changing versions of the history/circumstances
History/circumstances inconsistent with child's developmental stage
History of unexplained bruising
Incongruence between caregiver expectations and child's developmental stage, including assigning negative attributes to the child
History of the event
General description
Who reported the event?
Witness of the event? Parent(s), other children, other adults? Reliability of historian(s)?
State immediately before the event
Where did it occur (home/elsewhere, room, crib/floor, etc)?
Awake or asleep?
Position: supine, prone, upright, sitting, moving?
Feeding? Anything in the mouth? Availability of item to choke on? Vomiting or spitting up?
Objects nearby that could smother or choke?
State during the event
Choking or gagging noise?
Active/moving or quiet/flaccid?
Conscious? Able to see you or respond to voice?
Muscle tone increased or decreased?
Repetitive movements?
Appeared distressed or alarmed?
Breathing: yes/no, struggling to breathe?
Skin color: normal, pale, red, or blue?
Bleeding from nose or mouth?
Color of lips: normal, pale, or blue?
End of event
Approximate duration of the event?
How did it stop: with no intervention, picking up, positioning, rubbing or clapping back, mouth-to-mouth, chest compressions, etc?
End abruptly or gradually?
Treatment provided by parent/caregiver (eg, glucose-containing drink or food)?
911 called by caregiver?
State after event
Back to normal immediately/gradually/still not there?
Before back to normal, was quiet, dazed, fussy, irritable, crying?
Recent history
Illness in preceding day(s)?
If yes, detail signs/symptoms (fussiness, decreased activity, fever, congestion, rhinorrhea, cough, vomiting, diarrhea, decreased intake, poor sleep)
Injuries, falls, previous unexplained bruising?
Past medical history
Pre-/perinatal history
Gestational age
Newborn screen normal (for IEMs, congenital heart disease)?
Previous episodes/BRUE?
Reflux? If yes, obtain details, including management
Breathing problems? Noisy ever? Snoring?
Growth patterns normal?
Development normal? Assess a few major milestones across categories, any concerns about development or behavior?
Illnesses, injuries, emergencies?
Previous hospitalization, surgery?
Recent immunization?
Use of over-the-counter medications?
Family history
Sudden unexplained death (including unexplained car accident or drowning) in first- or second-degree family members before age 35, and particularly as an infant?
Apparent life-threatening event in sibling?
Long QT syndrome?
Arrhythmia?

TABLE 2 Continued

Features To Be Considered
Inborn error of metabolism or genetic disease?
Developmental delay?
Environmental history
Housing: general, water damage, or mold problems?
Exposure to tobacco smoke, toxic substances, drugs?
Social history
Family structure, individuals living in home?
Housing: general, mold?
Recent changes, stressors, or strife?
Exposure to smoke, toxic substances, drugs?
Recent exposure to infectious illness, particularly upper respiratory illness, paroxysmal cough, pertussis?
Support system(s)/access to needed resources?
Current level of concern/anxiety; how family manages adverse situations?
Potential impact of event/admission on work/family?
Previous child protective services or law enforcement involvement (eg, domestic violence, animal abuse), alerts/reports for this child or others in the family (when available)?
Exposure of child to adults with history of mental illness or substance abuse?

The key action statements in this clinical practice guideline do not apply to higher-risk patients but rather apply only to infants who meet the lower-risk criteria by having an otherwise normal history and physical examination.

RISK ASSESSMENT: LOWER- VERSUS HIGHER-RISK BRUE

Patients who have experienced a BRUE may have a recurrent event or an undiagnosed serious condition (eg, child abuse, pertussis, etc) that confers a risk of adverse outcomes. Although this risk has been difficult to quantify historically and no studies have fully evaluated patient-centered outcomes (eg, family experience survey), the systematic review of the ALTE literature identified a subset of BRUE patients who are unlikely to have a recurrent event or undiagnosed serious conditions, are at lower risk of adverse outcomes, and can likely be managed safely without extensive diagnostic evaluation or hospitalization.[3] In the systematic review of ALTE studies in which it was possible to identify BRUE patients, the following characteristics most consistently conferred higher risk: infants <2 months of age, those with a history of prematurity, and those with more than 1 event. There was generally an increased risk from prematurity in infants born at <32 weeks' gestation, and the risk attenuated once infants born at <32 weeks' gestation reached 45 weeks' postconceptional age. Two ALTE studies evaluated the duration of the event.[6,7] Although duration did not appear to be predictive of hospital admission, it was difficult to discern a BRUE population from the heterogeneous ALTE populations. Nonetheless, most events were less than one minute. By consensus, the subcommittee established <1 minute as the upper limit of a "brief event," understanding that objective, verifiable measurements were rarely, if ever, available. Cariopulmonary resuscitation (CPR) was identified as a risk factor in the older ALTE studies and confirmed in a recent study,[6] but it was unclear how the need for CPR was determined. Therefore, the committee agreed by consensus that the need for CPR should be determined by trained medical providers.

PATIENT FACTORS THAT DETERMINE A LOWER RISK

To be designated lower risk, the following criteria should be met (see Fig 1):

- Age >60 days
- Prematurity: gestational age ≥32 weeks and postconceptional age ≥45 weeks
- First BRUE (no previous BRUE ever and not occurring in clusters)
- Duration of event <1 minute
- No CPR required by trained medical provider
- No concerning historical features (see Table 2)
- No concerning physical examination findings (see Table 3)

Infants who have experienced a BRUE who do not qualify as lower-risk patients are, by definition, at higher risk. Unfortunately, the outcomes data from ALTE studies in the heterogeneous higher-risk population are unclear and preclude the derivation of evidence-based recommendations regarding management. Thus, pending further research, this guideline does not provide recommendations for the management of the higher-risk infant. Nonetheless, it is important for clinicians and researchers to recognize that some studies suggest that higher-risk BRUE patients may be more likely to have a serious underlying cause, recurrent event, or an adverse outcome. For example, infants younger than 2 months who experience a BRUE may be more likely to have a congenital or infectious cause and be at higher risk of an adverse outcome. Infants who have experienced multiple events or a concerning social assessment for child abuse may warrant increased observation to better document the events or contextual factors. A list of differential diagnoses for BRUE patients is provided in Supplemental Table 6.

METHODS

In July 2013, the American Academy of Pediatrics (AAP) convened a multidisciplinary subcommittee composed of primary care clinicians

TABLE 3 Physical Examination Features To Be Considered in the Evaluation of a Potential BRUE

Physical Examination
General appearance
Craniofacial abnormalities (mandible, maxilla, nasal)
Age-appropriate responsiveness to environment
Growth variables
Length, weight, occipitofrontal circumference
Vital signs
Temperature, pulse, respiratory rate, blood pressure, oxygen saturation
Skin
Color, perfusion, evidence of injury (eg, bruising or erythema)
Head
Shape, fontanelles, bruising or other injury
Eyes
General, extraocular movement, pupillary response
Conjunctival hemorrhage
Retinal examination, if indicated by other findings
Ears
Tympanic membranes
Nose and mouth
Congestion/coryza
Blood in nares or oropharynx
Evidence of trauma or obstruction
Torn frenulum
Neck
Mobility
Chest
Auscultation, palpation for rib tenderness, crepitus, irregularities
Heart
Rhythm, rate, auscultation
Abdomen
Organomegaly, masses, distention
Tenderness
Genitalia
Any abnormalities
Extremities
Muscle tone, injuries, limb deformities consistent with fracture
Neurologic
Alertness, responsiveness
Response to sound and visual stimuli
General tone
Pupillary constriction in response to light
Presence of symmetrical reflexes
Symmetry of movement/tone/strength

and experts in the fields of general pediatrics, hospital medicine, emergency medicine, infectious diseases, child abuse, sleep medicine, pulmonary medicine, cardiology, neurology, biochemical genetics, gastroenterology, environmental health, and quality improvement. The subcommittee also included a parent representative, a guideline methodologist/informatician, and an epidemiologist skilled in systematic reviews. All panel members declared potential conflicts on the basis of the AAP policy on Conflict of Interest and Voluntary Disclosure. Subcommittee members repeated this process annually and upon publication of the guideline. All potential conflicts of interest are listed at the end of this document. The project was funded by the AAP.

The subcommittee performed a comprehensive review of the literature related to ALTEs from 1970 through 2014. Articles from 1970 through 2011 were identified and evaluated by using "Management of Apparent Life Threatening Events in Infants: A Systematic Review," authored by the Society of Hospital Medicine's ALTE Expert Panel (which included 4 members of the subcommittee).[3] The subcommittee partnered with the Society of Hospital Medicine Expert Panel and a librarian to update the original systematic review with articles published through December 31, 2014, with the use of the same methodology as the original systematic review. PubMed, Cumulative Index to Nursing and Allied Health Literature, and Cochrane Library databases were searched for studies involving children younger than 24 months by using the stepwise approach specified in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[8] Search terms included "ALTE(s)," "apparent life threatening event(s)," "life threatening event(s)," "near miss SIDS" or "near miss sudden infant death syndrome," "aborted crib death" or "aborted sudden infant death syndrome," and "aborted SIDS" or "aborted cot death" or "infant death, sudden." The Medical Subject Heading "infantile apparent life-threatening event," introduced in 2011, was also searched but did not identify additional articles.

In updating the systematic review published in 2012, pairs of 2 subcommittee members used validated methodology to independently score the newly identified abstracts from English-language articles (n = 120) for relevance to the clinical questions (Supplemental Fig 3).[9,10] Two independent reviewers then critically appraised the full text of the identified articles (n = 23) using a structured data collection form based on published guidelines for evaluating medical literature.[11,12] They recorded each study's relevance to the clinical question, research design, setting, time period covered, sample size, patient eligibility criteria, data source, variables collected, key results, study

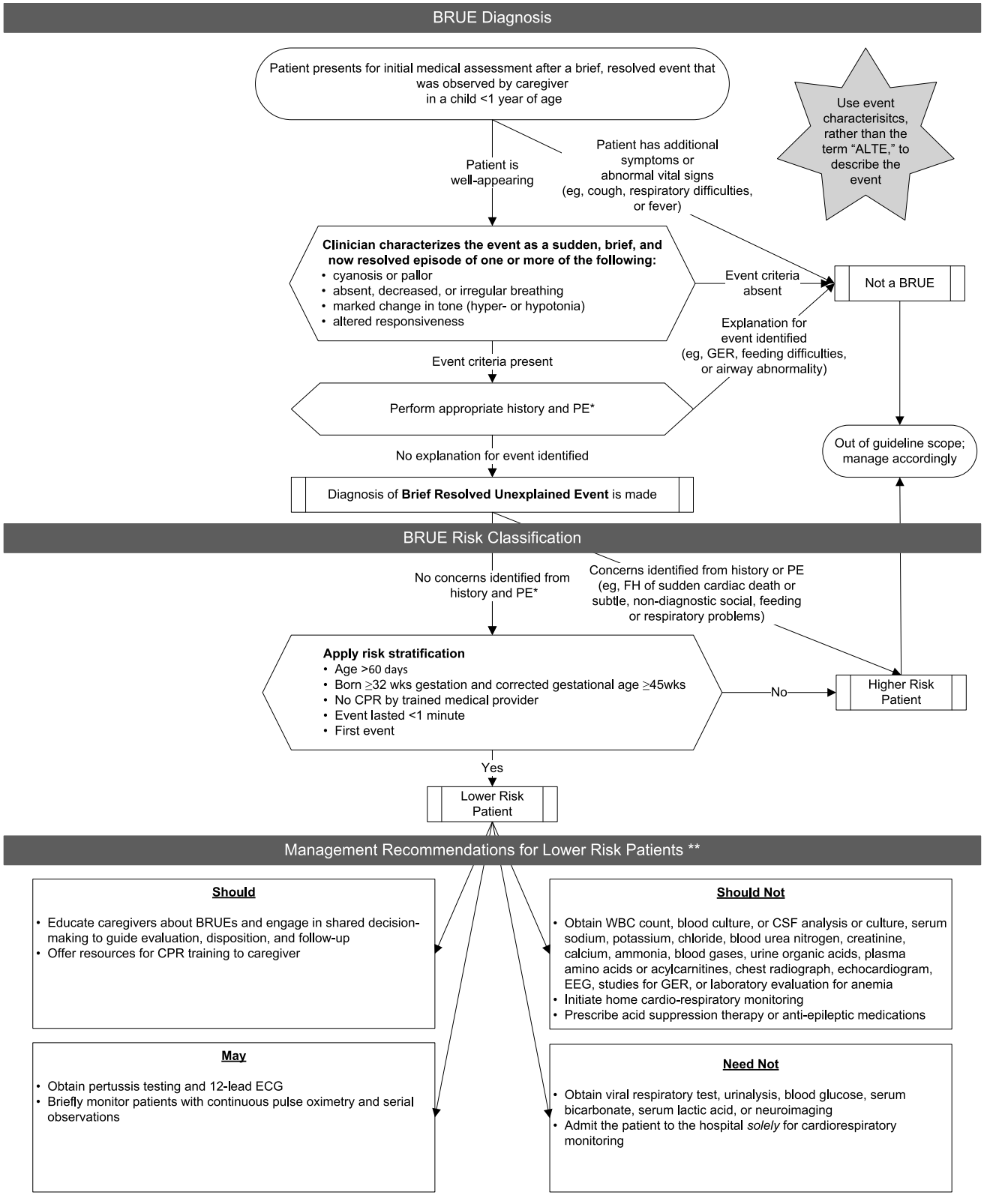

FIGURE 1

Diagnosis, risk classification, and recommended management of a BRUE. *See Tables 3 and 4 for the determination of an appropriate and negative FH and PE. **See Fig 2 for the AAP method for rating of evidence and recommendations. CSF, cerebrospinal fluid; FH, family history; PE, physical examination; WBC, white blood cell.

Figure 1, shown here, has been updated per the erratum at http://pediatrics.aappublications.org/content/138/2/e20161487.

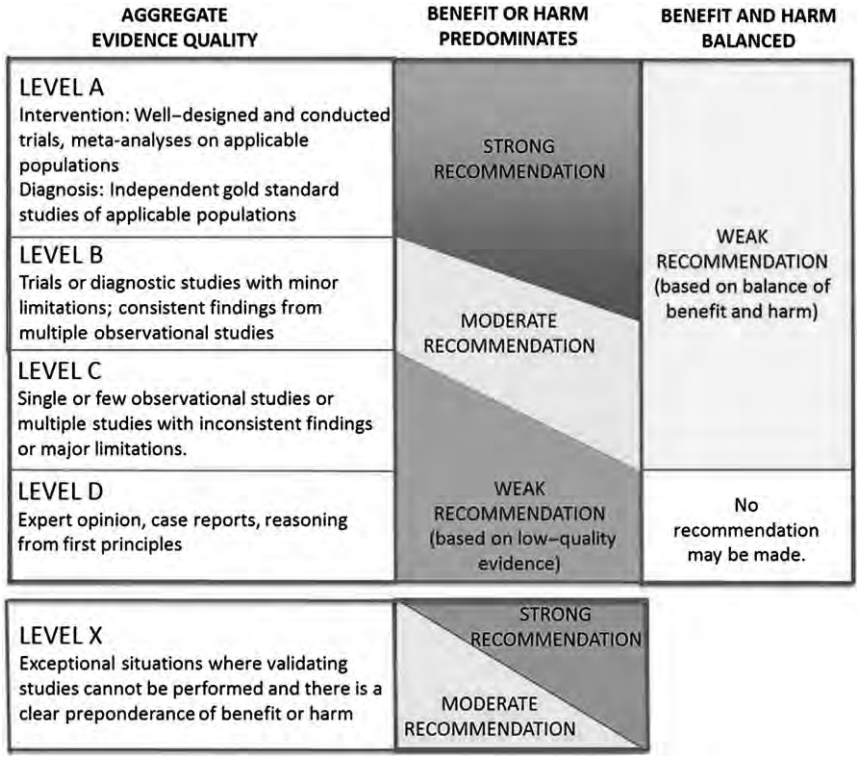

FIGURE 2
AAP rating of evidence and recommendations.

limitations, potential sources of bias, and stated conclusions. If at least 1 reviewer judged an article to be relevant on the basis of the full text, subsequently at least 2 reviewers critically appraised the article and determined by consensus what evidence, if any, should be cited in the systematic review. Selected articles used in the earlier review were also reevaluated for their quality. The final recommendations were based on articles identified in the updated (n = 18) and original (n = 37) systematic review (Supplemental Table 7).[6,7,13–28] The resulting systematic review was used to develop the guideline recommendations by following the policy statement from the AAP Steering Committee on Quality Improvement and Management, "Classifying Recommendations for Clinical Practice Guidelines."[29] Decisions and the strength of recommendations were based on a systematic grading of the quality of evidence from the updated literature review by 2 independent reviewers and incorporation of the previous systematic review. Expert consensus was used when definitive data were not available. If committee members disagreed with the rest of the consensus, they were encouraged to voice their concern until full agreement was reached. If full agreement could not be reached, each committee member reserved the right to state concern or disagreement in the publication (which did not occur). Because the recommendations of this guideline were based on the ALTE literature, we relied on the studies and outcomes that could be attributable to the new definition of lower- or higher-risk BRUE patients.

Key action statements (summarized in Table 5) were generated by using BRIDGE-Wiz (Building Recommendations in a Developers Guideline Editor), an interactive software tool that leads guideline development teams through a series of questions that are intended to create clear, transparent, and actionable key action statements.[30] BRIDGE-Wiz integrates the quality of available evidence and a benefit-harm assessment into the final determination of the strength of each recommendation. Evidence-based guideline recommendations from the AAP may be graded as strong,

TABLE 4 Guideline Definitions for Key Action Statements

Statement	Definition	Implication
Strong recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa) and quality of evidence is excellent or unobtainable.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Moderate recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa) and the quality of evidence is good but not excellent (or is unobtainable).	Clinicians would be prudent to follow a moderate recommendation but should remain alert to new information and sensitive to patient preferences.
Weak recommendation (based on low-quality evidence)	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), but the quality of evidence is weak.	Clinicians would be prudent follow a weak recommendation but should remain alert to new information and very sensitive to patient preferences.
Weak recommendation (based on balance of benefits and harms)	Weak recommendation is provided when the aggregate database shows evidence of both benefit and harm that appear to be similar in magnitude for any available courses of action.	Clinicians should consider the options in their decision-making, but patient preference may have a substantial role.

TABLE 5 Summary of Key Action Statements for Lower-Risk BRUEs

When managing an infant aged >60 d and <1 y and who, on the basis of a thorough history and physical examination, meets criteria for having experienced a lower-risk BRUE, clinicians:	Evidence Quality; Strength of Recommendation
1. Cardiopulmonary evaluation	
1A. Need not admit infants to the hospital solely for cardiorespiratory monitoring.	B; Weak
1B. May briefly monitor patients with continuous pulse oximetry and serial observations.	D; Weak
1C. Should not obtain a chest radiograph.	B; Moderate
1D. Should not obtain a measurement of venous or arterial blood gas.	B; Moderate
1E. Should not obtain an overnight polysomnograph.	B; Moderate
1F. May obtain a 12-lead electrocardiogram.	C; Weak
1G. Should not obtain an echocardiogram.	C; Moderate
1H. Should not initiate home cardiorespiratory monitoring.	B; Moderate
2. Child abuse evaluation	
2A. Need not obtain neuroimaging (CT, MRI, or ultrasonography) to detect child abuse.	C; Weak
2B. Should obtain an assessment of social risk factors to detect child abuse.	C; Moderate
3. Neurologic evaluation	
3A. Should not obtain neuroimaging (CT, MRI, or ultrasonography) to detect neurologic disorders.	C; Moderate
3B. Should not obtain an EEG to detect neurologic disorders.	C; Moderate
3C. Should not prescribe antiepileptic medications for potential neurologic disorders.	C; Moderate
4. Infectious disease evaluation	
4A. Should not obtain a WBC count, blood culture, or cerebrospinal fluid analysis or culture to detect an occult bacterial infection.	B; Strong
4B. Need not obtain a urinalysis (bag or catheter).	C; Weak
4C. Should not obtain chest radiograph to assess for pulmonary infection.	B; Moderate
4D. Need not obtain respiratory viral testing if rapid testing is available.	C; Weak
4E. May obtain testing for pertussis.	B; Weak
5. Gastrointestinal evaluation	
5A. Should not obtain investigations for GER (eg, upper gastrointestinal tract series, pH probe, endoscopy, barium contrast study, nuclear scintigraphy, and ultrasonography).	C; Moderate
5B. Should not prescribe acid suppression therapy.	C; Moderate
6. IEM evaluation	
6A. Need not obtain measurement of serum lactic acid or serum bicarbonate.	C; Weak
6B. Should not obtain a measurement of serum sodium, potassium, chloride, blood urea nitrogen, creatinine, calcium, or ammonia.	C; Moderate
6C. Should not obtain a measurement of venous or arterial blood gases.	C; Moderate
6D. Need not obtain a measurement of blood glucose.	C; Weak
6E. Should not obtain a measurement of urine organic acids, plasma amino acids, or plasma acylcarnitines.	C; Moderate
7. Anemia evaluation	
7A. Should not obtain laboratory evaluation for anemia.	C; Moderate
8. Patient- and family-centered care	
8A. Should offer resources for CPR training to caregiver.	C; Moderate
8B. Should educate caregivers about BRUEs.	C; Moderate
8C. Should use shared decision-making.	C; Moderate

CPR, cardiopulmonary resuscitation; CT, computed tomography; GER, gastroesophageal reflux; WBC, white blood cell.

moderate, weak based on low-quality evidence, or weak based on balance between benefits and harms. Strong and moderate recommendations are associated with "should" and "should not" recommendation statements, whereas weak recommendation may be recognized by use of "may" or "need not" (Fig 2, Table 4).

A strong recommendation means that the committee's review of the evidence indicates that the benefits of the recommended approach clearly exceed the harms of that approach (or, in the case of a strong negative recommendation, that the harms clearly exceed the benefits) and that the quality of the evidence supporting this approach is excellent. Clinicians are advised to follow such guidance unless a clear and compelling rationale for acting in a contrary manner is present. A moderate recommendation means that the committee believes that the benefits exceed the harms (or, in the case of a negative recommendation, that the harms exceed the benefits), but the quality of the evidence on which this recommendation is based is not as strong. Clinicians are also encouraged to follow such guidance but also should be alert to new information and sensitive to patient preferences.

A weak recommendation means either that the evidence quality that exists is suspect or that well-designed, well-conducted studies have shown little clear advantage to one approach versus another. Weak recommendations offer clinicians flexibility in their decision-making regarding appropriate practice, although they may set boundaries on alternatives. Family and patient preference should have a substantial role in influencing clinical

1A. Clinicians Need Not Admit Infants Presenting With a Lower-Risk BRUE to the Hospital Solely for Cardiorespiratory Monitoring (Grade B, Weak Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce unnecessary testing and caregiver/infant anxiety Avoid consequences of false-positive result, health care–associated infections, and other patient safety risks
Risks, harm, cost	May rarely miss a recurrent event or diagnostic opportunity for rare underlying condition
Benefit-harm assessment	The benefits of reducing unnecessary testing, nosocomial infections, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for an underlying condition
Intentional vagueness	None
Role of patient preferences	Caregiver anxiety and access to quality follow-up care may be important considerations in determining whether a hospitalization for cardiovascular monitoring is indicated
Exclusions	None
Strength	Weak recommendation (because of equilibrium between benefits and harms)
Key references	31, 32

1B. Clinicians May Briefly Monitor Infants Presenting With a Lower-Risk BRUE With Continuous Pulse Oximetry and Serial Observations (Grade D, Weak Recommendation)

Aggregate Evidence Quality	Grade D
Benefits	Identification of hypoxemia
Risks, harm, cost	Increased costs due to monitoring over time and the use of hospital resources False-positive results may lead to subsequent testing and hospitalization False reassurance from negative test results
Benefit-harm assessment	The potential benefit of detecting hypoxemia outweighs the harm of cost and false results
Intentional vagueness	Duration of time to monitor patients with continuous pulse oximetry and the number and frequency of serial observations may vary
Role of patient preferences	Level of caregiver concern may influence the duration of oximetry monitoring
Exclusions	None
Strength	Weak recommendation (based on low quality of evidence)
Key references	33, 36

decision-making, particularly when recommendations are expressed as weak. Key action statements based on that evidence and expert consensus are provided. A summary is provided in Table 5.

The practice guideline underwent a comprehensive review by stakeholders before formal approval by the AAP, including AAP councils, committees, and sections; selected outside organizations; and individuals identified by the subcommittee as experts in the field. All comments were reviewed by the subcommittee and incorporated into the final guideline when appropriate.

This guideline is intended for use primarily by clinicians providing care for infants who have experienced a BRUE and their families. This guideline may be of interest to parents and payers, but it is not intended to be used for reimbursement or to determine insurance coverage. This guideline is not intended as the sole source of guidance in the evaluation and management of BRUEs but rather is intended to assist clinicians by providing a framework for clinical decision-making.

KEY ACTION STATEMENTS FOR LOWER-RISK BRUE

1. Cardiopulmonary

1A. Clinicians Need Not Admit Infants Presenting With a Lower-Risk BRUE to the Hospital Solely for Cardiorespiratory Monitoring (Grade B, Weak Recommendation)

Infants presenting with an ALTE often have been admitted for observation and testing. Observational data indicate that 12% to 14% of infants presenting with a diagnosis of ALTE had a subsequent event or condition that required hospitalization.[7,31] Thus, research has sought to identify risk factors that could be used to identify infants likely to benefit from hospitalization. A long-term follow-up study in infants hospitalized with an ALTE showed that no infants subsequently had SIDS but 11% were victims of child abuse and 4.9% had adverse neurologic outcomes (see 3. Neurology).[32] The ALTE literature supports that infants presenting with a lower-risk BRUE do not have an increased rate of cardiovascular or other events during admission and hospitalization may not be required, but close follow-up is recommended. Careful outpatient follow-up is advised (repeat clinical history and physical examination within 24 hours after the initial evaluation) to identify infants with ongoing medical concerns that would indicate further evaluation and treatment.

Al-Kindy et al[33] used documented monitoring in 54% of infants admitted for an ALTE (338 of 625) and identified 46 of 338 (13.6%) with "extreme" cardiovascular events (central apnea >30 seconds, oxygen saturation <80% for 10 seconds, decrease in heart rate <50–60/ minutes for 10 seconds on the basis

of postconceptional age). However, no adverse outcomes were noted for any of their cohort (although whether there is a protective effect of observation alone is not known). Some of the infants with extreme events developed symptoms of upper respiratory infection 1 to 2 days after the ALTE presentation. The risk factors for "extreme" events were prematurity, postconceptional age <43 weeks, and (presence of) upper respiratory infection symptoms. Importantly, infants with a postconceptional age >48 weeks were not documented as having an extreme event in this cohort. A previous longitudinal study also identified "extreme" events that occurred with comparable frequency in otherwise normal term infants and that were not statistically increased in term infants with a history of ALTE.[34]

Preterm infants have been shown to have more serious events, although an ALTE does not further increase that risk compared with asymptomatic preterm infants without ALTE.[34] Claudius and Keens[31] performed an observational prospective study in 59 infants presenting with ALTE who had been born at >30 weeks' gestation and had no significant medical illness. They evaluated factors in the clinical history and physical examination that, according to the authors, would warrant hospital admission on the basis of adverse outcomes (including recurrent cardiorespiratory events, infection, child abuse, or any life-threatening condition). Among these otherwise well infants, those with multiple ALTEs or age <1 month experienced adverse outcomes necessitating hospitalization. Prematurity was also a risk factor predictive of subsequent adverse events after an ALTE. Paroxysmal decreases in oxygen saturation in infants immediately before and during viral illnesses have been well documented.[33,35] However, the significance of these brief hypoxemic events has not been established.

1B. Clinicians May Briefly Monitor Infants Presenting With a Lower-Risk BRUE With Continuous Pulse Oximetry and Serial Observations (Grade D, Weak Recommendation)

A normal physical examination, including vital signs and oximetry, is needed for a patient who has experienced a BRUE to be considered lower-risk. An evaluation at a single point in time may not be as accurate as a longer interval of observation. Unfortunately, there are few data to suggest the optimal duration of this period, the value of repeat examinations, and the effect of false-positive evaluations on family-centered care. Several studies have documented intermittent episodes of hypoxemia after admission for ALTE.[7,31,33] Pulse oximetry identified more infants with concerning paroxysmal events than cardiorespiratory monitoring alone.[33] However, occasional oxygen desaturations are commonly observed in normal infants, especially during sleep.[36] Furthermore, normative oximetry data are dependent on the specific machine, averaging interval, altitude, behavioral state, and postconceptional age. Similarly, there may be considerable variability in the vital signs and the clinical appearance of an infant. Pending further research into this important issue, clinicians may choose to monitor and provide serial examinations of infants in the lower-risk group for a brief period of time, ranging from 1 to 4 hours, to establish that the vital signs, physical examination, and symptomatology remain stable.

1C. Clinicians Should Not Obtain a Chest Radiograph in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Infectious processes can precipitate apnea. In 1 ALTE study, more than 80% of these infections involved the respiratory tract.[37] Most, but not all, infants with significant lower respiratory tract infections will be symptomatic at the time of ALTE presentation. However, 2 studies have documented pneumonia in infants presenting with ALTE and an otherwise noncontributory history and physical examination.[4,37] These rare exceptions have generally been in infants younger than 2 months and would have placed them in the higher-risk category for a BRUE in this guideline. Similarly, Davies and Gupta[38] reported that 9 of 65 patients (ages unknown) who had ALTEs had abnormalities on chest radiography (not fully specified) despite no suspected respiratory disorder on clinical history or physical examination. Some of the radiographs were performed up to 24 hours after presentation. Davies and Gupta further reported that 33% of infants with ALTEs that were ultimately associated with a respiratory disease had a normal initial respiratory examination.[38] Kant et al[18] reported that 2 of 176 infants discharged after admission for ALTE died within 2 weeks, both of pneumonia. One infant had a normal chest radiograph initially; the other, with a history of prematurity, had a "possible" infiltrate. Thus, most experience has shown that a chest radiograph in otherwise well-appearing infants rarely alters clinical management.[7] Careful follow-up within 24 hours is important in infants with a nonfocal clinical history and physical examination to identify those who will ultimately have a lower respiratory tract infection diagnosed.

1D. Clinicians Should Not Obtain Measurement of Venous or Arterial Blood Gases in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Blood gas measurements have not been shown to add significant clinical information in otherwise well-appearing infants presenting with an ALTE.[4] Although not part of

1C. Clinicians Should Not Obtain Chest Radiograph in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce costs, unnecessary testing, radiation exposure, and caregiver/infant anxiety
	Avoid consequences of false-positive results
Risks, harm, cost	May rarely miss diagnostic opportunity for early lower respiratory tract or cardiac disease
Benefit-harm assessment	The benefits of reducing unnecessary testing, radiation exposure, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for lower respiratory tract or cardiac disease
Intentional vagueness	None
Role of patient preferences	Caregiver may express concern regarding a longstanding breathing pattern in his/her infant or a recent change in breathing that might influence the decision to obtain chest radiography
Exclusions	None
Strength	Moderate recommendation
Key references	4, 37

1D. Clinicians Should Not Obtain Measurement of Venous or Arterial Blood Gases in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce costs, unnecessary testing, pain, risk of thrombosis, and caregiver/infant anxiety
	Avoid consequences of false-positive results
Risks, harm, cost	May miss rare instances of hypercapnia and acid-base imbalances
Benefit-harm assessment	The benefits of reducing unnecessary testing and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for hypercapnia and acid-base imbalances
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Moderate recommendation
Key reference	4

this guideline, future research may demonstrate that blood gases are helpful in select infants with a higher risk BRUE to support the diagnosis of pulmonary disease, control-of-breathing disorders, or inborn errors of metabolism (IEMs).

1E. Clinicians Should Not Obtain an Overnight Polysomnograph in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Polysomnography consists of 8 to 12 hours of documented monitoring, including EEG, electro-oculography, electromyography, nasal/oral airflow, electrocardiography, end-tidal carbon dioxide, chest/abdominal excursion, and oximetry. Polysomnography is considered by many to be the gold standard for identifying obstructive sleep apnea (OSA), central sleep apnea, and periodic breathing and may identify seizures. Some data have suggested using polysomnography in infants presenting with ALTEs as a means to predict the likelihood of recurrent significant cardiorespiratory events. A study in which polysomnography was performed in a cohort of infants with ALTEs (including recurrent episodes) reported that polysomnography may reveal respiratory pauses of >20 seconds or brief episodes of bradycardia that are predictive of ensuing events over the next several months.[40] However, without a control population, the clinical significance of these events is uncertain, because respiratory pauses are frequently observed in otherwise normal infants.[35] Similarly, Kahn and Blum[41] reported that 10 of 71 infants with a clinical history of "benign" ALTEs had an abnormal polysomnograph, including periodic breathing (7 of 10) or obstructive apnea (4 of 100), but specific data were not presented. These events were not found in a control group of 181 infants. The severity of the periodic breathing (frequency of arousals and extent of oxygen desaturation) could not be evaluated from these data. Daniëls et al[42] performed polysomnography in 422 infants with ALTEs and identified 11 infants with significant bradycardia, OSA, and/or oxygen desaturation. Home monitoring revealed episodes of bradycardia (<50 per minute) in 7 of 11 infants and concluded that polysomnography is a useful modality. However, the clinical history, physical examination, and laboratory findings were not presented. GER has also been associated with specific episodes of severe bradycardia in monitored infants.[43] Overall, most polysomnography studies have shown minimal or nonspecific findings in infants presenting with ALTEs.[44,45] Polysomnography studies generally have not been predictive of ALTE recurrence and do not identify those infants at risk of SIDS.[46] Thus, the routine use of polysomnography in infants presenting with a lower-risk BRUE is likely to have a low diagnostic yield and is unlikely to lead to changes in therapy.

OSA has been occasionally associated with ALTEs in many series, but not all.[39,47–49] The use of overnight polysomnography to evaluate for OSA should be guided by an assessment of risk on the basis of a

1E. Clinicians Should Not Obtain an Overnight Polysomnograph in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce costs, unnecessary testing, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss rare instances of hypoxemia, hypercapnia, and/or bradycardia that would be detected by polysomnography
Benefit-harm assessment	The benefits of reducing unnecessary testing and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for hypoxemia, hypercapnia, and/or bradycardia
Intentional vagueness	None
Role of patient preferences	Caregivers may report concern regarding some aspects of their infant's sleep pattern that may influence the decision to perform polysomnography
Exclusions	None
Strength	Moderate recommendation
Key reference	39

1F. Clinicians May Obtain a 12-Lead Electrocardiogram for Infants Presenting With Lower-Risk BRUE (Grade C, Weak Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	May identify BRUE patients with channelopathies (long QT syndrome, short QT syndrome, and Brugada syndrome), ventricular pre-excitation (Wolff-Parkinson-White syndrome), cardiomyopathy, or other heart disease
Risks, harm, cost	False-positive results may lead to further workup, expert consultation, anxiety, and cost False reassurance from negative results Cost and availability of electrocardiography testing and interpretation
Benefit-harm assessment	The benefit of identifying patients at risk of sudden cardiac death outweighs the risk of cost and false results
Intentional vagueness	None
Role of patient preferences	Caregiver may decide not to have testing performed
Exclusions	None
Strength	Weak recommendation (because of equilibrium between benefits and harms)
Key references	4, 16

comprehensive clinical history and physical examination.[50] Symptoms of OSA, which may be subtle or absent in infants, include snoring, noisy respirations, labored breathing, mouth breathing, and profuse sweating.[51] Occasionally, infants with OSA will present with failure to thrive, witnessed apnea, and/or developmental delay.[52] Snoring may be absent in younger infants with OSA, including those with micrognathia. In addition, snoring in otherwise normal infants is present at least 2 days per week in 11.8% and at least 3 days per week in 5.3% of infants.[53] Some infants with OSA may be asymptomatic and have a normal physical examination.[54] However, some studies have reported a high incidence of snoring in infants with (26%–44%) and without (22%–26%) OSA, making the distinction difficult.[55] Additional risk factors for infant OSA include prematurity, maternal smoking, bronchopulmonary dysplasia, obesity, and specific medical conditions including laryngomalacia, craniofacial abnormalities, neuromuscular weakness, Down syndrome, achondroplasia, Chiari malformations, and Prader-Willi syndrome.[34,56–58]

1F. Clinicians May Obtain a 12-Lead Electrocardiogram for Infants Presenting With Lower-Risk BRUE (Grade C, Weak Recommendation)

ALTE studies have examined screening electrocardiograms (ECGs). A study by Brand et al[4] found no positive findings on 24 ECGs performed on 72 patients (33%) without a contributory history or physical examination. Hoki et al[16] reported a 4% incidence of cardiac disease found in 485 ALTE patients; ECGs were performed in 208 of 480 patients (43%) with 3 of 5 abnormal heart rhythms identified by the ECG and the remaining 2 showing structural heart disease. Both studies had low positive-predictive values of ECGs (0% and 1%, respectively). Hoki et al had a negative predictive value of 100% (96%–100%), and given the low prevalence of disease, there is little need for further testing in patients with a negative ECG.

Some cardiac conditions that may present as a BRUE include channelopathies (long QT syndrome, short QT syndrome, Brugada syndrome, and catecholaminergic polymorphic ventricular tachycardia), ventricular pre-excitation (Wolff-Parkinson-White syndrome), and cardiomyopathy/myocarditis (hypertrophic cardiomyopathy, dilated cardiomyopathy). Resting ECGs are ineffective in identifying patients with catecholaminergic polymorphic ventricular tachycardia. Family history is important in identifying individuals with channelopathies.

Severe potential outcomes of any of these conditions, if left undiagnosed or untreated, include sudden death or neurologic injury.[59] However, many patients do not ever experience symptoms in their lifetime and adverse outcomes are uncommon. A genetic autopsy study in infants who died of SIDS in Norway showed an association between 9.5% and 13.0% of infants with abnormal

1G. Clinicians Should Not Obtain an Echocardiogram in Infants Presenting With Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, caregiver/infant anxiety, and sedation risk Avoid consequences of false-positive results
Risks, harm, cost	May miss rare diagnosis of cardiac disease
Benefit-harm assessment	The benefits of reducing unnecessary testing and sedation risk, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for cardiac causes
Intentional vagueness	Abnormal cardiac physical examination reflects the clinical judgment of the clinician
Role of patient preferences	Some caregivers may prefer to have echocardiography performed
Exclusions	Patients with an abnormal cardiac physical examination
Strength	Moderate recommendation
Key references	4, 16

1H. Clinicians Should Not Initiate Home Cardiorespiratory Monitoring in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce costs, unnecessary testing, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May rarely miss an infant with recurrent central apnea or cardiac arrhythmias
Benefit-harm assessment	The benefits of reducing unnecessary testing and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for recurrent apnea or cardiac arrhythmias
Intentional vagueness	None
Role of patient preferences	Caregivers will frequently request monitoring be instituted after an ALTE in their infant; a careful explanation of the limitations and disadvantages of this technology should be given
Exclusions	None
Strength	Moderate recommendation
Key reference	34

or novel gene findings at the long QT loci.[60] A syncopal episode, which could present as a BRUE, is strongly associated with subsequent sudden cardiac arrest in patients with long QT syndrome.[61] The incidence and risk in those with other channelopathies have not been adequately studied. The incidence of sudden cardiac arrest in patients with ventricular pre-excitation (Wolff-Parkinson-White syndrome) is 3% to 4% over the lifetime of the individual.[62]

1G. Clinicians Should Not Obtain an Echocardiogram in Infants Presenting With Lower-Risk BRUE (Grade C, Moderate Recommendation)

Cardiomyopathy (hypertrophic and dilated cardiomyopathy) and myocarditis could rarely present as a lower-risk BRUE and can be identified with echocardiography. The cost of an echocardiogram is high and accompanied by sedation risks.

In a study in ALTE patients, Hoki et al[16] did not recommend echocardiography as an initial cardiac test unless there are findings on examination or from an echocardiogram consistent with heart disease. The majority of abnormal echocardiogram findings in their study were not perceived to be life-threatening or related to a cause for the ALTE (eg, septal defects or mild valve abnormalities), and they would have been detected on echocardiogram or physical examination. Brand et al[4] reported 32 echocardiograms in 243 ALTE patients and found only 1 abnormal echocardiogram, which was suspected because of an abnormal history and physical examination (double aortic arch).

1H. Clinicians Should Not Initiate Home Cardiorespiratory Monitoring in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

The use of ambulatory cardiorespiratory monitors in infants presenting with ALTEs has been proposed as a modality to identify subsequent events, reduce the risk of SIDS, and alert caregivers of the need for intervention. Monitors can identify respiratory pauses and bradycardia in many infants presenting with ALTE; however, these events are also occasionally observed in otherwise normal infants.[34,40] In addition, infant monitors are prone to artifact and have not been shown to improve outcomes or prevent SIDS or improve neurodevelopmental outcomes.[63] Indeed, caregiver anxiety may be exacerbated with the use of infant monitors and potential false alarms. The overwhelming majority of monitor-identified alarms, including many with reported clinical symptomatology, do not reveal abnormalities on cardiorespiratory recordings.[64–66] Finally, there are several studies showing a lack of correlation between ALTEs and SIDS.[24,32]

Kahn and Blum[41] monitored 50 infants considered at "high risk" of SIDS and reported that 80% had alarms at home. All infants with alarms had at least 1 episode of parental intervention motivated by the alarms, although the authors acknowledged that some cases of parental intervention may have been attributable to parental anxiety. Nevertheless, the stimulated infants did not die of SIDS or require rehospitalization and therefore it was concluded that monitoring

resulted in successful resuscitation, but this was not firmly established. Côté et al[40] reported "significant events" involving central apnea and bradycardia with long-term monitoring. However, these events were later shown to be frequently present in otherwise well infants.[34] There are insufficient data to support the use of commercial infant monitoring devices marketed directly to parents for the purposes of SIDS prevention.[63] These monitors may be prone to false alarms, produce anxiety, and disrupt sleep. Furthermore, these machines are frequently used without a medical support system and in the absence of specific training to respond to alarms. Although it is beyond the scope of this clinical practice guideline, future research may show that home monitoring (cardiorespiratory and/or oximetry) is appropriate for some infants with higher-risk BRUE.

2. Child Abuse

2A. Clinicians Need Not Obtain Neuroimaging (Computed Tomography, MRI, or Ultrasonography) To Detect Child Abuse in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

2B. Clinicians Should Obtain an Assessment of Social Risk Factors To Detect Child Abuse in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Child abuse is a common and serious cause of an ALTE. Previous research has suggested that this occurs in up to 10% of ALTE cohorts.[3,67] Abusive head trauma is the most common form of child maltreatment associated with an ALTE. Other forms of child abuse that can present as an ALTE, but would not be identified by radiologic evaluations, include caregiver-fabricated illness (formally known as Münchausen by proxy), smothering, and poisoning.

Children who have experienced child abuse, most notably abusive head trauma, may present with a

2A. Clinicians Need Not Obtain Neuroimaging (Computed Tomography, MRI, or Ultrasonography) To Detect Child Abuse in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Decrease cost
	Avoid sedation, radiation exposure, consequences of false-positive results
Risks, harm, cost	May miss cases of child abuse and potential subsequent harm
Benefit-harm assessment	The benefits of reducing unnecessary testing, sedation, radiation exposure, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for child abuse
Intentional vagueness	None
Role of patient preferences	Caregiver concerns may lead to requests for CNS imaging
Exclusions	None
Strength	Weak recommendation (based on low quality of evidence)
Key references	3, 67

2B. Clinicians Should Obtain an Assessment of Social Risk Factors To Detect Child Abuse in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Identification of child abuse
	May benefit the safety of other children in the home
	May identify other social risk factors and needs and help connect caregivers with appropriate resources (eg, financial distress)
Risks, harm, cost	Resource intensive and not always available, particularly for smaller centers
	Some social workers may have inadequate experience in child abuse assessment
	May decrease caregiver's trust in the medical team
Benefit-harm assessment	The benefits of identifying child abuse and identifying and addressing social needs outweigh the cost of attempting to locate the appropriate resources or decreasing the trust in the medical team
Intentional vagueness	None
Role of patient preferences	Caregivers may perceive social services involvement as unnecessary and intrusive
Exclusions	None
Strength	Moderate recommendation
Key reference	68

BRUE. Four studies reported a low incidence (0.54%–2.5%) of abusive head trauma in infants presenting to the emergency department with an ALTE.[22,37,67,69] If only those patients meeting lower-risk BRUE criteria were included, the incidence of abusive head trauma would have been <0.3%. Although missing abusive head trauma can result in significant morbidity and mortality, the yield of performing neuroimaging to screen for abusive head trauma is extremely low and has associated risks of sedation and radiation exposure.[32,70]

Unfortunately, the subtle presentation of child abuse may lead to a delayed diagnosis of abuse and result in significant morbidity and mortality.[70] A thorough history and physical examination is the best way to identify infants at risk of these

conditions.[67,71] Significant concerning features for child abuse (especially abusive head trauma) can include a developmentally inconsistent or discrepant history provided by the caregiver(s), a previous ALTE, a recent emergency service telephone call, vomiting, irritability, or bleeding from the nose or mouth.[67,71]

Clinicians and medical team members (eg, nurses and social workers) should obtain an assessment of social risk factors in infants with a BRUE, including negative attributions to and unrealistic expectations of the child, mental health problems, domestic violence/intimate partner violence, social service involvement, law enforcement involvement, and substance abuse.[68] In addition, clinicians and medical team members can help families identify and use resources that may expand and strengthen their network of social support.

In previously described ALTE cohorts, abnormal physical findings were associated with an increased risk of abusive head trauma. These findings include bruising, subconjunctival hemorrhage, bleeding from the nose or mouth, and a history of rapid head enlargement or head circumference >95th percentile.[67,70–74] It is important to perform a careful physical examination to identify subtle findings of child abuse, including a large or full/bulging anterior fontanel, scalp bruising or bogginess, oropharynx or frenula damage, or skin findings such as bruising or petechiae, especially on the trunk, face, or ears. A normal physical examination does not rule out the possibility of abusive head trauma. Although beyond the scope of this guideline, it is important for the clinician to note that according to the available evidence, brain neuroimaging is probably indicated in patients who qualify as higher-risk because of concerns about abuse resulting from abnormal history or physical findings.[67]

A social and environmental assessment should evaluate the risk of intentional poisoning, unintentional poisoning, and environmental exposure (eg, home environment), because these can be associated with the symptoms of ALTEs in infants.[75–78] In 1 study, 8.4% of children presenting to the emergency department after an ALTE were found to have a clinically significant, positive comprehensive toxicology screen.[76] Ethanol or other drugs have also been associated with ALTEs.[79] Pulmonary hemorrhage can be caused by environmental exposure to moldy, water-damaged homes; it would usually present with hemoptysis and thus probably would not qualify as a BRUE.[80]

3. Neurology

3A. Clinicians Should Not Obtain Neuroimaging (Computed Tomography, MRI, or Ultrasonography) To Detect Neurologic Disorders in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Epilepsy or an abnormality of brain structure can present as a lower-risk BRUE. CNS imaging is 1 method for evaluating whether underlying abnormalities of brain development or structure might have led to the BRUE. The long-term risk of a diagnosis of neurologic disorders ranges from 3% to 11% in historical cohorts of ALTE patients.[2,32] One retrospective study in 243 ALTE patients reported that CNS imaging contributed to a neurologic diagnosis in 3% to 7% of patients.[4] However, the study population included all ALTEs, including those with a significant past medical history, non–well-appearing infants, and those with tests ordered as part of the emergency department evaluation.

In a large study of ALTE patients, the utility of CNS imaging studies in potentially classifiable lower-risk BRUE patients was found to be low.[32] The cohort of 471 patients was followed both acutely and long-term for the development of epilepsy and other neurologic disorders, and the sensitivity and positive-predictive value of abnormal CNS imaging for subsequent development of epilepsy was 6.7% (95% confidence interval [CI]: 0.2%–32%) and 25% (95% CI: 0.6%–81%), respectively.

The available evidence suggests minimal utility of CNS imaging to evaluate for neurologic disorders, including epilepsy, in lower-risk patients. This situation is particularly true for pediatric epilepsy, in which even if a patient is determined ultimately to have seizures/epilepsy, there is no evidence of benefit from starting therapy after the first seizure compared with starting therapy after a second seizure in terms of achieving seizure remission.[81–83] However, our recommendations for BRUEs are not based on any prospective studies and only on a single retrospective study. Future work should track both short- and long-term neurologic outcomes when considering this issue.

3B. Clinicians Should Not Obtain an EEG To Detect Neurologic Disorders in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Epilepsy may first present as a lower-risk BRUE. The long-term risk of epilepsy ranges from 3% to 11% in historical cohorts of ALTE patients.[2,32] EEG is part of the typical evaluation for diagnosis of seizure disorders. However, the utility of obtaining an EEG routinely was found to be low in 1 study.[32] In a cohort of 471 ALTE patients followed both acutely and long-term for the development of epilepsy, the sensitivity and positive-predictive value of an abnormal EEG for subsequent development of epilepsy was 15% (95% CI: 2%–45%) and 33% (95% CI: 4.3%–48%), respectively. In contrast, another retrospective study in 243 ALTE patients reported that EEG contributed to a neurologic diagnosis in 6% of patients.[4] This study

3A. Clinicians Should Not Obtain Neuroimaging (Computed Tomography, MRI, or Ultrasonography) To Detect Neurologic Disorders in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce unnecessary testing, radiation exposure, sedation, caregiver/infant anxiety, and costs
	Avoid consequences of false-positive results
Risks, harm, cost	May rarely miss diagnostic opportunity for CNS causes of BRUEs
	May miss unexpected cases of abusive head trauma
Benefit-harm assessment	The benefits of reducing unnecessary testing, radiation exposure, sedation, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for CNS cause
Intentional vagueness	None
Role of patient preferences	Caregivers may seek reassurance from neuroimaging and may not understand the risks from radiation and sedation
Exclusions	None
Strength	Moderate recommendation
Key references	2, 32, 81

3B. Clinicians Should Not Obtain an EEG To Detect Neurologic Disorders in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce unnecessary testing, sedation, caregiver/infant anxiety, and costs
	Avoid consequences of false-positive or nonspecific results
Risks, harm, cost	Could miss early diagnosis of seizure disorder
Benefit-harm assessment	The benefits of reducing unnecessary testing, sedation, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for epilepsy
Intentional vagueness	None
Role of patient preferences	Caregivers may seek reassurance from an EEG, but they may not appreciate study limitations and the potential of false-positive results
Exclusions	None
Strength	Moderate recommendation
Key references	32, 84, 85

population differed significantly from that of Bonkowsky et al[32] in that all ALTE patients with a significant past medical history and non–well-appearing infants were included in the analysis and that tests ordered in the emergency department evaluation were also included in the measure of EEG yield.

A diagnosis of seizure is difficult to make from presenting symptoms of an ALTE.[30] Although EEG is recommended by the American Academy of Neurology after a first-time nonfebrile seizure, the yield and sensitivity of an EEG after a first-time ALTE in a lower-risk child are low.[86] Thus, the evidence available suggests no utility for routine EEG to evaluate for epilepsy in a lower-risk BRUE. However, our recommendations for BRUEs are based on no prospective studies and on only a single retrospective study. Future work should track both short- and long-term epilepsy when considering this issue.

Finally, even if a patient is determined ultimately to have seizures/epilepsy, the importance of an EEG for a first-time ALTE is low, because there is little evidence that shows a benefit from starting therapy after the first seizure compared with after a second seizure in terms of achieving seizure remission.[81–83,85]

3C. Clinicians Should Not Prescribe Antiepileptic Medications for Potential Neurologic Disorders in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Once epilepsy is diagnosed, treatment can consist of therapy with an antiepileptic medication. In a cohort of 471 ALTE patients followed both acutely and long-term for the development of epilepsy, most patients who developed epilepsy had a second event within 1 month of their initial presentation.[32,87] Even if a patient is determined ultimately to have seizures/epilepsy, there is no evidence of benefit from starting therapy after the first seizure compared with starting therapy after a second seizure in terms of achieving seizure remission.[81–83,85] Sudden unexpected death in epilepsy (SUDEP) has a frequency close to 1 in 1000 patient-years, but the risks of SUDEP are distinct from ALTEs/BRUEs and include adolescent age and presence of epilepsy for more than 5 years. These data do not support prescribing an antiepileptic medicine for a first-time possible seizure because of a concern for SUDEP. Thus, the evidence available for ALTEs suggests lack of benefit for starting an antiepileptic medication for a lower-risk BRUE. However, our recommendations for BRUEs are based on no prospective studies and on only a single retrospective study. Future work should track both short- and long-term epilepsy when considering this issue.

4. Infectious Diseases

4A. Clinicians Should Not Obtain a White Blood Cell Count, Blood Culture, or Cerebrospinal Fluid Analysis or Culture To Detect an Occult Bacterial Infection in Infants Presenting With a Lower-Risk BRUE (Grade B, Strong Recommendation)

Some studies reported that ALTEs are the presenting complaint of an invasive infection, including bacteremia and/or meningitis

3C. Clinicians Should Not Prescribe Antiepileptic Medications for Potential Neurologic Disorders in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce medication adverse effects and risks, avoid treatment with unproven efficacy, and reduce cost
Risks, harm, cost	Delay in treatment of epilepsy could lead to subsequent BRUE or seizure
Benefit-harm assessment	The benefits of reducing medication adverse effects, avoiding unnecessary treatment, and reducing cost outweigh the risk of delaying treatment of epilepsy
Intentional vagueness	None
Role of patient preferences	Caregivers may feel reassured by starting a medicine but may not understand the medication risks
Exclusions	None
Strength	Moderate recommendation
Key references	32, 85, 87

4A. Clinicians Should Not Obtain a White Blood Cell Count, Blood Culture, or Cerebrospinal Fluid Analysis or Culture To Detect an Occult Bacterial Infection in Infants Presenting With a Lower-Risk BRUE (Grade B, Strong Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce unnecessary testing, pain, exposure, caregiver/infant anxiety, and costs Avoid unnecessary antibiotic use and hospitalization pending culture results Avoid consequences of false-positive results/contaminants
Risks, harm, cost	Could miss serious bacterial infection at presentation
Benefit-harm assessment	The benefits of reducing unnecessary testing, pain, exposure, costs, unnecessary antibiotic use, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for a bacterial infection
Intentional vagueness	None
Role of patient preferences	Caregiver concerns over possible infectious etiology may lead to requests for antibiotic therapy
Exclusions	None
Strength	Strong recommendation
Key references	4, 37, 88

detected during the initial workup. However, on further review of such cases with serious bacterial infections, these infants did not qualify as lower-risk BRUEs, because they had risk factors (eg, age <2 months) and/or appeared ill and had abnormal findings on physical examination (eg, meningeal signs, nuchal rigidity, hypothermia, shock, respiratory failure) suggesting a possible severe bacterial infection. After eliminating those cases, it appears extremely unlikely that meningitis or sepsis will be the etiology of a lower-risk BRUE.[2–4,37,88,89] Furthermore, performing these tests for bacterial infection may then lead the clinician to empirically treat with antibiotics with the consequent risks of medication adverse effects, intravenous catheters, and development of resistant organisms. Furthermore, false-positive blood cultures (eg, coagulase negative staphylococci, *Bacillus* species, *Streptococcus viridans)* are likely to occur at times, leading to additional testing, longer hospitalization and antibiotic use, and increased parental anxiety until they are confirmed as contaminants.

Thus, the available evidence suggests that a complete blood cell count, blood culture, and lumbar puncture are not of benefit in infants with the absence of risk factors or findings from the patient's history, vital signs, and physical examination (ie, a lower-risk BRUE).

4B. Clinicians Need Not Obtain a Urinalysis (Bag or Catheter) in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Case series of infants with ALTEs have suggested that a urinary tract infection (UTI) may be detected at the time of first ALTE presentation in up to 8% of cases.[3,4,37,88] Claudius et al[88] provided insight into 17 cases of certain (n = 13) or possible (n = 4) UTI. However, 14 of these cases would not meet the criteria for a lower-risk BRUE on the basis of age younger than 2 months or being ill-appearing and/or having fever at presentation.

Furthermore, these studies do not always specify the method of urine collection, urinalysis findings, and/or the specific organisms and colony-forming units per milliliter of the isolates associated with the reported UTIs that would confirm the diagnosis. AAP guidelines for the diagnosis and management of UTIs in children 2 to 24 months of age assert that the diagnosis of UTI requires "*both* urinalysis results that suggest infection (pyuria and/or bacteruria) *and* the presence of at least 50 000 colony-forming units/mL of a uropathogen cultured from a urine specimen obtained through catheterization or suprapubic aspirate."[90] Thus, it seems unlikely for a UTI to present as a lower-risk BRUE.

Pending more detailed studies that apply a rigorous definition of UTI to infants presenting with a lower-risk BRUE, a screening urinalysis need not be obtained routinely. If it is decided to evaluate the infant for a possible UTI, then a urinalysis can be obtained but should only be followed up with a culture if the urinalysis has

4B. Clinicians Need Not Obtain a Urinalysis (Bag or Catheter) in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce unnecessary testing, pain, iatrogenic infection, caregiver/infant anxiety, and costs Avoid consequences of false-positive results Avoid delay from time it takes to obtain a bag urine
Risks, harm, cost	May delay diagnosis of infection
Benefit-harm assessment	The benefits of reducing unnecessary testing, iatrogenic infection, pain, costs, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for a urinary tract infection
Intentional vagueness	None
Role of patient preferences	Caregiver concerns may lead to preference for testing
Exclusions	None
Strength	Weak recommendation (based on low quality of evidence)
Key references	4, 88

4C. Clinicians Should Not Obtain a Chest Radiograph To Assess for Pulmonary Infection in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Reduce costs, unnecessary testing, radiation exposure, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss early lower respiratory tract infection
Benefit-harm assessment	The benefits of reducing unnecessary testing, radiation exposure, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for pulmonary infection
Intentional vagueness	None
Role of patient preferences	Caregiver concerns may lead to requests for a chest radiograph
Exclusions	None
Strength	Moderate recommendation
Key references	4, 18, 37

abnormalities suggestive of possible infection (eg, increased white blood cell count, positive nitrates, and/or leukocyte esterase).

4C. Clinicians Should Not Obtain a Chest Radiograph To Assess for Pulmonary Infection in Infants Presenting With a Lower-Risk BRUE (Grade B, Moderate Recommendation)

Chest radiography is unlikely to yield clinical benefit in a well-appearing infant presenting with a lower-risk BRUE. In the absence of abnormal respiratory findings (eg, cough, tachypnea, decreased oxygen saturation, auscultatory changes), lower respiratory tract infection is unlikely to be present.

Studies in children presenting with an ALTE have described occasional cases with abnormal findings on chest radiography in the absence of respiratory findings on history or physical examination.[4,37] However, the nature of the abnormalities and their role in the ALTE presentation in the absence of further details about the radiography results make it difficult to interpret the significance of these observations. For instance, descriptions of increased interstitial markings or small areas of atelectasis would not have the same implication as a focal consolidation or pleural effusion.

Kant et al,[18] in a follow-up of 176 children admitted for an ALTE, reported that 2 infants died within 2 weeks of discharge and both were found to have pneumonia on postmortem examination. This observation does not support the potential indication for an initial radiograph. In fact, one of the children had a normal radiograph during the initial evaluation. The finding of pneumonia on postmortem examination may reflect an agonal aspiration event. Brand et al[4] reported 14 cases of pneumonia identified at presentation in their analysis of 95 cases of ALTEs. However, in 13 of the patients, findings suggestive of lower respiratory infection, such as tachypnea, stridor, retractions, use of accessory muscles, or adventitious sounds on auscultation, were detected at presentation, leading to the request for chest radiography.

4D. Clinicians Need Not Obtain Respiratory Viral Testing If Rapid Testing Is Available in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Respiratory viral infections (especially with respiratory syncytial virus [RSV]) have been reported as presenting with apnea or an ALTE, with anywhere from 9% to 82% of patients tested being positive for RSV.[2,4,37,88] However, this finding was observed predominantly in children younger than 2 months and/or those who were born prematurely. Recent data suggest that apnea or an ALTE presentation is not unique to RSV and may be seen with a spectrum of respiratory viral infections.[90] The data in ALTE cases do not address the potential role of other respiratory viruses in ALTEs or BRUEs.

In older children, respiratory viral infection would be expected to present with symptoms ranging from upper respiratory to lower respiratory tract infection rather than as an isolated BRUE. A history of respiratory symptoms and illness exposure; findings of congestion and/or cough, tachypnea, or lower respiratory tract abnormalities; and local epidemiology regarding currently circulating viruses are

4D. Clinicians Need Not Obtain Respiratory Viral Testing If Rapid Testing Is Available in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, and caregiver/infant discomfort Avoid false-negative result leading to missed diagnosis and false reassurance
Risks, harm, cost	Failure to diagnose a viral etiology Not providing expectant management for progression and appropriate infection control interventions for viral etiology
Benefit-harm assessment	The benefits of reducing unnecessary testing, pain, costs, false reassurance, and false-positive results, as well as alleviating caregiver and infant anxiety and challenges associated with providing test results in a timely fashion, outweigh the rare missed diagnostic opportunity for a viral infection
Intentional vagueness	"Rapid testing"; time to results may vary
Role of patient preferences	Caregiver may feel reassured by a specific viral diagnosis
Exclusions	None
Strength	Weak recommendation (based on low-quality evidence)
Key references	4, 37, 91

4E. Clinicians May Obtain Testing for Pertussis in Infants Presenting With a Lower-Risk BRUE (Grade B, Weak Recommendation)

Aggregate Evidence Quality	Grade B
Benefits	Identify a potentially treatable infection Monitor for progression of symptoms, additional apneic episodes Potentially prevent secondary spread and/or identify and treat additional cases
Risks, harm, cost	Cost of test Discomfort of nasopharyngeal swab False-negative results leading to missed diagnosis and false reassurance Rapid testing not always available False reassurance from negative results
Benefit-harm assessment	The benefits of identifying and treating pertussis and preventing apnea and secondary spread outweigh the cost, discomfort, and consequences of false test results and false reassurance; the benefits are greatest in at-risk populations (exposed, underimmunized, endemic, and during outbreaks)
Intentional vagueness	None
Role of patient preferences	Caregiver may feel reassured if a diagnosis is obtained and treatment can be implemented
Exclusions	None
Strength	Weak recommendation (based on balance of benefit and harm)
Key reference	93

considerations in deciding whether to order rapid testing for respiratory viruses. Because lower-risk BRUE patients do not have these symptoms, clinicians need not perform such testing.

In addition, until recently and in reports of ALTE patients to date, RSV testing was performed by using antigen detection tests. More recently, automated nucleic acid amplification-based tests have entered clinical practice. These assays are more sensitive than antigen detection tests and can detect multiple viruses from a single nasopharyngeal swab. The use of these tests in future research may allow better elucidation of the role of respiratory viruses in patients presenting with an ALTE in general and whether they play a role in BRUEs.

As a cautionary note, detection of a virus in a viral multiplex assay may not prove causality, because some agents, such as rhinovirus and adenovirus, may persist for periods beyond the acute infection (up to 30 days) and may or may not be related to the present episode.[92] In a lower-risk BRUE without respiratory symptoms testing for viral infection may not be indicated, but in the presence of congestion and/or cough, or recent exposure to a viral respiratory infection, such testing may provide useful information regarding the cause of the child's symptoms and for infection control management. Anticipatory guidance and arranging close follow-up at the initial presentation could be helpful if patients subsequently develop symptoms of a viral infection.

4E. Clinicians May Obtain Testing for Pertussis in Infants Presenting With a Lower-Risk BRUE (Grade B, Weak Recommendation)

Pertussis infection has been reported to cause ALTEs in infants, because it can cause gagging, gasping, and color change followed by respiratory pause. Such infants can be afebrile and may not develop cough or lower respiratory symptoms for several days afterward.

The decision to test a lower-risk BRUE patient for pertussis should consider potential exposures, vaccine history (including intrapartum immunization of the mother as well as the infant's vaccination history), awareness of pertussis activity in the community, and turnaround time for results. Polymerase chain reaction testing for pertussis on a nasopharyngeal specimen, if available, offers the advantage of rapid turnaround time to results.[94] Culture for the organism requires selective media and will take days to yield results but may still be useful in the face of identified risk of exposure. In patients in whom there is a high index of suspicion on the basis of

the aforementioned risk factors, clinicians may consider prolonging the observation period and starting empirical antibiotics while awaiting test results (more information is available from the Centers for Disease Control and Prevention).[95]

5. Gastroenterology

5A. Clinicians Should Not Obtain Investigations for GER (eg, Upper Gastrointestinal Series, pH Probe, Endoscopy, Barium Contrast Study, Nuclear Scintigraphy, and Ultrasonography) in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

GER occurs in more than two-thirds of infants and is the topic of discussion with pediatricians at one-quarter of all routine 6-month infant visits.[96] GER can lead to airway obstruction, laryngospasm, or aspiration. Although ALTEs that can be attributed to GER symptoms (eg, choking after spitting up) qualify as an ALTE according to the National Institutes of Health definition, importantly, they do not qualify as a BRUE.

GER may still be a contributing factor to a lower-risk BRUE if the patient's GER symptoms were not witnessed or well described by caregivers. However, the available evidence suggests no utility of routine diagnostic testing to evaluate for GER in these patients. The brief period of observation that occurs during an upper gastrointestinal series is inadequate to rule out the occurrence of pathologic reflux at other times, and the high prevalence of nonpathologic reflux that often occurs during the study can encourage false-positive diagnoses. In addition, the observation of the reflux of a barium column into the esophagus during gastrointestinal contrast studies may not correlate with the severity of GER or the degree of esophageal mucosal inflammation in patients with reflux esophagitis. Routine performance

5A. Clinicians Should Not Obtain Investigations for GER (eg, Upper Gastrointestinal Series, pH Probe, Endoscopy, Barium Contrast Study, Nuclear Scintigraphy, and Ultrasonography) in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce unnecessary testing, procedural complications (sedation, intestinal perforation, bleeding), pain, radiation exposure, caregiver/infant anxiety, and costs
	Avoid consequences of false-positive results
Risks, harm, cost	Delay diagnosis of rare but serious gastrointestinal abnormalities (eg, tracheoesophageal fistula)
	Long-term morbidity of repeated events (eg, chronic lung disease)
Benefit-harm assessment	The benefits of reducing unnecessary testing, complications, radiation, pain, costs, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for a gastrointestinal abnormality or morbidity from repeat events
Intentional vagueness	None
Role of patient preferences	Caregiver may be reassured by diagnostic evaluation of GER
Exclusions	None
Strength	Moderate recommendation
Key references	96, 97

of an upper gastrointestinal series to diagnose GER is not justified and should be reserved to screen for anatomic abnormalities associated with vomiting (which is a symptom that precludes the diagnosis of a lower-risk BRUE).[98] Gastroesophageal scintigraphy scans for reflux of ^{99m}Tc-labeled solids or liquids into the esophagus or lungs after the administration of the test material into the stomach. The lack of standardized techniques and age-specific normal values limits the usefulness of this test. Therefore, gastroesophageal scintigraphy is not recommended in the routine evaluation of pediatric patients with GER symptoms or a lower-risk BRUE.[97] Multiple intraluminal impedance (MII) is useful for detecting both acidic and nonacidic reflux, thereby providing a more detailed picture of esophageal events than pH monitoring. Combined pH/MII testing is evolving into the test of choice to detect temporal relationships between specific symptoms and the reflux of both acid and nonacid gastric contents. In particular, MII has been used in recent years to investigate how GER correlates with respiratory symptoms, such as apnea or cough. Performing esophageal pH +/- impedance monitoring is not indicated in the routine evaluation of infants presenting with a lower-risk BRUE, although it may be considered in patients with recurrent BRUEs and GER symptoms even if these occur independently.

Problems with the coordination of feedings can lead to ALTEs and BRUEs. In a study in Austrian newborns, infants who experienced an ALTE had a more than twofold increase in feeding difficulties (multivariate relative risk: 2.5; 95% CI: 1.3–4.6).[99] In such patients, it is likely that poor suck-swallow-breathe coordination triggered choking or laryngospasm. A clinical speech therapy evaluation may help to evaluate any concerns for poor coordination swallowing with feeding.

5B. Clinicians Should Not Prescribe Acid Suppression Therapy for Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

The available evidence suggests no proven efficacy of acid suppression therapy for esophageal reflux in patients presenting with a lower-risk BRUE. Acid suppression therapy with H2-receptor antagonists or proton

5B. Clinicians Should Not Prescribe Acid Suppression Therapy for Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce unnecessary medication use, adverse effects, and cost from treatment with unproven efficacy
Risks, harm, cost	Delay treatment of rare but undiagnosed gastrointestinal disease, which could lead to complications (eg, esophagitis)
Benefit-harm assessment	The benefits of reducing medication adverse effects, avoiding unnecessary treatment, and reducing cost outweigh the risk of delaying treatment of gastrointestinal disease
Intentional vagueness	None
Role of patient preferences	Caregiver concerns may lead to requests for treatment
Exclusions	None
Strength	Moderate recommendation
Key reference	98

pump inhibitors may be indicated in selected pediatric patients with GER disease (GERD), which is diagnosed in patients when reflux of gastric contents causes troublesome symptoms or complications.[98] Infants with spitting up or throat-clearing coughs that are not troublesome do not meet diagnostic criteria for GERD. Indeed, the inappropriate administration of acid suppression therapy may have harmful adverse effects because it exposes infants to an increased risk of pneumonia or gastroenteritis.[100]

GER leading to apnea is not always clinically apparent and can be the cause of a BRUE. Acid reflux into the esophagus has been shown to be temporally associated with oxygen desaturation and obstructive apnea, suggesting that esophageal reflux may be one of the underlying conditions in selected infants presenting with BRUEs.[101] Respiratory symptoms are more likely to be associated with GER when gross emesis occurs at the time of a BRUE, when episodes occur while the infant is awake and supine (sometimes referred to as "awake apnea"), and when a pattern of obstructive apnea is observed while the infant is making respiratory efforts without effective air movement.[102]

Wenzl et al[103] reported a temporal association between 30% of the nonpathologic, short episodes of central apnea and GER by analyzing combined data from simultaneous esophageal and cardiorespiratory monitoring. These findings cannot be extrapolated to pathologic infant apnea and may represent a normal protective cessation of breathing during regurgitation. Similarly, Mousa et al[104] analyzed data from 527 apneic events in 25 infants and observed that only 15.2% were temporally associated with GER. Furthermore, there was no difference in the linkage between apneic events and acid reflux (7.0%) and nonacid reflux (8.2%). They concluded that there is little evidence for an association between acid reflux or nonacid reflux and the frequency of apnea. Regression analysis revealed a significant association between apnea and reflux in 4 of 25 infants. Thus, in selected infants, a clear temporal relationship between apnea and ALTE can be shown. However, larger studies have not proven a causal relationship between pathologic apnea and GER.[105]

As outlined in the definition of a BRUE, when an apparent explanation for the event, such as GER, is evident at the time of initial evaluation, the patient should be managed as appropriate for the clinical situation. However, BRUEs can be caused by episodes of reflux-related laryngospasm (sometimes referred to as "silent reflux"), which may not be clinically apparent at the time of initial evaluation. Laryngospasm may also occur during feeding in the absence of GER. Measures that have been shown to be helpful in the nonpharmacologic management of GER in infants include avoiding overfeeding, frequent burping during feeding, upright positioning in the caregiver's arms after feeding, and avoidance of secondhand smoke.[106] Thickening feedings with commercially thickened formula for infants without milk-protein intolerance does not alter esophageal acid exposure detected by esophageal pH study but has been shown to decrease the frequency of regurgitation. Given the temporal association observed between GER and respiratory symptoms in selected infants, approaches that decrease the height of the reflux column, the volume of refluxate, and the frequency of reflux episodes may theoretically be beneficial.[98] Combined pH/MII testing has shown that, although the frequency of reflux events is unchanged with thickened formula, the height of the column of refluxate is decreased. Studies have shown that holding the infant on the caregiver's shoulders for 10 to 20 minutes to allow for adequate burping after a feeding before placing the infant in the "back to sleep position" can decrease the frequency of GER in infants. In contrast, placing an infant in a car seat or in other semisupine positions, such as in an infant carrier, exacerbates esophageal reflux and should be avoided.[98] The frequency of GER has been reported to be decreased in breastfed compared with formula-fed infants. Thus, the benefits of breastfeeding are preferred over the theoretical effect of thickened formula feeding, so exclusive breastfeeding should be encouraged whenever possible.

6. Inborn Errors of Metabolism

6A. Clinicians Need Not Obtain Measurement of Serum Lactic Acid or Serum Bicarbonate To Detect an IEM in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

6B. Clinicians Should Not Obtain a Measurement of Serum Sodium, Potassium, Chloride, Blood Urea Nitrogen, Creatinine, Calcium, or Ammonia To Detect an IEM on Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

6C. Clinicians Should Not Obtain a Measurement of Venous or Arterial Blood Gases To Detect an IEM in Infants Presenting With Lower-Risk BRUE (Grade C, Moderate Recommendation)

6D. Clinicians Need Not Obtain a Measurement of Blood Glucose To Detect an IEM in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

6E. Clinicians Should Not Obtain Measurements of Urine Organic Acids, Plasma Amino Acids, or Plasma Acylcarnitines To Detect an IEM in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

6A. Clinicians Need Not Obtain Measurement of Serum Lactic Acid or Serum Bicarbonate To Detect an IEM in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce unnecessary testing, caregiver/infant anxiety, and costs Avoid consequences of false-positive or nonspecific results
Risks, harm, cost	May miss detection of an IEM
Benefit-harm assessment	The benefits of reducing unnecessary testing, cost, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for an IEM
Intentional vagueness	Detection of higher lactic acid or lower bicarbonate levels should be considered to have a lower likelihood of being a false-positive result and may warrant additional investigation
Role of patient preferences	Caregiver concerns may lead to requests for diagnostic testing
Exclusions	None
Strength	Weak recommendation (based on low-quality evidence)
Key reference	38

6B. Clinicians Should Not Obtain a Measurement of Serum Sodium, Potassium, Chloride, Blood Urea Nitrogen, Creatinine, Calcium, or Ammonia To Detect an IEM on Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, pain, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss detection of an IEM
Benefit-harm assessment	The benefits of reducing unnecessary testing, cost, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for an IEM
Intentional vagueness	None
Role of patient preferences	Caregiver concerns may lead to requests for diagnostic testing
Exclusions	None
Strength	Moderate recommendation
Key reference	4

IEMs are reported to cause an ALTE in 0% to 5% of cases.[2,27,38,99,107,108] On the basis of the information provided by the authors for these patients, it seems unlikely that events could have been classified as a lower-risk BRUE, either because the patient had a positive history or physical examination or a recurrent event. The most commonly reported disorders include fatty acid oxidation disorders or urea cycle disorders.[107,109] In cases of vague or resolved symptoms, a careful history can help determine whether the infant had not received previous treatment (eg, feeding after listlessness for suspected hypoglycemia). These rare circumstances could include milder or later-onset presentations of IEMs.

Infants may be classified as being at a higher risk of BRUE because of a family history of an IEM, developmental disabilities, SIDS, or a medical history of abnormal newborn screening results, unexplained infant death, age younger than 2 months, a prolonged event (>1 minute), or multiple events without an explanation. Confirmation that a newborn screen is complete and is negative is an important aspect of the medical history, but the clinician must consider that not all potential disorders are included in current newborn screening panels in the United States.

Lactic Acid

Measurement of lactic acid can result in high false-positive rates if the sample is not collected properly, making the decision to check a lactic acid problematic. In addition, lactic acid may be elevated because of metabolic abnormalities attributable to other conditions, such as sepsis, and are not specific for IEMs.

Only 2 studies evaluated the specific measurement of lactic acid.[27,38] Davies and Gupta[38] reported 65 infants with consistent laboratory evaluations and found that 54% of infants had a lactic acid >2 mmol/L but only 15% had levels >3 mmol/L. The latter percentage of infants are more likely to be clinically significant and less likely to reflect a false-positive result. Five of 7 infants with a lactic acid >3 mmol/L had a "specific, serious diagnosis," although the specifics of these diagnoses were not included and no IEM was

6C. Clinicians Should Not Obtain a Measurement of Venous or Arterial Blood Gases To Detect an IEM in Infants Presenting With Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, pain, risk of thrombosis, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss detection of an IEM
Benefit-harm assessment	The benefits of reducing unnecessary testing, cost, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for an IEM
Intentional vagueness	None
Role of patient preferences	Caregiver concerns may lead to requests for diagnostic testing
Exclusions	None
Strength	Moderate recommendation
Key reference	4

6D. Clinicians Need Not Obtain a Measurement of Blood Glucose To Detect an IEM in Infants Presenting With a Lower-Risk BRUE (Grade C, Weak Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, pain, risk of thrombosis, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss rare instances of hypoglycemia attributable to undiagnosed IEM
Benefit-harm assessment	The benefits of reducing unnecessary testing, cost, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for an IEM
Intentional vagueness	Measurement of glucose is often performed immediately through a simple bedside test; no abnormalities have been reported in asymptomatic infants, although studies often do not distinguish between capillary or venous measurement
Role of patient preferences	Caregiver concerns may lead to requests for diagnostic testing
Exclusions	None
Strength	Weak recommendation (based on low-quality evidence)
Key reference	4

confirmed in this study. This study also reported a 20% positive yield of testing for a bicarbonate <20 mmol/L and commented that there was a trend for lower bicarbonate and higher lactic acid levels in those with a recurrent event or a definitive diagnosis. The second publication[27] found no elevations of lactate in 4 of 49 children who had an initial abnormal venous blood gas, of which all repeat blood gas measurements were normal.

Serum Bicarbonate

Abnormal serum bicarbonate levels have been studied in 11 infants, of whom 7 had a diagnosis of sepsis or seizures.[38] Brand et al[4] studied 215 infants who had bicarbonate measured and found only 9 abnormal results, and only 3 of these contributed to the final diagnosis. Although unknown, it is most likely that the event in those infants would not have been classified as a BRUE under the new classification, because those infants were most likely symptomatic on presentation.

Serum Glucose

Abnormal blood glucose levels were evaluated but not reported in 3 studies.[4,38,110] Although abnormalities of blood glucose can occur from various IEMs, such as medium-chain acyl–coenzyme A dehydrogenase deficiency or other fatty acid oxidation disorders, their prevalence has not been increased in SIDS and near-miss SIDS but could be considered as a cause of higher-risk BRUEs.[111] It is important to clarify through a careful medical history evaluation that the infant was not potentially hypoglycemic at discovery of the event and improved because of enteral treatment, because these disorders will not typically self-resolve without intervention (ie, feeding).

Serum Electrolytes and Calcium

ALTE studies evaluating the diagnostic value of electrolytes, including sodium, potassium, blood urea nitrogen, and creatinine, reported the rare occurrence of abnormalities, ranging from 0% to 4.3%.[4,38,110] Abnormal calcium levels have been reported in 0% to 1.5% of infants with ALTE, although these reports did not provide specific causes of hypocalcemia. Another study reported profound vitamin D deficiency with hypocalcemia in 5 of 25 infants with a diagnosis of an ALTE over a 2-year period in Saudi Arabia.[4,21,38,110] In lower-risk BRUE infants, clinicians should not obtain a calcium measurement unless the clinical history raises suspicion of hypocalcemia (eg, vitamin D deficiency or hypoparathyroidism).

Ammonia

Elevations of ammonia are typically associated with persistent symptoms and recurring events, and therefore testing would not be indicated in lower-risk BRUEs. Elevations of ammonia were reported in 11 infants (7 whom had an IEM) in a report of infants with recurrent ALTE and SIDS, limiting extrapolation to

lower-risk BRUEs.[109] Elevations of ammonia >100 mmol/L were found in 4% of 65 infants, but this publication did not document a confirmed IEM.[38] Weiss et al[27] reported no abnormal elevations of ammonia in 4 infants with abnormal venous blood gas.

Venous or Arterial Blood Gas

Blood gas abnormalities leading to a diagnosis have not been reported in previous ALTE studies. Brand et al[4] reported 53 of 60 with positive findings, with none contributing to the final diagnosis. Weiss et al[27] reported 4 abnormal findings of 49 completed, all of which were normal on repeat measurements (along with normal lactate and ammonia levels). Blood gas detection is a routine test performed in acutely symptomatic patients who are being evaluated for suspected IEMs and may be considered in higher-risk BRUEs.

Urine Organic Acids, Plasma Amino Acids, Plasma Acylcarnitines

The role of advanced screening for IEMs has been reported in only 1 publication. Davies and Gupta[38] reported abnormalities of urine organic acids in 2% of cases and abnormalities of plasma amino acids in 4% of cases. Other reports have described an "unspecified metabolic screen" that was abnormal in 4.5% of cases but did not provide further description of specifics within that "screen."[4] Other reports have frequently included the descriptions of ALTEs with urea cycle disorders, organic acidemias, lactic acidemias, and fatty acid oxidation disorders such as medium chain acyl–coenzyme A dehydrogenase deficiency but did not distinguish between SIDS and near-miss SIDS.[107,109,111] Specific testing of urine organic acids, plasma amino acids, or plasma acylcarnitines may have a role in patients with a higher-risk BRUE.

6E. Clinicians Should Not Obtain Measurements of Urine Organic Acids, Plasma Amino Acids, or Plasma Acylcarnitines To Detect an IEM in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, pain, risk of thrombosis, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss detection of an IEM
Benefit-harm assessment	The benefits of reducing unnecessary testing, cost, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the rare missed diagnostic opportunity for an IEM
Intentional vagueness	Lower-risk BRUEs will have a very low likelihood of disease, but these tests may be indicated in rare cases in which there is no documentation of a newborn screen being performed
Role of patient preferences	Caregiver concerns may lead to requests for diagnostic testing
Exclusions	None
Strength	Moderate recommendation
Key references	4, 38

7A. Clinicians Should Not Obtain Laboratory Evaluation for Anemia in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Reduce costs, unnecessary testing, pain, risk of thrombosis, and caregiver/infant anxiety Avoid consequences of false-positive results
Risks, harm, cost	May miss diagnosis of anemia
Benefit-harm assessment	The benefits of reducing unnecessary testing, cost, and false-positive results, as well as alleviating caregiver and infant anxiety, outweigh the missed diagnostic opportunity for anemia
Intentional vagueness	None
Role of patient preferences	Caregivers may be reassured by testing
Exclusions	None
Strength	Moderate recommendation
Key reference	22

7. Anemia

7A. Clinicians Should Not Obtain Laboratory Evaluation for Anemia in Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Anemia has been associated with ALTEs in infants, but the significance and causal association with the event itself are unclear.[38,112,113] Normal hemoglobin concentrations have also been reported in many other ALTE populations.[69,112,114] Brand et al[4] reported an abnormal hemoglobin in 54 of 223 cases, but in only 2 of 159 was the hemoglobin concentration associated with the final diagnosis (which was abusive head injury in both). Parker and Pitetti[22] also reported that infants who presented with ALTEs and ultimately were determined to be victims of child abuse were more likely to have a lower mean hemoglobin (10.6 vs 12.7 g/dL; $P = .02$).

8. Patient- and Family-Centered Care

8A. Clinicians Should Offer Resources for CPR Training to Caregivers (Grade C, Moderate Recommendation)

The majority of cardiac arrests in children result from a respiratory deterioration. Bystander CPR has been reported to have been conducted in 37% to 48% of pediatric out-of-hospital cardiac arrests and

in 34% of respiratory arrests.[116] Bystander CPR results in significant improvement in 1-month survival rates in both cardiac and respiratory arrest.[117–119]

Although lower-risk BRUEs are neither a cardiac nor a respiratory arrest, the AAP policy statement on CPR recommends that pediatricians advocate for life-support training for caregivers and the general public.[115] A technical report that accompanies the AAP policy statement on CPR proposes that this can improve overall community health.[115] CPR training has not been shown to increase caregiver anxiety, and in fact, caregivers have reported a sense of empowerment.[120–122] There are many accessible and effective methods for CPR training (eg, e-learning).

8B. Clinicians Should Educate Caregivers About BRUEs (Grade C, Moderate Recommendation)

Pediatric providers are an important source of this health information and can help guide important conversations around BRUEs. A study by Feudtner et al[123] identified 4 groups of attributes of a "good parent": (1) making sure the child feels loved, (2) focusing on the child's health, (3) advocating for the child and being informed, and (4) ensuring the child's spiritual well-being. Clinicians should be the source of information for caregivers. Informed caregivers can advocate for their child in all of the attribute areas/domains, and regardless of health literacy levels, prefer being offered choices and being asked for information.[124] A patient- and family-centered care approach results in better health outcomes.[125,126]

8C. Clinicians Should Use Shared Decision-Making for Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Shared decision-making is a partnership between the clinician and the patient and family.[125,126] The general principles of shared decision-making are as follows: (1) information sharing, (2) respect and honoring differences, (3) partnership and collaboration, (4) negotiation, and (5) care in the context of family and community.[125] The benefits include improved care and outcomes; improved patient, family, and clinician satisfaction; and better use of health resources.[126] It is advocated for by organizations such as the AAP and the Institute of Medicine.[126,127] The 5 principles can be applied to all aspects of the infant who has experienced a BRUE, through each step (assessment, stabilization, management, disposition, and follow-up). Shared decision-making will empower families and foster a stronger clinician-patient/family alliance as they make decisions together in the face of a seemingly uncertain situation.

8A. Clinicians Should Offer Resources for CPR Training to Caregivers (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Decrease caregiver anxiety and increase confidence Benefit to society
Risks, harm, cost	May increase caregiver anxiety Cost and availability of training
Benefit-harm assessment	The benefits of decreased caregiver anxiety and increased confidence, as well as societal benefits, outweigh the increase in caregiver anxiety, cost, and resources
Intentional vagueness	None
Role of patient preferences	Caregiver may decide not to seek out the training
Exclusions	None
Strength	Moderate recommendation
Key reference	115

8B. Clinicians Should Educate Caregivers About BRUEs (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Improve caregiver empowerment and health literacy and decrease anxiety May reduce unnecessary return visits Promotion of the medical home
Risks, harm, cost	Increase caregiver anxiety and potential for caregiver intimidation in voicing concerns Increase health care costs and length of stay
Benefit-harm assessment	The benefits of decreased caregiver anxiety and increased empowerment and health literacy outweigh the increase in cost, length of stay, and caregiver anxiety and intimidation
Intentional vagueness	None
Role of patient preferences	Caregiver may decide not to listen to clinician
Exclusions	None
Strength	Moderate recommendation
Key references	None

DISSEMINATION AND IMPLEMENTATION

Dissemination and implementation efforts are needed to facilitate guideline use across pediatric medicine, family medicine, emergency medicine, research, and patient/family communities.[128] The following general approaches and a Web-based toolkit are proposed for the dissemination and implementation of this guideline.

8C. Clinicians Should Use Shared Decision-Making for Infants Presenting With a Lower-Risk BRUE (Grade C, Moderate Recommendation)

Aggregate Evidence Quality	Grade C
Benefits	Improve caregiver empowerment and health literacy and decrease anxiety May reduce unnecessary return visits Promotion of the medical home
Risks, harm, cost	Increase cost, length of stay, and caregiver anxiety and intimidation in voicing concerns
Benefit-harm assessment	The benefits of decreased caregiver anxiety and unplanned return visits and increased empowerment, health, literacy, and medical home promotion outweigh the increase in cost, length of stay, and caregiver anxiety and information
Intentional vagueness	None
Role of patient preferences	Caregiver may decide not to listen to clinician
Exclusions	None
Strength	Moderate recommendation
Key references	None

1. Education

Education will be partially achieved through the AAP communication outlets and educational services (*AAP News, Pediatrics,* and PREP). Further support will be sought from stakeholder organizations (American Academy of Family Physicians, American College of Emergency Physicians, American Board of Pediatrics, Society of Hospital Medicine). A Web-based toolkit (to be published online) will include caregiver handouts and a shared decision-making tool to facilitate patient- and family-centered care. Efforts will address appropriate disease classification and diagnosis coding.

2. Integration of Clinical Workflow

An algorithm is provided (Fig 1) for diagnosis and management. Structured history and physical examination templates also are provided to assist in addressing all of the relevant risk factors for BRUEs (Tables 2 and 3). Order sets and modified documents will be hosted on a Web-based learning platform that promotes crowd-sourcing.

3. Administrative and Research

International Classification of Diseases, 9th Revision, and International Classification of Diseases, 10th Revision, diagnostic codes are used for billing, quality improvement, and research; and new codes for lower- and higher-risk BRUEs will need to be developed. In the interim, the current code for an ALTE (799.82) will need to be used for billing purposes. Efforts will be made to better reflect present knowledge and to educate clinicians and payers in appropriate use of codes for this condition.

4. Quality Improvement

Quality improvement initiatives that provide Maintenance of Certification credit, such as the AAP's PREP and EQIPP courses, or collaborative opportunities through the AAP's Quality Improvement Innovation Networks, will engage clinicians in the use and improvement of the guideline. By using proposed quality measures, adherence and outcomes can be assessed and benchmarked with others to inform continual improvement efforts. Proposed measures include process evaluation (use of definition and evaluation), outcome assessment (family experience and diagnostic outcomes), and balancing issues (cost and length of visit). Future research will need to be conducted to validate any measures.

FUTURE RESEARCH

The transition in nomenclature from the term ALTE to BRUE after 30 years reflects the expanded understanding of the etiology and consequences of this entity. Previous research has been largely retrospective or observational in nature, with little long-term follow-up data available. The more-precise definition, the classification of lower- and higher-risk groups, the recommendations for the lower-risk group, and the implementation toolkit will serve as the basis for future research. Important areas for future prospective research include the following.

1. Epidemiology

- Incidence of BRUEs in all infants (in addition to those seeking medical evaluation)
- Influence of race, gender, ethnicity, seasonality, environmental exposures, and socioeconomic status on incidence and outcomes

2. Diagnosis

- Use and effectiveness of the BRUE definition
- Screening tests and risk of UTI
- Quantify and better understand risk in higher- and lower-risk groups
- Risk and benefit of screening tests
- Risk and benefit and optimal duration of observation and monitoring periods
- Effect of prematurity on risk
- Appropriate indications for subspecialty referral
- Early recognition of child maltreatment
- Importance of environmental history taking
- Role of human psychology on accuracy of event characterization

- Type and length of monitoring in the acute setting

3. Pathophysiology

- Role of abnormalities of swallowing, laryngospasm, GER, and autonomic function

4. Outcomes

- Patient- and family-centered outcomes, including caregiver satisfaction, anxiety, and family dynamics (eg, risk of vulnerable child syndrome)
- Long-term health and cognitive consequences

5. Treatment

- Empirical GER treatment on recurrent BRUEs
- Caregiver education strategies, including basic life support, family-centered education, and postpresentation clinical visits

6. Follow-up

- Strategies for timely follow-up and surveillance

SUBCOMMITTEE ON BRIEF RESOLVED UNEXPLAINED EVENTS (FORMERLY REFERRED TO AS APPARENT LIFE THREATENING EVENTS) (OVERSIGHT BY THE COUNCIL ON QUALITY IMPROVEMENT AND PATIENT SAFETY)

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ABBREVIATIONS

AAP: American Academy of Pediatrics
ALTE: apparent life-threatening event
BRUE: brief resolved unexplained event
CI: confidence interval
CNS: central nervous system
CPR: cardiopulmonary resuscitation
ECG: electrocardiogram
GER: gastroesophageal reflux
IEM: inborn error of metabolism
MII: multiple intraluminal impedance
OSA: obstructive sleep apnea
RSV: respiratory syncytial virus
SIDS: sudden infant death syndrome
SUDEP: sudden unexpected death in epilepsy
UTI: urinary tract infection

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CLINICAL PRACTICE GUIDELINE Guidance for the Clinician in Rendering Pediatric Care

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Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants: Executive Summary

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EXECUTIVE SUMMARY

This clinical practice guideline has 2 primary objectives. First, it recommends the replacement of the term "apparent life-threatening event" (ALTE) with a new term, "brief resolved unexplained event" (BRUE). Second, it provides an approach to evaluation and management that is based on the risk that the infant will have a repeat event or has a serious underlying disorder.

Clinicians should use the term BRUE to describe an event occurring in an infant younger than 1 year when the observer reports a sudden, brief, and now resolved episode of ≥1 of the following: (1) cyanosis or pallor; (2) absent, decreased, or irregular breathing; (3) marked change in tone (hyper- or hypotonia); and (4) altered level of responsiveness. Moreover, clinicians should diagnose a BRUE only when there is no explanation for a qualifying event after conducting an appropriate history and physical examination (see Tables 2 and 3 in www.pediatrics.org/cgi/doi/10.1542/peds.2016-0590). Among infants who present for medical attention after a BRUE, the guideline identifies (1) lower-risk patients on the basis of history and physical examination, for whom evidence-based guidelines for evaluation and management are offered, and (2) higher-risk patients, whose history and physical examination suggest the need for further investigation, monitoring, and/or treatment, but for whom recommendations are not offered (because of insufficient evidence or the availability of guidance from other clinical practice guidelines specific to their presentation or diagnosis). Recommendations in this guideline apply only to lower-risk patients,

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who are defined by (1) age >60 days; (2) gestational age ≥32 weeks and postconceptional age ≥45 weeks; (3) occurrence of only 1 BRUE (no prior BRUE ever and not occurring in clusters); (4) duration of BRUE <1 minute; (5) no cardiopulmonary resuscitation by trained medical provider required; (6) no concerning historical features; and (7) no concerning physical examination findings (Fig 1). This clinical practice guideline also provides implementation support and suggests directions for future research.

The term ALTE originated from a 1986 National Institutes of Health Consensus Conference on Infantile Apnea and was intended to replace the term "near-miss sudden infant death syndrome (SIDS)."[1] An ALTE was defined as "[a]n episode that is frightening to the observer and that is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging. In some cases, the observer fears that the infant has died."[2] Although the definition of ALTE enabled researchers to establish over time that these events were a separate entity from SIDS, the clinical application of this classification, which describes a constellation of observed, subjective, and nonspecific symptoms, has raised significant challenges for clinicians and parents in the evaluation and care of these infants.[3] Although a broad range of disorders can present as an ALTE (eg, child abuse, congenital abnormalities, epilepsy, inborn errors of metabolism, and infections), for a majority of well-appearing infants, the risk of a recurrent event or a serious underlying disorder is extremely low.

ALTEs can create a feeling of uncertainty in both the caregiver and the clinician. Clinicians may feel compelled to perform tests and hospitalize the patient even though this may subject the patient to unnecessary risk and is unlikely to lead to a treatable diagnosis or prevent future events.[2,4,5] Understanding the risk of an adverse outcome for an infant who has experienced an ALTE has been difficult because of the nonspecific nature and variable application of the ALTE definition in research. A recent systematic review of nearly 1400 ALTE publications spanning 4 decades concluded that risk of a subsequent or underlying disorder could not be quantified because of the variability in case definitions across studies.[3] Although there are history and physical examination factors that can determine lower or higher risk, it is clear that the term ALTE must be replaced to advance the quality of care and improve research.

This guideline is intended for use primarily by clinicians providing care for infants who have experienced a BRUE, as well as their families. The guideline may be of interest to payers, but it is not intended to be used for reimbursement or to determine insurance coverage. This guideline is not intended as the sole source of guidance in the evaluation and management of BRUEs and specifically does not address higher-risk BRUE patients. Rather, it is intended to assist clinicians by providing a framework for clinical decision making. It is not intended to replace clinical judgment, and these recommendations may not provide the only appropriate approach to the management of this problem.

This guideline is intended to provide a patient- and family-centered approach to care, reduce unnecessary and costly medical interventions, and improve patient outcomes. It includes recommendations for diagnosis, risk-based stratification, monitoring, disposition planning, effective communication with the patient and family, guideline implementation and evaluation, and future research. In addition, it aims to help clinicians determine the presence of a serious underlying cause and a safe disposition by alerting them to the most significant features of the clinical history and physical examination on which to base an approach for diagnostic testing and hospitalization. Key action statements are summarized in Table 1.

SUBCOMMITTEE ON BRIEF RESOLVED UNEXPLAINED EVENTS (FORMERLY REFERRED TO AS APPARENT LIFE THREATENING EVENTS); OVERSIGHT BY THE COUNCIL ON QUALITY IMPROVEMENT AND PATIENT SAFETY

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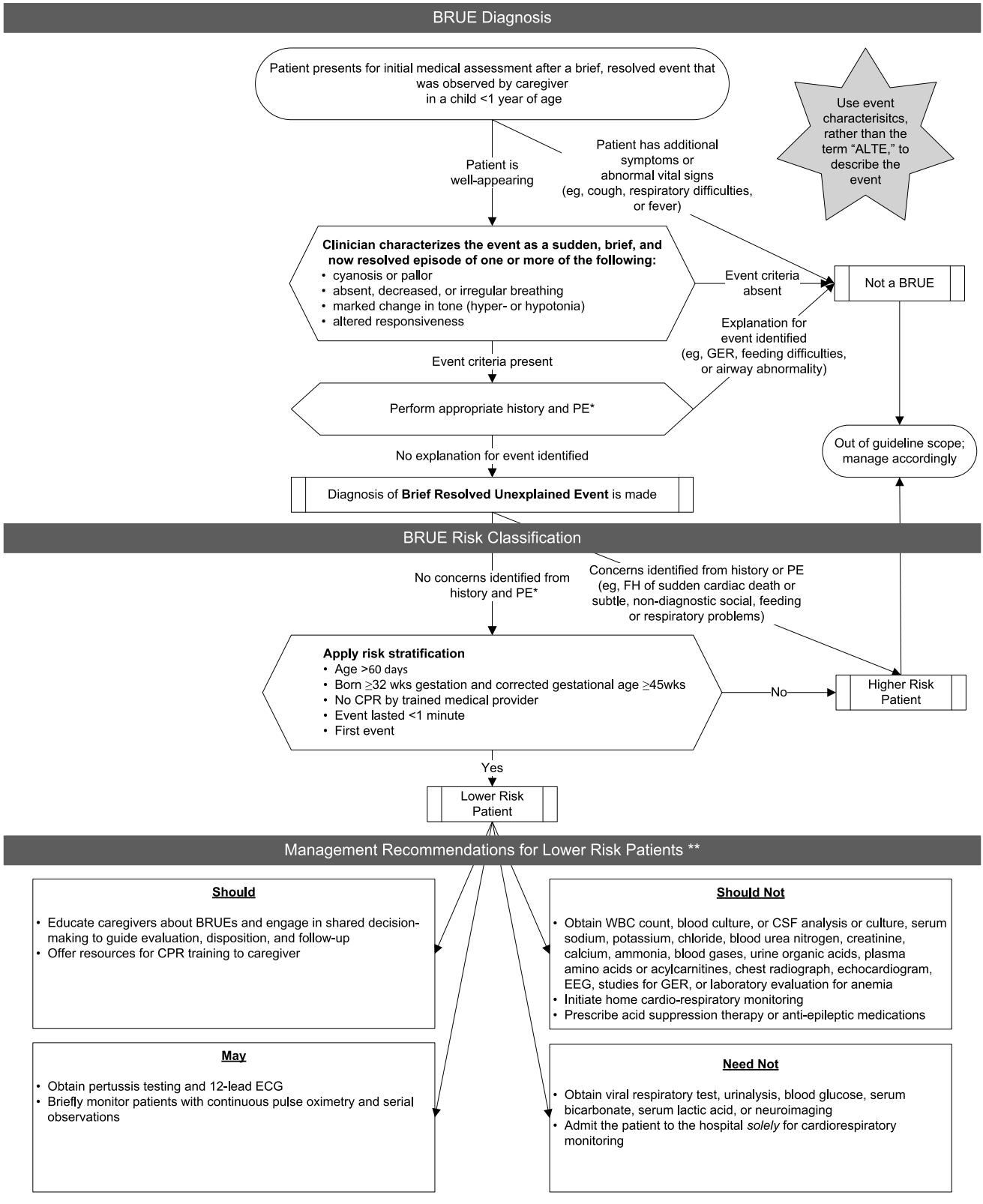

FIGURE 1

Diagnosis, risk classification, and recommended management of a BRUE. *Refer to Tables 3 and 4 in www.pediatrics.org/cgi/doi/10.1542/peds.2016-0591 for the determination of an appropriate and negative history and PE. **Refer to Figure 2 in www.pediatrics.org/cgi/doi/10.1542/peds.2016-0591 for the American Academy of Pediatrics method for rating of evidence and recommendations. CPR, cardiopulmonary resuscitation; CSF, cerebrospinal fluid; ECG, electrocardiogram; FH, family history; GER, gastroesophageal reflux; PE, physical examination; WBC, white blood cell.

Figure 1, shown here, has been updated per the erratum at http://pediatrics.aappublications.org/content/138/2/e20161488.

TABLE 1 Summary of Key Action Statements for Lower-Risk BRUEs

When managing an infant who is >60 d and <1 y of age and who, on the basis of a thorough history and physical examination, meets criteria for having experienced a lower-risk BRUE, clinicians:	Evidence Quality; Strength of Recommendation
1. Cardiopulmonary Evaluation	
1A. Need not admit infants to the hospital solely for cardiorespiratory monitoring.	B; Weak
1B. May briefly monitor patients with continuous pulse oximetry and serial observations.	D; Weak
1C. Should not obtain chest radiograph.	B; Moderate
1D. Should not obtain a measurement of venous or arterial blood gas.	B; Moderate
1E. Should not obtain an overnight polysomnograph.	B; Moderate
1F. May obtain a 12-lead electrocardiogram.	C; Weak
1G. Should not obtain an echocardiogram.	C; Moderate
1H. Should not initiate home cardiorespiratory monitoring.	B; Moderate
2. Child Abuse Evaluation	
2A. Need not obtain neuroimaging (CT, MRI, or ultrasonography) to detect child abuse.	C; Weak
2B. Should obtain an assessment of social risk factors to detect child abuse.	C; Moderate
3. Neurologic Evaluation	
3A. Should not obtain neuroimaging (CT, MRI, or ultrasonography) to detect neurologic disorders.	C; Moderate
3B. Should not obtain an EEG to detect neurologic disorders.	C; Moderate
3C. Should not prescribe antiepileptic medications for potential neurologic disorders.	C; Moderate
4. Infectious Disease Evaluation	
4A. Should not obtain a WBC count, blood culture, or cerebrospinal fluid analysis or culture to detect an occult bacterial infection.	B; Strong
4B. Need not obtain a urinalysis (bag or catheter).	C; Weak
4C. Should not obtain chest radiograph to assess for pulmonary infection.	B; Moderate
4D. Need not obtain respiratory viral testing if rapid testing is available.	C; Weak
4E. May obtain testing for pertussis.	B; Weak
5. Gastrointestinal Evaluation	
5A. Should not obtain investigations for GER (eg, upper gastrointestinal tract series, pH probe, endoscopy, barium contrast study, nuclear scintigraphy, and ultrasonography).	C; Moderate
5B. Should not prescribe acid suppression therapy.	C; Moderate
6. Inborn Error of Metabolism Evaluation	
6A. Need not obtain measurement of serum lactic acid or serum bicarbonate.	C; Weak
6B. Should not obtain a measurement of serum sodium, potassium, chloride, blood urea nitrogen, creatinine, calcium, or ammonia.	C; Moderate
6C. Should not obtain a measurement of venous or arterial blood gases.	C; Moderate
6D. Need not obtain a measurement of blood glucose.	C; Weak
6E. Should not obtain measurements of urine organic acids, plasma amino acids, or plasma acylcarnitines.	C; Moderate
7. Anemia Evaluation	
7A. Should not obtain laboratory evaluation for anemia.	C; Moderate
8. Patient- and Family-Centered Care	
8A. Should offer resources for CPR training to caregiver.	C; Moderate
8B. Should educate caregivers about BRUEs.	C; Moderate
8C. Should use shared decision making.	C; Moderate

CPR, cardiopulmonary resuscitation; CT, computed tomography; GER, gastroesophageal reflux; WBC, white blood cell.

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ABBREVIATIONS

ALTE: apparent life-threatening event
BRUE: brief resolved unexplained event
SIDS: sudden infant death syndrome

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Brief Resolved Unexplained Events Clinical Practice Guideline Quick Reference Tools

- Action Statement Summary
  — Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants
- *ICD-10-CM* Coding Quick Reference for Brief Resolved Unexplained Events
- AAP Patient Education Handout
  — *Brief Resolved Unexplained Event: What Parents and Caregivers Need to Know*

Action Statement Summary

Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants

Key Action Statement 1

Cardiopulmonary

Key Action Statement 1A

Clinicians need not admit infants presenting with a lower-risk BRUE to the hospital solely for cardiorespiratory monitoring (grade B, weak recommendation)

Key Action Statement 1B

Clinicians may briefly monitor infants presenting with a lower-risk BRUE with continuous pulse oximetry and serial observations (grade D, weak recommendation)

Key Action Statement 1C

Clinicians should not obtain a chest radiograph in infants presenting with a lower-risk BRUE (grade B, moderate recommendation)

Key Action Statement 1D

Clinicians should not obtain measurement of venous or arterial blood gases in infants presenting with a lower-risk BRUE (grade B, moderate recommendation)

Key Action Statement 1E

Clinicians should not obtain an overnight polysomnograph in infants presenting with a lower-risk BRUE (grade B, moderate recommendation)

Key Action Statement 1F

Clinicians may obtain a 12-lead electrocardiogram for infants presenting with lower-risk BRUE (grade C, weak recommendation)

Key Action Statement 1G

Clinicians should not obtain an echocardiogram in infants presenting with lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 1H

Clinicians should not initiate home cardiorespiratory monitoring in infants presenting with a lower-risk BRUE (grade B, moderate recommendation)

Key Action Statement 2

Child abuse

Key Action Statement 2A

Clinicians need not obtain neuroimaging (computed tomography, MRI, or ultrasonography) to detect child abuse in infants presenting with a lower-risk BRUE (grade C, weak recommendation)

Key Action Statement 2B

Clinicians should obtain an assessment of social risk factors to detect child abuse in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 3

Neurology

Key Action Statement 3A

Clinicians should not obtain neuroimaging (computed tomography, MRI, or ultrasonography) to detect neurologic disorders in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 3B

Clinicians should not obtain an EEG to detect neurologic disorders in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 3C

Clinicians should not prescribe antiepileptic medications for potential neurologic disorders in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 4

Infectious diseases

Key Action Statement 4A

Clinicians should not obtain a white blood cell count, blood culture, or cerebrospinal fluid analysis or culture to detect an occult bacterial infection in infants presenting with a lower-risk BRUE (grade B, strong recommendation)

Key Action Statement 4B

Clinicians need not obtain a urinalysis (bag or catheter) in infants presenting with a lower-risk BRUE (grade C, weak recommendation)

Key Action Statement 4C

Clinicians should not obtain a chest radiograph to assess for pulmonary infection in infants presenting with a lower-risk BRUE (grade B, moderate recommendation)

Key Action Statement 4D

Clinicians need not obtain respiratory viral testing if rapid testing is available in infants presenting with a lower-risk BRUE (grade C, weak recommendation)

Key Action Statement 4E

Clinicians may obtain testing for pertussis in infants presenting with a lower-risk BRUE (grade B, weak recommendation)

Key Action Statement 5

Gastroenterology

Key Action Statement 5A

Clinicians should not obtain investigations for GER (eg, upper gastrointestinal series, pH probe, endoscopy, barium contrast study, nuclear scintigraphy, and ultrasonography) in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 5B

Clinicians should not prescribe acid suppression therapy for infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 6

Inborn errors of metabolism

Key Action Statement 6A

Clinicians need not obtain measurement of serum lactic acid or serum bicarbonate to detect an IEM in infants presenting with a lower-risk BRUE (grade C, weak recommendation)

Key Action Statement 6B

Clinicians should not obtain a measurement of serum sodium, potassium, chloride, blood urea nitrogen, creatinine, calcium, or ammonia to detect an IEM in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 6C

Clinicians should not obtain a measurement of venous or arterial blood gases to detect an IEM in infants presenting with lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 6D

Clinicians need not obtain a measurement of blood glucose to detect an IEM in infants presenting with a lower-risk BRUE (grade C, weak recommendation)

Key Action Statement 6E

Clinicians should not obtain measurements of urine organic acids, plasma amino acids, or plasma acylcarnitines to detect an IEM in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 7

Anemia

Key Action Statement 7A

Clinicians should not obtain laboratory evaluation for anemia in infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Key Action Statement 8

Patient- and family-centered care

Key Action Statement 8A

Clinicians should offer resources for CPR training to caregivers (grade C, moderate recommendation)

Key Action Statement 8B

Clinicians should educate caregivers about BRUEs (grade C, moderate recommendation)

Key Action Statement 8C

Clinicians should use shared decision-making for infants presenting with a lower-risk BRUE (grade C, moderate recommendation)

Coding Quick Reference for Brief Resolved Unexplained Events
ICD-10-CM
R68.13 Apparent life threatening event (ALTE) in infant (includes brief resolved unexplained events [BRUE])

Brief Resolved Unexplained Event:
What Parents and Caregivers Need to Know

What is a brief resolved unexplained event?

A **b**rief **r**esolved **u**nexplained **e**vent (or BRUE for short) occurs suddenly and can be scary for parents and caregivers. A brief resolved unexplained event is a diagnosis made after your baby's doctor or health care professional has examined your baby and determined that there was no known concerning cause for the event.

When a brief resolved unexplained event occurs, babies may seem to stop breathing, their skin color may change to pale or blue, their muscles may relax or tighten, or they may seem to pass out. After a brief period of time, they recover (with or without any medical help) and are soon back to normal.

Though we can never say that a baby who has had a brief resolved unexplained event is at *no* risk for future problems, we can say that babies are at lower risk if

- They are older than 60 days.
- They were born on time (not premature).
- They did not need CPR (cardiopulmonary resuscitation) by a health care professional.
- The brief resolved unexplained event lasted less than 1 minute.
- This was their only such event.

Frequently asked questions after a brief resolved unexplained event

Q: Why did my baby have this event?

A: Your baby's doctor was unable to find a cause based on the results of your baby's examination and cannot tell you why this event happened. If it happens again or your baby develops additional problems, contact your baby's doctor or health care professional. The doctor may decide to have your baby return for another visit.

Q: Should my baby stay in the hospital?

A: Babies who are felt to be at lower risk by their doctors or health care professionals do not need to stay in the hospital. They are safe to go home without doing blood tests or imaging that uses x-rays, and they do not need home monitoring of their heart or lungs.

Q: Does having a brief resolved unexplained event increase my baby's risk for sudden infant death syndrome (SIDS)?

A: No—though the causes of SIDS are not known, events like these do not increase the risk of SIDS. For all babies, it is important to create a safe home and sleeping environment. Your baby should not be exposed to smoky environments. Visit **www.HealthyChildren.org/safesleep** to learn more about how to create a safe sleeping environment for your baby.

Q: What should I do if it happens again?

A: If you are worried that this new event is life threatening, call 911 or your local emergency numbers. If not, call your baby's doctor if you have any questions or worries and to let the doctor know about the event.

Q: Does my baby need extra care after having a brief resolved unexplained event? Is my baby more delicate or weak?

A: No special care is needed. Continue to love and care for your baby as you normally do.

A few important reminders for parents and caregivers of healthy infants

- Remember to take your baby to regular well-child visits to help keep your child healthy and safe.
- Though your baby is not more likely to need it, it is a good idea for everyone who cares for an infant to learn CPR. If you know CPR, you may also use it one day to help someone else in need. For classes near you, contact your child's doctor, the American Red Cross, the American Heart Association, or a national or local organization that offers training.

From your doctor

American Academy of Pediatrics

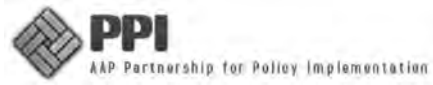
DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics (AAP) is an organization of 64,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of all infants, children, adolescents, and young adults.

American Academy of Pediatrics
Web site— www.HealthyChildren.org

The Diagnosis, Management, and Prevention of Bronchiolitis

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 1 for more information.



CLINICAL PRACTICE GUIDELINE

Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis

abstract

FREE

This guideline is a revision of the clinical practice guideline, "Diagnosis and Management of Bronchiolitis," published by the American Academy of Pediatrics in 2006. The guideline applies to children from 1 through 23 months of age. Other exclusions are noted. Each key action statement indicates level of evidence, benefit-harm relationship, and level of recommendation. Key action statements are as follows: *Pediatrics* 2014;134:e1474–e1502

DIAGNOSIS

1a. Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical examination (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

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

1c. When clinicians diagnose bronchiolitis on the basis of history and physical examination, radiographic or laboratory studies should not be obtained routinely (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

TREATMENT

2. Clinicians should not administer albuterol (or salbutamol) to infants and children with a diagnosis of bronchiolitis (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

3. Clinicians should not administer epinephrine to infants and children with a diagnosis of bronchiolitis (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

4a. Nebulized hypertonic saline should not be administered to infants with a diagnosis of bronchiolitis in the emergency department (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

4b. Clinicians may administer nebulized hypertonic saline to infants and children hospitalized for bronchiolitis (Evidence Quality: B; Recommendation Strength: Weak Recommendation [based on randomized controlled trials with inconsistent findings]).

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KEY WORDS

bronchiolitis, infants, children, respiratory syncytial virus, evidence-based, guideline

ABBREVIATIONS

AAP—American Academy of Pediatrics
AOM—acute otitis media
CI—confidence interval
ED—emergency department
KAS—Key Action Statement
LOS—length of stay
MD—mean difference
PCR—polymerase chain reaction
RSV—respiratory syncytial virus
SBI—serious bacterial infection

Dedicated to the memory of Dr Caroline Breese Hall.

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

5. Clinicians should not administer systemic corticosteroids to infants with a diagnosis of bronchiolitis in any setting (Evidence Quality: A; Recommendation Strength: Strong Recommendation).

6a. Clinicians may choose not to administer supplemental oxygen if the oxyhemoglobin saturation exceeds 90% in infants and children with a diagnosis of bronchiolitis (Evidence Quality: D; Recommendation Strength: Weak Recommendation [based on low level evidence and reasoning from first principles]).

6b. Clinicians may choose not to use continuous pulse oximetry for infants and children with a diagnosis of bronchiolitis (Evidence Quality: D; Recommendation Strength: Weak Recommendation [based on low-level evidence and reasoning from first principles]).

7. Clinicians should not use chest physiotherapy for infants and children with a diagnosis of bronchiolitis (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

8. Clinicians should not administer antibacterial medications to infants and children with a diagnosis of bronchiolitis unless there is a concomitant bacterial infection, or a strong suspicion of one (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

9. Clinicians should administer nasogastric or intravenous fluids for infants with a diagnosis of bronchiolitis who cannot maintain hydration orally (Evidence Quality: X; Recommendation Strength: Strong Recommendation).

PREVENTION

10a. Clinicians should not administer palivizumab to otherwise healthy infants with a gestational age of 29 weeks, 0 days or greater (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

10b. Clinicians should administer palivizumab during the first year of life to infants with hemodynamically significant heart disease or chronic lung disease of prematurity defined as preterm infants <32 weeks 0 days' gestation who require >21% oxygen for at least the first 28 days of life (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

10c. Clinicians should administer a maximum 5 monthly doses (15 mg/kg/dose) of palivizumab during the respiratory syncytial virus season to infants who qualify for palivizumab in the first year of life (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

11a. All people should disinfect hands before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

11b. All people should use alcohol-based rubs for hand decontamination when caring for children with bronchiolitis. When alcohol-based rubs are not available, individuals should wash their hands with soap and water (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

12a. Clinicians should inquire about the exposure of the infant or child to tobacco smoke when assessing infants and children for bronchiolitis (Evidence Quality: C; Recommendation Strength: Moderate Recommendation).

12b. Clinicians should counsel caregivers about exposing the infant or child to environmental tobacco smoke and smoking cessation when assessing a child for bronchiolitis (Evidence Quality: B; Recommendation Strength: Strong).

13. Clinicians should encourage exclusive breastfeeding for at least 6 months to decrease the morbidity of respiratory infections. (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

14. Clinicians and nurses should educate personnel and family members on evidence-based diagnosis, treatment, and prevention in bronchiolitis. (Evidence Quality: C; observational studies; Recommendation Strength: Moderate Recommendation).

INTRODUCTION

In October 2006, the American Academy of Pediatrics (AAP) published the clinical practice guideline "Diagnosis and Management of Bronchiolitis."[1] The guideline offered recommendations ranked according to level of evidence and the benefit-harm relationship. Since completion of the original evidence review in July 2004, a significant body of literature on bronchiolitis has been published. This update of the 2006 AAP bronchiolitis guideline evaluates published evidence, including that used in the 2006 guideline as well as evidence published since 2004. Key action statements (KASs) based on that evidence are provided.

The goal of this guideline is to provide an evidence-based approach to the diagnosis, management, and prevention of bronchiolitis in children from 1 month through 23 months of age. The guideline is intended for pediatricians, family physicians, emergency medicine specialists, hospitalists, nurse practitioners,

and physician assistants who care for these children. The guideline does not apply to children with immunodeficiencies, including those with HIV infection or recipients of solid organ or hematopoietic stem cell transplants. Children with underlying respiratory illnesses, such as recurrent wheezing, chronic neonatal lung disease (also known as bronchopulmonary dysplasia), neuromuscular disease, or cystic fibrosis and those with hemodynamically significant congenital heart disease are excluded from the sections on management unless otherwise noted but are included in the discussion of prevention. This guideline will not address long-term sequelae of bronchiolitis, such as recurrent wheezing or risk of asthma, which is a field with a large and distinct literature.

Bronchiolitis is a disorder commonly caused by viral lower respiratory tract infection in infants. Bronchiolitis is characterized by acute inflammation, edema, and necrosis of epithelial cells lining small airways, and increased mucus production. Signs and symptoms typically begin with rhinitis and cough, which may progress to tachypnea, wheezing, rales, use of accessory muscles, and/or nasal flaring.[2]

Many viruses that infect the respiratory system cause a similar constellation of signs and symptoms. The most common etiology of bronchiolitis is respiratory syncytial virus (RSV), with the highest incidence of infection occurring between December and March in North America; however, regional variations occur[3] (Fig 1).[4] Ninety percent of children are infected with RSV in the first 2 years of life,[5] and up to 40% will experience lower respiratory tract infection during the initial infection.[6,7] Infection with RSV does not grant permanent or long-term immunity, with reinfections common throughout life.[8] Other viruses that cause bronchiolitis include human rhinovirus, human metapneumovirus, influenza, adenovirus, coronavirus, human, and parainfluenza viruses. In a study of inpatients and outpatients with bronchiolitis,[9] 76% of patients had RSV, 39% had human rhinovirus, 10% had influenza, 2% had coronavirus, 3% had human metapneumovirus, and 1% had parainfluenza viruses (some patients had coinfections, so the total is greater than 100%).

Bronchiolitis is the most common cause of hospitalization among infants during the first 12 months of life. Approximately 100 000 bronchiolitis admissions occur annually in the United States at an estimated cost of $1.73 billion.[10] One prospective, population-based study sponsored by the Centers for Disease Control and Prevention reported the average RSV hospitalization rate was 5.2 per 1000 children younger than 24 months of age during the 5-year period between 2000 and 2005.[11] The highest age-specific rate of RSV hospitalization occurred among infants between 30 days and 60 days of age (25.9 per 1000 children). For preterm infants (<37 weeks' gestation), the RSV hospitalization rate was 4.6 per 1000 children, a number similar to the RSV hospitalization rate for term infants of 5.2 per 1000. Infants born at <30 weeks' gestation had the highest hospitalization rate at 18.7 children per 1000, although the small number of infants born before 30 weeks' gestation make this number unreliable. Other studies indicate the RSV hospitalization rate in extremely

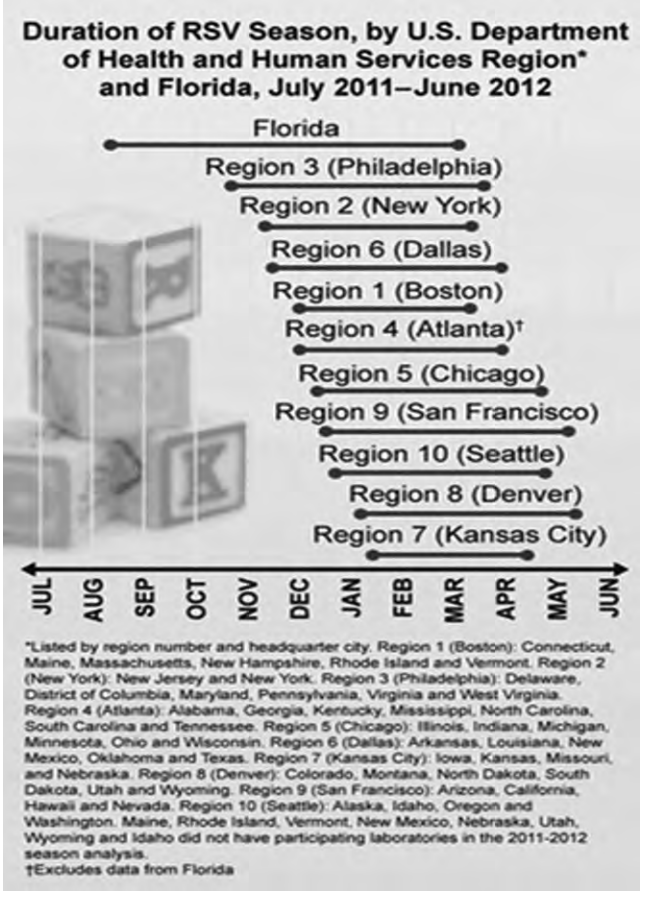

FIGURE 1
RSV season by US regions. Centers for Disease Control and Prevention. RSV activity—United States, July 2011–Jan 2013. *MMWR Morb Mortal Wkly Rep.* 2013;62(8):141–144.

preterm infants is similar to that of term infants.[12,13]

METHODS

In June 2013, the AAP convened a new subcommittee to review and revise the 2006 bronchiolitis guideline. The subcommittee included primary care physicians, including general pediatricians, a family physician, and pediatric subspecialists, including hospitalists, pulmonologists, emergency physicians, a neonatologist, and pediatric infectious disease physicians. The subcommittee also included an epidemiologist trained in systematic reviews, a guideline methodologist/informatician, and a parent representative. All panel members reviewed the AAP Policy on Conflict of Interest and Voluntary Disclosure and were given an opportunity to declare any potential conflicts. Any conflicts can be found in the author listing at the end of this guideline. All funding was provided by the AAP, with travel assistance from the American Academy of Family Physicians, the American College of Chest Physicians, the American Thoracic Society, and the American College of Emergency Physicians for their liaisons.

The evidence search and review included electronic database searches in *The Cochrane Library*, Medline via Ovid, and CINAHL via EBSCO. The search strategy is shown in the Appendix. Related article searches were conducted in PubMed. The bibliographies of articles identified by database searches were also reviewed by 1 of 4 members of the committee, and references identified in this manner were added to the review. Articles included in the 2003 evidence report on bronchiolitis in preparation of the AAP 2006 guideline2 also were reviewed. In addition, the committee reviewed articles published after completion of the systematic review for these updated guidelines. The current literature review encompasses the period from 2004 through May 2014.

The evidence-based approach to guideline development requires that the evidence in support of a policy be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is anticipated when the recommendation is followed. The AAP policy statement "Classifying Recommendations for Clinical Practice"[14] was followed in designating levels of recommendation (Fig 2; Table 1).

A draft version of this clinical practice guideline underwent extensive peer review by committees, councils, and sections within AAP; the American Thoracic Society, American College of Chest Physicians, American Academy of Family Physicians, and American College of Emergency Physicians; other outside organizations; and other individuals identified by the subcommittee as experts in the field. The resulting comments were reviewed by the subcommittee and, when appropriate, incorporated into the guideline.

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

All AAP guidelines are reviewed every 5 years.

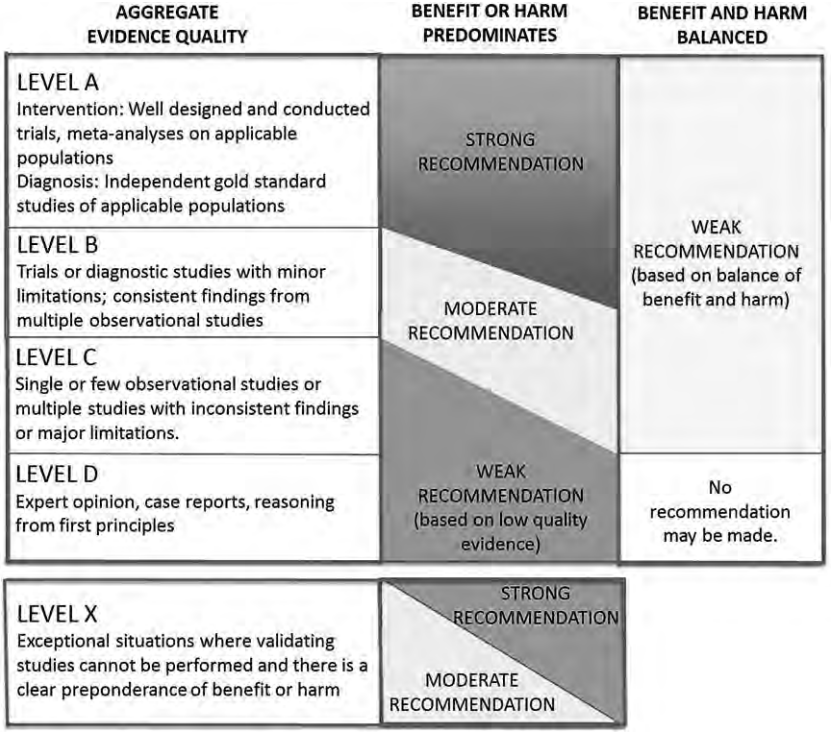

FIGURE 2
Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms leads to designation of a policy as a strong recommendation, moderate recommendation, or weak recommendation.

TABLE 1 Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
Strong recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and quality of evidence is excellent or unobtainable.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Moderate recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and the quality of evidence is good but not excellent (or is unobtainable).	Clinicians would be prudent to follow a moderate recommendation but should remain alert to new information and sensitive to patient preferences.
Weak recommendation (based on low-quality evidence	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), but the quality of evidence is weak.	Clinicians would be prudent to follow a weak recommendation but should remain alert to new information and very sensitive to patient preferences.
Weak recommendation (based on balance of benefits and harms)	Weak recommendation is provided when the aggregate database shows evidence of both benefit and harm that appear similar in magnitude for any available courses of action	Clinicians should consider the options in their decision making, but patient preference may have a substantial role.

DIAGNOSIS

Key Action Statement 1a

Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical examination (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 1a

Aggregate evidence quality	B
Benefits	Inexpensive, noninvasive, accurate
Risk, harm, cost	Missing other diagnoses
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None

Key Action Statement 1b

Clinicians should assess risk factors for severe disease, such as age <12 weeks, a history of prematurity, underlying cardiopulmonary disease, or immunodeficiency, when making decisions about evaluation and management of children with bronchiolitis (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 1b

Aggregate evidence quality	B
Benefits	Improved ability to predict course of illness, appropriate disposition
Risk, harm, cost	Possible unnecessary hospitalization parental anxiety
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	"Assess" is not defined
Role of patient preferences	None
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None

Key Action Statement 1c

When clinicians diagnose bronchiolitis on the basis of history and physical examination, radiographic or laboratory studies should not be obtained routinely (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 1b

Aggregate evidence quality	B
Benefits	Decreased radiation exposure, noninvasive (less procedure-associated discomfort), decreased antibiotic use, cost savings, time saving
Risk, harm, cost	Misdiagnosis, missed diagnosis of comorbid condition
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	Infants and children with unexpected worsening disease
Strength	Moderate recommendation
Differences of opinion	None

The main goals in the history and physical examination of infants presenting with wheeze or other lower respiratory tract symptoms, particularly in the winter season, is to differentiate infants with probable viral bronchiolitis from those with other disorders. In addition, an estimate of disease severity (increased respiratory rate, retractions, decreased oxygen saturation) should

be made. Most clinicians recognize bronchiolitis as a constellation of clinical signs and symptoms occurring in children younger than 2 years, including a viral upper respiratory tract prodrome followed by increased respiratory effort and wheezing. Clinical signs and symptoms of bronchiolitis consist of rhinorrhea, cough, tachypnea, wheezing, rales, and increased respiratory effort manifested as grunting, nasal flaring, and intercostal and/or subcostal retractions.

The course of bronchiolitis is variable and dynamic, ranging from transient events, such as apnea, to progressive respiratory distress from lower airway obstruction. Important issues to assess in the history include the effects of respiratory symptoms on mental status, feeding, and hydration. The clinician should assess the ability of the family to care for the child and to return for further evaluation if needed. History of underlying conditions, such as prematurity, cardiac disease, chronic pulmonary disease, immunodeficiency, or episodes of previous wheezing, should be identified. Underlying conditions that may be associated with an increased risk of progression to severe disease or mortality include hemodynamically significant congenital heart disease, chronic lung disease (bronchopulmonary dysplasia), congenital anomalies,[15–17] in utero smoke exposure,[18] and the presence of an immunocompromising state.[19,20] In addition, genetic abnormalities have been associated with more severe presentation with bronchiolitis.[21]

Assessment of a child with bronchiolitis, including the physical examination, can be complicated by variability in the disease state and may require serial observations over time to fully assess the child's status. Upper airway obstruction contributes to work of breathing. Suctioning and positioning may decrease the work of breathing and improve the quality of the examination. Respiratory rate in otherwise healthy children changes considerably over the first year of life.[22–25] In hospitalized children, the 50th percentile for respiratory rate decreased from 41 at 0 to 3 months of age to 31 at 12 to 18 months of age.[26] Counting respiratory rate over the course of 1 minute is more accurate than shorter observations.[27] The presence of a normal respiratory rate suggests that risk of significant viral or bacterial lower respiratory tract infection or pneumonia in an infant is low (negative likelihood ratio approximately 0.5),[27–29] but the presence of tachypnea does not distinguish between viral and bacterial disease.[30,31]

The evidence relating the presence of specific findings in the assessment of bronchiolitis to clinical outcomes is limited. Most studies addressing this issue have enrolled children when presenting to hospital settings, including a large, prospective, multicenter study that assessed a variety of outcomes from the emergency department (ED) and varied inpatient settings.[18,32,33] Severe adverse events, such as ICU admission and need for mechanical ventilation, are uncommon among children with bronchiolitis and limit the power of these studies to detect clinically important risk factors associated with disease progression.[16,34,35] Tachypnea, defined as a respiratory rate $\geq$70 per minute, has been associated with increased risk of severe disease in some studies[35–37] but not others.[38] Many scoring systems have been developed in an attempt to objectively quantify respiratory distress, although none has achieved widespread acceptance and few have demonstrated any predictive validity, likely because of the substantial temporal variability in physical findings in infants with bronchiolitis.[39]

Pulse oximetry has been rapidly adopted into clinical assessment of children with bronchiolitis on the basis of data suggesting that it reliably detects hypoxemia not suspected on physical examination[36,40]; however, few studies have assessed the effectiveness of pulse oximetry to predict clinical outcomes. Among inpatients, perceived need for supplemental oxygen on the basis of pulse oximetry has been associated with prolonged hospitalization, ICU admission, and mechanical ventilation.[16,34,41] Among outpatients, available evidence differs on whether mild reductions in pulse oximetry (<95% on room air) predict progression of disease or need for a return observational visit.[38]

Apnea has been reported to occur with a wide range of prevalence estimates and viral etiologies.[42,43] Retrospective, hospital-based studies have included a high proportion of infants with risk factors, such as prematurity or neuromuscular disease, that may have biased the prevalence estimates. One large study found no apnea events for infants assessed as low risk by using several risk factors: age >1 month for full-term infants or 48 weeks' postconceptional age for preterm infants, and absence of any previous apneic event at presentation to the hospital.[44] Another large multicenter study found no association between the specific viral agent and risk of apnea in bronchiolitis.[42]

The literature on viral testing for bronchiolitis has expanded in recent years with the availability of sensitive polymerase chain reaction (PCR) assays. Large studies of infants hospitalized for bronchiolitis have consistently found that 60% to 75% have positive test results for RSV, and have noted coinfections in up to one-third of infants.[32,33,45] In the event an infant receiving monthly prophylaxis is hospitalized with bronchiolitis, testing should be performed to determine if RSV is the etiologic agent. If a breakthrough RSV infection is determined to be present based on antigen detection or other

assay, monthly palivizumab prophylaxis should be discontinued because of the very low likelihood of a second RSV infection in the same year. Apart from this setting, routine virologic testing is not recommended.

Infants with non-RSV bronchiolitis, in particular human rhinovirus, appear to have a shorter courses and may represent a different phenotype associated with repeated wheezing.[32] PCR assay results should be interpreted cautiously, given that the assay may detect prolonged viral shedding from an unrelated previous illness, particularly with rhinovirus. In contrast, RSV detected by PCR assay almost always is associated with disease. At the individual patient level, the value of identifying a specific viral etiology causing bronchiolitis has not been demonstrated.[33]

Current evidence does not support routine chest radiography in children with bronchiolitis. Although many infants with bronchiolitis have abnormalities on chest radiography, data are insufficient to demonstrate that chest radiography correlates well with disease severity. Atelectasis on chest radiography was associated with increased risk of severe disease in 1 outpatient study.[16] Further studies, including 1 randomized trial, suggest children with suspected lower respiratory tract infection who had radiography performed were more likely to receive antibiotics without any difference in outcomes.[46,47] Initial radiography should be reserved for cases in which respiratory effort is severe enough to warrant ICU admission or where signs of an airway complication (such as pneumothorax) are present.

TREATMENT

ALBUTEROL

Key Action Statement 2

Clinicians should not administer albuterol (or salbutamol) to infants and children with a diagnosis of bronchiolitis (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 2

Aggregate evidence quality	B
Benefits	Avoid adverse effects, avoid ongoing use of ineffective medication, lower costs
Risk, harm, cost	Missing transient benefit of drug
Benefit-harm assessment	Benefits outweigh harms
Value judgments	Overall ineffectiveness outweighs possible transient benefit
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None
Notes	This guideline no longer recommends a trial of albuterol, as was considered in the 2006 AAP bronchiolitis guideline

Although several studies and reviews have evaluated the use of bronchodilator medications for viral bronchiolitis, most randomized controlled trials have failed to demonstrate a consistent benefit from α- or β-adrenergic agents. Several meta-analyses and systematic reviews[48–53] have shown that bronchodilators may improve clinical symptom scores, but they do not affect disease resolution, need for hospitalization, or length of stay (LOS). Because clinical scores may vary from one observer to the next[39,54] and do not correlate with more objective measures, such as pulmonary function tests,[55] clinical scores are not validated measures of the efficacy of bronchodilators. Although transient improvements in clinical score have been observed, most infants treated with bronchodilators will not benefit from their use.

A recently updated Cochrane systematic review assessing the impact of bronchodilators on oxygen saturation, the primary outcome measure, reported 30 randomized controlled trials involving 1992 infants in 12 countries.[56] Some studies included in this review evaluated agents other than albuterol/salbutamol (eg, ipratropium and metaproterenol) but did not include epinephrine. Small sample sizes, lack of standardized methods for outcome evaluation (eg, timing of assessments), and lack of standardized intervention (various bronchodilators, drug dosages, routes of administration, and nebulization delivery systems) limit the interpretation of these studies. Because of variable study designs as well as the inclusion of infants who had a history of previous wheezing in some studies, there was considerable heterogeneity in the studies. Sensitivity analysis (ie, including only studies at low risk of bias) significantly reduced heterogeneity measures for oximetry while having little effect on the overall effect size of oximetry (mean difference [MD] −0.38, 95% confidence interval [CI] −0.75 to 0.00). Those studies showing benefit[57–59] are methodologically weaker than other studies and include older children with recurrent wheezing. Results of the Cochrane review indicated no benefit in the clinical course of infants with bronchiolitis who received bronchodilators. The potential adverse effects (tachycardia and tremors) and cost of these agents outweigh any potential benefits.

In the previous iteration of this guideline, a trial of β-agonists was included as an option. However, given the greater strength of the evidence demonstrating no benefit, and that there is no well-established way to determine an "objective method of response" to bronchodilators in bronchiolitis, this option has been removed. Although it is true that a small subset of children

with bronchiolitis may have reversible airway obstruction resulting from smooth muscle constriction, attempts to define a subgroup of responders have not been successful to date. If a clinical trial of bronchodilators is undertaken, clinicians should note that the variability of the disease process, the host's airway, and the clinical assessments, particularly scoring, would limit the clinician's ability to observe a clinically relevant response to bronchodilators.

Chavasse et al[60] reviewed the available literature on use of β-agonists for children younger than 2 years with recurrent wheezing. At the time of that review, there were 3 studies in the outpatient setting, 2 in the ED, and 3 in the pulmonary function laboratory setting. This review concluded there were no clear benefits from the use of β-agonists in this population. The authors noted some conflicting evidence, but further study was recommended only if the population could be clearly defined and meaningful outcome measures could be identified.

The population of children with bronchiolitis studied in most trials of bronchodilators limits the ability to make recommendations for all clinical scenarios. Children with severe disease or with respiratory failure were generally excluded from these trials, and this evidence cannot be generalized to these situations. Studies using pulmonary function tests show no effect of albuterol among infants hospitalized with bronchiolitis.[56,61] One study in a critical care setting showed a small decrease in inspiratory resistance after albuterol in one group and levalbuterol in another group, but therapy was accompanied by clinically significant tachycardia.[62] This small clinical change occurring with significant adverse effects does not justify recommending albuterol for routine care.

EPINEPHRINE

Key Action Statement 3

Clinicians should not administer epinephrine to infants and children with a diagnosis of bronchiolitis (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 3

Aggregate evidence quality	B
Benefits	Avoiding adverse effects, lower costs, avoiding ongoing use of ineffective medication
Risk, harm, cost	Missing transient benefit of drug
Benefit-harm assessment	Benefits outweigh harms
Value judgments	The overall ineffectiveness outweighs possible transient benefit
Intentional vagueness	None
Role of patient preferences	None
Exclusions	Rescue treatment of rapidly deteriorating patients
Strength	Strong recommendation
Differences of opinion	None

Epinephrine is an adrenergic agent with both β- and α-receptor agonist activity that has been used to treat upper and lower respiratory tract illnesses both as a systemic agent and directly into the respiratory tract, where it is typically administered as a nebulized solution. Nebulized epinephrine has been administered in the racemic form and as the purified L-enantiomer, which is commercially available in the United States for intravenous use. Studies in other diseases, such as croup, have found no difference in efficacy on the basis of preparation,[63] although the comparison has not been specifically studied for bronchiolitis. Most studies have compared L-epinephrine to placebo or albuterol. A recent Cochrane meta-analysis by Hartling et al[64] systematically evaluated the evidence on this topic and found no evidence for utility in the inpatient setting. Two large, multicenter randomized trials comparing nebulized epinephrine to placebo[65] or albuterol[66] in the hospital setting found no improvement in LOS or other inpatient outcomes. A recent, large multicenter trial found a similar lack of efficacy compared with placebo and further demonstrated longer LOS when epinephrine was used on a fixed schedule compared with an as-needed schedule.[67] This evidence suggests epinephrine should not be used in children hospitalized for bronchiolitis, except potentially as a rescue agent in severe disease, although formal study is needed before a recommendation for the use of epinephrine in this setting.

The role of epinephrine in the outpatient setting remains controversial. A major addition to the evidence base came from the Canadian Bronchiolitis Epinephrine Steroid Trial.[68] This multicenter randomized trial enrolled 800 patients with bronchiolitis from 8 EDs and compared hospitalization rates over a 7-day period. This study had 4 arms: nebulized epinephrine plus oral dexamethasone, nebulized epinephrine plus oral placebo, nebulized placebo plus oral dexamethasone, and nebulized placebo plus oral placebo. The group of patients who received epinephrine concomitantly with corticosteroids had a lower likelihood of hospitalization by day 7 than the double placebo group, although this effect was no longer statistically significant after adjusting for multiple comparisons.

The systematic review by Hartling et al[64] concluded that epinephrine reduced hospitalizations compared with placebo on the day of the ED visit but not overall. Given that epinephrine

has a transient effect and home administration is not routine practice, discharging an infant after observing a response in a monitored setting raises concerns for subsequent progression of illness. Studies have not found a difference in revisit rates, although the numbers of revisits are small and may not be adequately powered for this outcome. In summary, the current state of evidence does not support a routine role for epinephrine for bronchiolitis in outpatients, although further data may help to better define this question.

HYPERTONIC SALINE

Key Action Statement 4a

Nebulized hypertonic saline should not be administered to infants with a diagnosis of bronchiolitis in the emergency department (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 4a

Aggregate evidence quality	B
Benefits	Avoiding adverse effects, such as wheezing and excess secretions, cost
Risk, harm, cost	None
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None

Key Action Statement 4b

Clinicians may administer nebulized hypertonic saline to infants and children hospitalized for bronchiolitis (Evidence Quality: B; Recommendation Strength: Weak Recommendation [based on randomized controlled trials with inconsistent findings]).

Action Statement Profile KAS 4b

Aggregate evidence quality	B
Benefits	May shorten hospital stay if LOS is >72 h
Risk, harm, cost	Adverse effects such as wheezing and excess secretions; cost
Benefit-harm assessment	Benefits outweigh harms for longer hospital stays
Value judgments	Anticipating an individual child's LOS is difficult. Most US hospitals report an average LOS of <72 h for patients with bronchiolitis. This weak recommendation applies only if the average length of stay is >72 h
Intentional vagueness	This weak recommendation is based on an average LOS and does not address the individual patient.
Role of patient preferences	None
Exclusions	None
Strength	Weak
Differences of opinion	None

Nebulized hypertonic saline is an increasingly studied therapy for acute viral bronchiolitis. Physiologic evidence suggests that hypertonic saline increases mucociliary clearance in both normal and diseased lungs.[69–71] Because the pathology in bronchiolitis involves airway inflammation and resultant mucus plugging, improved mucociliary clearance should be beneficial, although there is only indirect evidence to support such an assertion. A more specific theoretical mechanism of action has been proposed on the basis of the concept of rehydration of the airway surface liquid, although again, evidence remains indirect.[72]

A 2013 Cochrane review[73] included 11 trials involving 1090 infants with mild to moderate disease in both inpatient and emergency settings. There were 6 studies involving 500 inpatients providing data for the analysis of LOS with an aggregate 1-day decrease reported, a result largely driven by the inclusion of 3 studies with relatively long mean length of stay of 5 to 6 days. The analysis of effect on clinical scores included 7 studies involving 640 patients in both inpatient and outpatient settings and demonstrated incremental positive effect with each day posttreatment from day 1 to day 3 (–0.88 MD on day 1, –1.32 MD on day 2, and –1.51 MD on day 3). Finally, Zhang et al[73] found no effect on hospitalization rates in the pooled analysis of 1 outpatient and 3 ED studies including 380 total patients.

Several randomized trials published after the Cochrane review period further informed the current guideline recommendation. Four trials evaluated admission rates from the ED, 3 using 3% saline and 1 using 7% saline.[74–76] A single trial[76] demonstrated a difference in admission rates from the ED favoring hypertonic saline, although the other 4 studies were concordant with the studies included in the Cochrane review. However, contrary to the studies included in the Cochrane review, none of the more recent trials reported improvement in LOS and, when added to the older studies for an updated meta-analysis, they significantly attenuate the summary estimate of the effect on LOS.[76,77] Most of the trials included in the Cochrane review occurred in settings with typical LOS of more than 3 days in their usual care arms. Hence, the significant decrease in LOS noted by Zhang et al[73] may not be generalizable to the United States where the average LOS is 2.4 days.[10] One other ongoing clinical trial performed in the United States, unpublished except in abstract form, further supports the observation that hypertonic saline does not decrease LOS in settings where expected stays are less than 3 days.[78]

The preponderance of the evidence suggests that 3% saline is safe and effective at improving symptoms of mild to moderate bronchiolitis after 24 hours of use and reducing hospital LOS in settings in which

the duration of stay typically exceeds 3 days. It has not been shown to be effective at reducing hospitalization in emergency settings or in areas where the length of usage is brief. It has not been studied in intensive care settings, and most trials have included only patients with mild to moderate disease. Most studies have used a 3% saline concentration, and most have combined it with bronchodilators with each dose; however, there is retrospective evidence that the rate of adverse events is similar without bronchodilators,[79] as well as prospective evidence extrapolated from 2 trials without bronchodilators.[79,80] A single study was performed in the ambulatory outpatient setting[81]; however, future studies in the United States should focus on sustained usage on the basis of pattern of effects discerned in the available literature.

CORTICOSTEROIDS

Key Action Statement 5

Clinicians should not administer systemic corticosteroids to infants with a diagnosis of bronchiolitis in any setting (Evidence Quality: A; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 5

Aggregate evidence quality	A
Benefits	No clinical benefit, avoiding adverse effects
Risk, harm, cost	None
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None

Although there is good evidence of benefit from corticosteroids in other respiratory diseases, such as asthma and croup,[82–84] the evidence on corticosteroid use in bronchiolitis is negative. The most recent Cochrane systematic review shows that corticosteroids do not significantly reduce outpatient admissions when compared with placebo (pooled risk ratio, 0.92; 95% CI, 0.78 to 1.08; and risk ratio, 0.86; 95% CI, 0.7 to 1.06, respectively) and do not reduce LOS for inpatients (MD –0.18 days; 95% CI –0.39 to 0.04).[85] No other comparisons showed relevant differences for either primary or secondary outcomes. This review contained 17 trials with 2596 participants and included 2 large ED-based randomized trials, neither of which showed reductions in hospital admissions with treatment with corticosteroids as compared with placebo.[69,86]

One of these large trials, the Canadian Bronchiolitis Epinephrine Steroid Trial, however, did show a reduction in hospitalizations 7 days after treatment with combined nebulized epinephrine and oral dexamethasone as compared with placebo.[69] Although an unadjusted analysis showed a relative risk for hospitalization of 0.65 (95% CI 0.45 to 0.95; $P = .02$) for combination therapy as compared with placebo, adjustment for multiple comparison rendered the result insignificant ($P = .07$). These results have generated considerable controversy.[87] Although there is no standard recognized rationale for why combination epinephrine and dexamethasone would be synergistic in infants with bronchiolitis, evidence in adults and children older than 6 years with asthma shows that adding inhaled long-acting β agonists to moderate/high doses of inhaled corticosteroids allows reduction of the corticosteroid dose by, on average, 60%.[88] Basic science studies focused on understanding the interaction between β agonists and corticosteroids have shown potential mechanisms for why simultaneous administration of these drugs could be synergistic.[89–92] However, other bronchiolitis trials of corticosteroids administered by using fixed simultaneous bronchodilator regimens have not consistently shown benefit[93–97]; hence, a recommendation regarding the benefit of combined dexamethasone and epinephrine therapy is premature.

The systematic review of corticosteroids in children with bronchiolitis cited previously did not find any differences in short-term adverse events as compared with placebo.[86] However, corticosteroid therapy may prolong viral shedding in patients with bronchiolitis.[17]

In summary, a comprehensive systematic review and large multicenter randomized trials provide clear evidence that corticosteroids alone do not provide significant benefit to children with bronchiolitis. Evidence for potential benefit of combined corticosteroid and agents with both α- and β-agonist activity is at best tentative, and additional large trials are needed to clarify whether this therapy is effective.

Further, although there is no evidence of short-term adverse effects from corticosteroid therapy, other than prolonged viral shedding, in infants and children with bronchiolitis, there is inadequate evidence to be certain of safety.

OXYGEN

Key Action Statement 6a

Clinicians may choose not to administer supplemental oxygen if the oxyhemoglobin saturation exceeds 90% in infants and children with a diagnosis of bronchiolitis (Evidence Quality: D; Recommendation Strength: Weak Recommendation [based on low-level evidence and reasoning from first principles]).

Action Statement Profile KAS 6a

Benefits	Decreased hospitalizations, decreased LOS
Risk, harm, cost	Hypoxemia, physiologic stress, prolonged LOS, increased hospitalizations, increased LOS, cost
Benefit-harm assessment	Benefits outweigh harms
Value judgments	Oxyhemoglobin saturation >89% is adequate to oxygenate tissues; the risk of hypoxemia with oxyhemoglobin saturation >89% is minimal
Intentional vagueness	None
Role of patient preferences	Limited
Exclusions	Children with acidosis or fever
Strength	Weak recommendation (based on low-level evidence/ reasoning from first principles)
Differences of opinion	None

Key Action Statement 6b

Clinicians may choose not to use continuous pulse oximetry for infants and children with a diagnosis of bronchiolitis (Evidence Quality: C; Recommendation Strength: Weak Recommendation [based on lower-level evidence]).

Action Statement Profile KAS 6b

Aggregate evidence quality	C
Benefits	Shorter LOS, decreased alarm fatigue, decreased cost
Risk, harm, cost	Delayed detection of hypoxemia, delay in appropriate weaning of oxygen
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Limited
Exclusions	None
Strength	Weak recommendation (based on lower level of evidence)
Differences of opinion	None

Although oxygen saturation is a poor predictor of respiratory distress, it is associated closely with a perceived need for hospitalization in infants with bronchiolitis.[98,99] Additionally, oxygen saturation has been implicated as a primary determinant of LOS in bronchiolitis.[40,100,101]

Physiologic data based on the oxyhemoglobin dissociation curve (Fig 3) demonstrate that small increases in arterial partial pressure of oxygen are associated with marked improvement in pulse oxygen saturation when the latter is less than 90%; with pulse oxygen saturation readings greater than 90% it takes very large elevations in arterial partial pressure of oxygen to affect further increases. In infants and children with bronchiolitis, no data exist to suggest such increases result in any clinically significant difference in physiologic function, patient symptoms, or clinical outcomes. Although it is well understood that acidosis, temperature, and 2,3-diphosphoglutarate influence the oxyhemoglobin dissociation curve, there has never been research to demonstrate how those influences practically affect infants with hypoxemia. The risk of hypoxemia must be weighed against the risk of hospitalization when making any decisions about site of care. One study of hospitalized children with bronchiolitis, for example, noted a 10% adverse error or near-miss rate for harm-causing interventions.[103] There are no studies on the effect of short-term, brief periods of hypoxemia such as may be seen in bronchiolitis. Transient hypoxemia is common in healthy infants.[104] Travel of healthy children even to moderate altitudes of 1300 m results in transient sleep desaturation to an average of 84% with no known adverse consequences.[105] Although children with chronic hypoxemia do incur developmental and behavioral problems, children who suffer intermittent hypoxemia from diseases such as asthma do not have impaired intellectual abilities or behavioral disturbance.[106–108]

Supplemental oxygen provided for infants not requiring additional respiratory support is best initiated with nasal prongs, although exact measurement of fraction of inspired oxygen is unreliable with this method.[109]

Pulse oximetry is a convenient method to assess the percentage of hemoglobin bound by oxygen in children. Pulse oximetry has been erroneously used in bronchiolitis as a proxy for respiratory distress. Accuracy of pulse oximetry is poor, especially in the 76% to 90% range.[110] Further, it has been well demonstrated that oxygen saturation has much less impact on respiratory drive than carbon dioxide concentrations in the blood.[111] There is very poor correlation between respiratory distress and oxygen saturations among infants with lower respiratory tract infections.[112] Other than cyanosis, no published clinical sign, model, or score accurately identifies hypoxemic children.[113]

Among children admitted for bronchiolitis, continuous pulse oximetry measurement is not well studied and potentially problematic for children who do not require oxygen. Transient desaturation is a normal phenomenon in healthy infants. In 1 study of 64 healthy infants between 2 weeks and 6 months of age, 60% of these infants exhibited a transient oxygen desaturation below 90%, to values as low as 83%.[105] A retrospective study of the role of continuous measurement of oxygenation in infants hospitalized with bronchiolitis found that 1 in 4 patients incur unnecessarily prolonged hospitalization as a result of a perceived need for oxygen outside of other symptoms[40] and no evidence of benefit was found.

Pulse oximetry is prone to errors of measurement. Families of infants hospitalized with continuous pulse oximeters are exposed to frequent alarms that

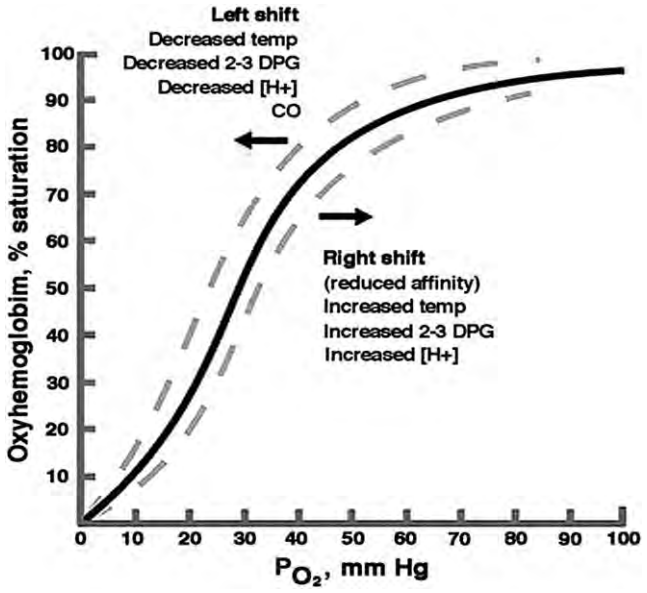

FIGURE 3
Oxyhemoglobin dissociation curve showing percent saturation of hemoglobin at various partial pressures of oxygen (reproduced with permission from the educational Web site www.anaesthesiauk.com).[102]

may negatively affect sleep. Alarm fatigue is recognized by The Joint Commission as a contributor toward in-hospital morbidity and mortality.[114] One adult study demonstrated very poor documentation of hypoxemia alerts by pulse oximetry, an indicator of alarm fatigue.[115] Pulse oximetry probes can fall off easily, leading to inaccurate measurements and alarms.[116] False reliance on pulse oximetry may lead to less careful monitoring of respiratory status. In one study, continuous pulse oximetry was associated with increased risk of minor adverse events in infants admitted to a general ward.[117] The pulse oximetry–monitored patients were found to have less-effective surveillance of their severity of illness when controlling for other variables.

There are a number of new approaches to oxygen delivery in bronchiolitis, 2 of which are home oxygen and high-frequency nasal cannula. There is emerging evidence for the role of home oxygen in reducing LOS or admission rate for infants with bronchiolitis, including 2 randomized trials.[118,119] Most of the studies have been performed in areas of higher altitude, where prolonged hypoxemia is a prime determinant of LOS in the hospital.[120,121] Readmission rates may be moderately higher in patients discharged with home oxygen; however, overall hospital use may be reduced,[122] although not in all settings.[123] Concerns have been raised that home pulse oximetry may complicate care or confuse families.[124] Communication with follow-up physicians is important, because primary care physicians may have difficulty determining safe pulse oximetry levels for discontinuation of oxygen.[125] Additionally, there may be an increased demand for follow-up outpatient visits associated with home oxygen use.[124]

Use of humidified, heated, high-flow nasal cannula to deliver air-oxygen mixtures provides assistance to infants with bronchiolitis through multiple proposed mechanisms.[126] There is evidence that high-flow nasal cannula improves physiologic measures of respiratory effort and can generate continuous positive airway pressure in bronchiolitis.[127–130] Clinical evidence suggests it reduces work of breathing[131,132] and may decrease need for intubation,[133–136] although studies are generally retrospective and small. The therapy has been studied in the ED[136,137] and the general inpatient setting,[134,138] as well as the ICU. The largest and most rigorous retrospective study to date was from Australia,[138] which showed a decline in intubation rate in the subgroup of infants with bronchiolitis (n = 330) from 37% to 7% after the introduction of high-flow nasal cannula, while the national registry intubation rate remained at 28%. A single pilot for a randomized trial has been published to date.[139] Although promising, the absence of any completed randomized trial of the efficacy of high-flow nasal cannula in bronchiolitis precludes specific recommendations on it use at present. Pneumothorax is a reported complication.

CHEST PHYSIOTHERAPY

Key Action Statement 7

Clinicians should not use chest physiotherapy for infants and children with a diagnosis of bronchiolitis (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 7

Aggregate evidence quality	B
Benefits	Decreased stress from therapy, reduced cost
Risk, harm, cost	None
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None

Airway edema, sloughing of respiratory epithelium into airways, and generalized hyperinflation of the lungs, coupled with poorly developed collateral ventilation, put infants with bronchiolitis at risk for atelectasis. Although lobar atelectasis is not characteristic of this disease, chest radiographs may show evidence of subsegmental atelectasis, prompting clinicians to consider ordering chest physiotherapy to promote airway clearance. A Cochrane Review[140] found 9 randomized controlled trials that evaluated chest physiotherapy in hospitalized patients with bronchiolitis. No clinical benefit was found by using vibration or percussion (5 trials)[141–144] or passive expiratory techniques (4 trials).[145–148] Since that review, a study[149] of the passive expiratory technique found a small, but significant reduction in duration of oxygen therapy, but no other benefits.

Suctioning of the nasopharynx to remove secretions is a frequent practice in infants with bronchiolitis. Although suctioning the nares may provide temporary relief of nasal congestion or upper airway obstruction, a retrospective study reported that deep suctioning[150] was associated with longer LOS in hospitalized infants 2 to 12 months of age. The same study also noted that lapses of greater than 4 hours in noninvasive, external nasal suctioning were also associated with longer LOS. Currently, there are insufficient data to make a recommendation about suctioning, but it appears that routine use of "deep" suctioning[151,153] may not be beneficial.

ANTIBACTERIALS

Key Action Statement 8

Clinicians should not administer antibacterial medications to infants and children with a diagnosis of bronchiolitis unless there is a concomitant bacterial infection, or a strong suspicion of one. (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 8

Aggregate evidence quality	B
Benefits	Fewer adverse effects, less resistance to antibacterial agents, lower cost
Risk, harm, cost	None
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	Strong suspicion is not specifically defined and requires clinician judgment. An evaluation for the source of possible serious bacterial infection should be completed before antibiotic use
Role of patient preferences	None
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None

Infants with bronchiolitis frequently receive antibacterial therapy because of fever,[152] young age,[153] and concern for secondary bacterial infection.[154] Early randomized controlled trials[155,156] showed no benefit from routine antibacterial therapy for children with bronchiolitis. Nonetheless, antibiotic therapy continues to be overused in young infants with bronchiolitis because of concern for an undetected bacterial infection. Studies have shown that febrile infants without an identifiable source of fever have a risk of bacteremia that may be as high as 7%. However, a child with a distinct viral syndrome, such as bronchiolitis, has a lower risk (much less than 1%) of bacterial infection of the cerebrospinal fluid or blood.[157]

Ralston et al[158] conducted a systematic review of serious bacterial infections (SBIs) occurring in hospitalized febrile infants between 30 and 90 days of age with bronchiolitis. Instances of bacteremia or meningitis were extremely rare. Enteritis was not evaluated. Urinary tract infection occurred at a rate of approximately 1%, but asymptomatic bacteriuria may have explained this finding. The authors concluded routine screening for SBI among hospitalized febrile infants with bronchiolitis between 30 and 90 days of age is not justified. Limited data suggest the risk of bacterial infection in hospitalized infants with bronchiolitis younger than 30 days of age is similar to the risk in older infants. An abnormal white blood cell count is not useful for predicting a concurrent SBI in infants and young children hospitalized with RSV lower respiratory tract infection.[159] Several retrospective studies support this conclusion.[160–166] Four prospective studies of SBI in patients with bronchiolitis and/or RSV infections also demonstrated low rates of SBI.[167–171]

Approximately 25% of hospitalized infants with bronchiolitis have radiographic evidence of atelectasis, and it may be difficult to distinguish between atelectasis and bacterial infiltrate or consolidation.[169] Bacterial pneumonia in infants with bronchiolitis without consolidation is unusual.[170] Antibiotic therapy may be justified in some children with bronchiolitis who require intubation and mechanical ventilation for respiratory failure.[172,173]

Although acute otitis media (AOM) in infants with bronchiolitis may be attributable to viruses, clinical features generally do not permit differentiation of viral AOM from those with a bacterial component.[174] Two studies address the frequency of AOM in patients with bronchiolitis. Andrade et al[175] prospectively identified AOM in 62% of 42 patients who presented with bronchiolitis. AOM was present in 50% on entry to the study and developed in an additional 12% within 10 days. A subsequent report[176] followed 150 children hospitalized for bronchiolitis for the development of AOM. Seventy-nine (53%) developed AOM, two-thirds within the

first 2 days of hospitalization. AOM did not influence the clinical course or laboratory findings of bronchiolitis. The current AAP guideline on AOM[177] recommends that a diagnosis of AOM should include bulging of the tympanic membrane. This is based on bulging being the best indicator for the presence of bacteria in multiple tympanocentesis studies and on 2 articles comparing antibiotic to placebo therapy that used a bulging tympanic membrane as a necessary part of the diagnosis.[178,179] New studies are needed to determine the incidence of AOM in bronchiolitis by using the new criterion of bulging of the tympanic membrane. Refer to the AOM guideline[180] for recommendations regarding the management of AOM.

NUTRITION AND HYDRATION

Key Action Statement 9

Clinicians should administer nasogastric or intravenous fluids for infants with a diagnosis of bronchiolitis who cannot maintain hydration orally (Evidence Quality: X; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 9

Aggregate evidence quality	X
Benefits	Maintaining hydration
Risk, harm, cost	Risk of infection, risk of aspiration with nasogastric tube, discomfort, hyponatremia, intravenous infiltration, overhydration
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Shared decision as to which mode is used
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None

The level of respiratory distress attributable to bronchiolitis guides the indications for fluid replacement. Conversely, food intake in the previous 24 hours may be a predictor of oxygen saturation among infants with bronchiolitis. One study found that food intake at less than 50% of normal for the previous 24 hours is associated with a pulse oximetry value of <95%.[180] Infants with mild respiratory distress may require only observation, particularly if feeding remains unaffected. When the respiratory rate exceeds 60 to 70 breaths per minute, feeding may be compromised, particularly if nasal secretions are copious. There is limited evidence to suggest coordination of breathing with swallowing may be impaired among infants with bronchiolitis.[181] These infants may develop increased nasal flaring, retractions, and prolonged expiratory wheezing when fed and may be at increased risk of aspiration.[182]

One study estimated that one-third of infants hospitalized for bronchiolitis require fluid replacement.[183] One case series[184] and 2 randomized trials,[185,186] examined the comparative efficacy and safety of the intravenous and nasogastric routes for fluid replacement. A pilot trial in Israel that included 51 infants younger than 6 months demonstrated no significant differences in the duration of oxygen needed or time to full oral feeds between infants receiving intravenous 5% dextrose in normal saline solution or nasogastric breast milk or formula.[187] Infants in the intravenous group had a shorter LOS (100 vs 120 hours) but it was not statistically significant. In a larger open randomized trial including infants between 2 and 12 months of age and conducted in Australia and New Zealand, there were no significant differences in rates of admission to ICUs, need for ventilatory support, and adverse events between 381 infants assigned to nasogastric hydration and 378 infants assigned to intravenous hydration.[188] There was a difference of 4 hours in mean LOS between the intravenous group (82.2 hours) and the nasogastric group (86.2 hours) that was not statistically significant. The nasogastric route had a higher success rate of insertion than the intravenous route. Parental satisfaction scores did not differ between the intravenous and nasogastric groups. These studies suggest that infants who have difficulty feeding safely because of respiratory distress can receive either intravenous or nasogastric fluid replacement; however, more evidence is needed to increase the strength of this recommendation.

The possibility of fluid retention related to production of antidiuretic hormone has been raised in patients with bronchiolitis.[187–189] Therefore, receipt of hypotonic fluid replacement and maintenance fluids may increase the risk of iatrogenic hyponatremia in these infants. A recent meta-analysis demonstrated that among hospitalized children requiring maintenance fluids, the use of hypotonic fluids was associated with significant hyponatremia compared with isotonic fluids in older children.[190] Use of isotonic fluids, in general, appears to be safer.

PREVENTION

Key Action Statement 10a

Clinicians should not administer palivizumab to otherwise healthy

infants with a gestational age of 29 weeks, 0 days or greater (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 10a

Aggregate evidence quality	B
Benefits	Reduced pain of injections, reduced use of a medication that has shown minimal benefit, reduced adverse effects, reduced visits to health care provider with less exposure to illness
Risk, harm, cost	Minimal increase in risk of RSV hospitalization
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Parents may choose to not accept palivizumab
Exclusions	Infants with chronic lung disease of prematurity and hemodynamically significant cardiac disease (as described in KAS 10b)
Strength	Recommendation
Differences of opinion	None
Notes	This KAS is harmonized with the AAP policy statement on palivizumab

Key Action Statement 10b

Clinicians should administer palivizumab during the first year of life to infants with hemodynamically significant heart disease or chronic lung disease of prematurity defined as preterm infants <32 weeks, 0 days' gestation who require >21% oxygen for at least the first 28 days of life (Evidence Quality: B; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 10b

Aggregate evidence quality	B
Benefits	Reduced risk of RSV hospitalization
Risk, harm, cost	Injection pain; increased risk of illness from increased visits to clinician office or clinic; cost; side effects from palivizumab
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Parents may choose to not accept palivizumab
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None
Notes	This KAS is harmonized with the AAP policy statement on palivizumab[191,192]

Key Action Statement 10c

Clinicians should administer a maximum 5 monthly doses (15 mg/kg/dose) of palivizumab during the RSV season to infants who qualify for palivizumab in the first year of life (Evidence Quality: B, Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 10c

Aggregate evidence quality	B
Benefits	Reduced risk of hospitalization; reduced admission to ICU
Risk, harm, cost	Injection pain; increased risk of illness from increased visits to clinician office or clinic; cost; adverse effects of palivizumab
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	Fewer doses should be used if the bronchiolitis season ends before the completion of 5 doses; if the child is hospitalized with a breakthrough RSV, monthly prophylaxis should be discontinued
Strength	Moderate recommendation
Differences of opinion	None
Notes	This KAS is harmonized with the AAP policy statement on palivizumab[191,192]

Detailed evidence to support the policy statement on palivizumab and this palivizumab section can be found in the technical report on palivizumab.[192]

Palivizumab was licensed by the US Food and Drug Administration in June 1998 largely on the basis of results of 1 clinical trial.[193] The results of a second clinical trial among children with congenital heart disease were reported in December 2003.[194] No other prospective, randomized, placebo-controlled trials have been conducted in any subgroup. Since licensure of palivizumab, new peer-reviewed publications provide greater insight into the epidemiology of disease caused by RSV.[195–197] As a result of new data, the Bronchiolitis Guideline Committee and the Committee on Infectious Diseases have updated recommendations for use of prophylaxis.

PREMATURITY

Monthly palivizumab prophylaxis should be restricted to infants born before 29 weeks, 0 days' gestation, except for infants who qualify on the basis of congenital heart disease or chronic lung disease of prematurity. Data show that infants born at or after 29 weeks, 0 days' gestation have an RSV hospitalization rate similar to the rate of full-term infants.[11,198] Infants with a gestational age of 28 weeks, 6 days or less who will be younger than 12 months at the start of the RSV season should receive a maximum of 5 monthly doses of palivizumab or until the end of the RSV season, whichever comes first. Depending on the month of birth, fewer than 5 monthly doses

will provide protection for most infants for the duration of the season.

CONGENITAL HEART DISEASE

Despite the large number of subjects enrolled, little benefit from palivizumab prophylaxis was found in the industry-sponsored cardiac study among infants in the cyanotic group (7.9% in control group versus 5.6% in palivizumab group, or 23 fewer hospitalizations per1000 children; P = .285).[197] In the acyanotic group (11.8% vs 5.0%), there were 68 fewer RSV hospitalizations per 1000 prophylaxis recipients (P = .003).[197,199,200]

CHRONIC LUNG DISEASE OF PREMATURITY

Palivizumab prophylaxis should be administered to infants and children younger than 12 months who develop chronic lung disease of prematurity, defined as a requirement for 28 days of more than 21% oxygen beginning at birth. If a child meets these criteria and is in the first 24 months of life and continues to require supplemental oxygen, diuretic therapy, or chronic corticosteroid therapy within 6 months of the start of the RSV season, monthly prophylaxis should be administered for the remainder of the season.

NUMBER OF DOSES

Community outbreaks of RSV disease usually begin in November or December, peak in January or February, and end by late March or, at times, in April.[4] Figure 1 shows the 2011–2012 bronchiolitis season, which is typical of most years. Because 5 monthly doses will provide more than 24 weeks of protective serum palivizumab concentration, administration of more than 5 monthly doses is not recommended within the continental United States. For infants who qualify for 5 monthly doses, initiation of prophylaxis in November and continuation for a total of 5 doses will provide protection into April.[201] If prophylaxis is initiated in October, the fifth and final dose should be administered in February, and protection will last into March for most children.

SECOND YEAR OF LIFE

Because of the low risk of RSV hospitalization in the second year of life, palivizumab prophylaxis is not recommended for children in the second year of life with the following exception. Children who satisfy the definition of chronic lung disease of infancy and continue to require supplemental oxygen, chronic corticosteroid therapy, or diuretic therapy within 6 months of the onset of the second RSV season may be considered for a second season of prophylaxis.

OTHER CONDITIONS

Insufficient data are available to recommend routine use of prophylaxis in children with Down syndrome, cystic fibrosis, pulmonary abnormality, neuromuscular disease, or immune compromise.

Down Syndrome

Routine use of prophylaxis for children in the first year of life with Down syndrome is not recommended unless the child qualifies because of cardiac disease or prematurity.[202]

Cystic Fibrosis

Routine use of palivizumab prophylaxis in patients with cystic fibrosis is not recommended.[203,204] Available studies indicate the incidence of RSV hospitalization in children with cystic fibrosis is low and unlikely to be different from children without cystic fibrosis. No evidence suggests a benefit from palivizumab prophylaxis in patients with cystic fibrosis. A randomized clinical trial involving 186 children with cystic fibrosis from 40 centers reported 1 subject in each group was hospitalized because of RSV infection. Although this study was not powered for efficacy, no clinically meaningful differences in outcome were reported.[205] A survey of cystic fibrosis center directors published in 2009 noted that palivizumab prophylaxis is not the standard of care for patients with cystic fibrosis.[206] If a neonate is diagnosed with cystic fibrosis by newborn screening, RSV prophylaxis should not be administered if no other indications are present. A patient with cystic fibrosis with clinical evidence of chronic lung disease in the first year of life may be considered for prophylaxis.

Neuromuscular Disease and Pulmonary Abnormality

The risk of RSV hospitalization is not well defined in children with pulmonary abnormalities or neuromuscular disease that impairs ability to clear secretions from the lower airway because of ineffective cough, recurrent gastroesophageal tract reflux, pulmonary malformations, tracheoesophageal fistula, upper airway conditions, or conditions requiring tracheostomy. No data on the relative risk of RSV hospitalization are available for this cohort. Selected infants with disease or congenital anomaly that impairs their ability to clear secretions from the lower airway because of ineffective cough may be considered for prophylaxis during the first year of life.

Immunocompromised Children

Population-based data are not available on the incidence or severity of RSV hospitalization in children who undergo solid organ or hematopoietic stem cell transplantation, receive chemotherapy, or are immunocompromised because of other conditions. Prophylaxis may be considered for hematopoietic stem cell transplant

patients who undergo transplantation and are profoundly immunosuppressed during the RSV season.[207]

MISCELLANEOUS ISSUES

Prophylaxis is not recommended for prevention of nosocomial RSV disease in the NICU or hospital setting.[208,209]

No evidence suggests palivizumab is a cost-effective measure to prevent recurrent wheezing in children. Prophylaxis should not be administered to reduce recurrent wheezing in later years.[210,211]

Monthly prophylaxis in Alaska Native children who qualify should be determined by locally generated data regarding season onset and end.

Continuation of monthly prophylaxis for an infant or young child who experiences breakthrough RSV hospitalization is not recommended.

HAND HYGIENE

Key Action Statement 11a

All people should disinfect hands before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 11a

Aggregate evidence quality	B
Benefits	Decreased transmission of disease
Risk, harm, cost	Possible hand irritation
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None

Key Action Statement 11b

All people should use alcohol-based rubs for hand decontamination when caring for children with bronchiolitis. When alcohol-based rubs are not available, individuals should wash their hands with soap and water (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 11b

Aggregate evidence quality	B
Benefits	Less hand irritation
Risk, harm, cost	If there is visible dirt on the hands, hand washing is necessary; alcohol-based rubs are not effective for *Clostridium difficile,* present a fire hazard, and have a slight increased cost
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Strong recommendation
Differences of opinion	None

Efforts should be made to decrease the spread of RSV and other causative agents of bronchiolitis in medical settings, especially in the hospital. Secretions from infected patients can be found on beds, crib railings, tabletops, and toys.[12] RSV, as well as many other viruses, can survive better on hard surfaces than on porous surfaces or hands. It can remain infectious on counter tops for ≥6 hours, on gowns or paper tissues for 20 to 30 minutes, and on skin for up to 20 minutes.[212]

It has been shown that RSV can be carried and spread to others on the hands of caregivers.[213] Studies have shown that health care workers have acquired infection by performing activities such as feeding, diaper change, and playing with the RSV-infected infant. Caregivers who had contact only with surfaces contaminated with the infants' secretions or touched inanimate objects in patients' rooms also acquired RSV. In these studies, health care workers contaminated their hands (or gloves) with RSV and inoculated their oral or conjunctival mucosa.[214] Frequent hand washing by health care workers has been shown to reduce the spread of RSV in the health care setting.[215]

The Centers for Disease Control and Prevention published an extensive review of the hand-hygiene literature and made recommendations as to indications for hand washing and hand antisepsis.[216] Among the recommendations are that hands should be disinfected before and after direct contact with every patient, after contact with inanimate objects in the direct vicinity of the patient, and before putting on and after removing gloves. If hands are not visibly soiled, an alcohol-based rub is preferred. In guidelines published in 2009, the World Health Organization also recommended alcohol-based hand-rubs as the standard for hand hygiene in health care.[217] Specifically, systematic reviews show them to remove organisms more effectively, require less time, and irritate skin less often than hand washing with soap or other antiseptic agents and water. The availability of bedside alcohol-based solutions increased compliance with hand hygiene among health care workers.[214]

When caring for hospitalized children with clinically diagnosed bronchiolitis, strict adherence to hand decontamination and use of personal protective equipment (ie, gloves and gowns) can reduce the risk of cross-infection in the health care setting.[215]

Other methods of infection control in viral bronchiolitis include education of personnel and family members, surveillance for the onset of RSV season, and wearing masks when anticipating exposure to aerosolized secretions while performing patient care activities. Programs that implement the aforementioned principles, in conjunction with effective hand decontamination and cohorting of patients, have been shown to reduce the spread of RSV in the health care setting by 39% to 50%.[218,219]

TOBACCO SMOKE

Key Action Statement 12a

Clinicians should inquire about the exposure of the infant or child to tobacco smoke when assessing infants and children for bronchiolitis (Evidence Quality: C; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 12a

Aggregate evidence quality	C
Benefits	Can identify infants and children at risk whose family may benefit from counseling, predicting risk of severe disease
Risk, harm, cost	Time to inquire
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Parent may choose to deny tobacco use even though they are, in fact, users
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None

Key Action Statement 12b

Clinicians should counsel caregivers about exposing the infant or child to environmental tobacco smoke and smoking cessation when assessing a child for bronchiolitis (Evidence Quality: B; Recommendation Strength: Strong Recommendation).

Action Statement Profile KAS 12b

Aggregate evidence quality	B
Benefits	Reinforces the detrimental effects of smoking, potential to decrease smoking
Risk, harm, cost	Time to counsel
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Parents may choose to ignore counseling
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None
Notes	Counseling for tobacco smoke prevention should begin in the prenatal period and continue in family-centered care and at all well-infant visits

Tobacco smoke exposure increases the risk and severity of bronchiolitis. Strachan and Cook[220] first delineated the effects of environmental tobacco smoke on rates of lower respiratory tract disease in infants in a meta-analysis including 40 studies. In a more recent systematic review, Jones et al[221] found a pooled odds ratio of 2.51 (95% CI 1.96 to 3.21) for tobacco smoke exposure and bronchiolitis hospitalization among the 7 studies specific to the condition. Other investigators have consistently reported tobacco smoke exposure increases both severity of illness and risk of hospitalization for bronchiolitis.[222–225] The AAP issued a technical report on the risks of secondhand smoke in 2009. The report makes recommendations regarding effective ways to eliminate or reduce secondhand smoke exposure, including education of parents.[226]

Despite our knowledge of this important risk factor, there is evidence to suggest health care providers identify fewer than half of children exposed to tobacco smoke in the outpatient, inpatient, or ED settings.[227–229] Furthermore, there is evidence that counseling parents in these settings is well received and has a measurable impact. Rosen et al[230] performed a meta-analysis of the effects of interventions in pediatric settings on parental cessation and found a pooled risk ratio of 1.3 for cessation among the 18 studies reviewed.

In contrast to many of the other recommendations, protecting children from tobacco exposure is a recommendation that is primarily implemented outside of the clinical setting. As such, it is critical that parents are fully educated about the importance of not allowing smoking in the home and that smoke lingers on clothes and in the environment for prolonged periods.[231] It should be provided in plain language and in a respectful, culturally effective manner that is family centered, engages parents as partners in their child's health, and factors in their literacy, health literacy, and primary language needs.

BREASTFEEDING

Key Action Statement 13

Clinicians should encourage exclusive breastfeeding for at least 6 months to decrease the morbidity of respiratory infections (Evidence Quality: Grade B; Recommendation Strength: Moderate Recommendation).

Action Statement Profile KAS 13

Aggregate evidence quality	B
Benefits	May reduce the risk of bronchiolitis and other illnesses; multiple benefits of breastfeeding unrelated to bronchiolitis
Risk, harm, cost	None
Benefit-harm assessment	Benefits outweigh risks
Value judgments	None
Intentional vagueness	None
Role of patient preferences	Parents may choose to feed formula rather than breastfeed
Exclusions	None
Strength	Moderate recommendation
Notes	Education on breastfeeding should begin in the prenatal period

In 2012, the AAP presented a general policy on breastfeeding.[232] The policy statement was based on the proven benefits of breastfeeding for at least 6 months. Respiratory infections were shown to be significantly less common in breastfed children. A primary resource was a meta-analysis from the Agency for Healthcare Research and Quality that showed an overall 72% reduction in the risk of hospitalization secondary to respiratory diseases in infants who were exclusively breastfed for 4 or more months compared with those who were formula fed.[233]

The clinical evidence also supports decreased incidence and severity of illness in breastfed infants with bronchiolitis. Dornelles et al[234] concluded that the duration of exclusive breastfeeding was inversely related to the length of oxygen use and the length of hospital stay in previously healthy infants with acute bronchiolitis. In a large prospective study in Australia, Oddy et al[235] showed that breastfeeding for less than 6 months was associated with an increased risk for 2 or more medical visits and hospital admission for wheezing lower respiratory illness. In Japan, Nishimura et al[236] looked at 3 groups of RSV-positive infants defined as full, partial, or token breastfeeding. There were no significant differences in the hospitalization rate among the 3 groups; however, there were significant differences in the duration of hospitalization and the rate of requiring oxygen therapy, both favoring breastfeeding.

FAMILY EDUCATION

Key Action Statement 14

Clinicians and nurses should educate personnel and family members on evidence-based diagnosis, treatment, and prevention in bronchiolitis (Evidence Quality: C; observational studies; Recommendation Strength; Moderate Recommendation).

Action Statement Profile KAS 14

Aggregate evidence quality	C
Benefits	Decreased transmission of disease, benefits of breastfeeding, promotion of judicious use of antibiotics, risks of infant lung damage attributable to tobacco smoke
Risk, harm, cost	Time to educate properly
Benefit-harm assessment	Benefits outweigh harms
Value judgments	None
Intentional vagueness	Personnel is not specifically defined but should include all people who enter a patient's room
Role of patient preferences	None
Exclusions	None
Strength	Moderate recommendation
Differences of opinion	None

Shared decision-making with parents about diagnosis and treatment of bronchiolitis is a key tenet of patient-centered care. Despite the absence of effective therapies for viral bronchiolitis, caregiver education by clinicians may have a significant impact on care patterns in the disease. Children with bronchiolitis typically suffer from symptoms for 2 to 3 weeks, and parents often seek care in multiple settings during that time period.[237] Given that children with RSV generally shed virus for 1 to 2 weeks and from 30% to 70% of family members may become ill,[238,239] education about prevention of transmission of disease is key. Restriction of visitors to newborns during the respiratory virus season should be considered. Consistent evidence suggests that parental education is helpful in the promotion of judicious use of antibiotics and that clinicians may misinterpret parental expectations about therapy unless the subject is openly discussed.[240–242]

FUTURE RESEARCH NEEDS

- Better algorithms for predicting the course of illness
- Impact of clinical score on patient outcomes
- Evaluating different ethnic groups and varying response to treatments
- Does epinephrine alone reduce admission in outpatient settings?
- Additional studies on epinephrine in combination with dexamethasone or other corticosteroids
- Hypertonic saline studies in the outpatient setting and in in hospitals with shorter LOS
- More studies on nasogastric hydration
- More studies on tonicity of intravenous fluids

- Incidence of true AOM in bronchiolitis by using 2013 guideline definition
- More studies on deep suctioning and nasopharyngeal suctioning
- Strategies for monitoring oxygen saturation
- Use of home oxygen
- Appropriate cutoff for use of oxygen in high altitude
- Oxygen delivered by high-flow nasal cannula
- RSV vaccine and antiviral agents
- Use of palivizumab in special populations, such as cystic fibrosis, neuromuscular diseases, Down syndrome, immune deficiency
- Emphasis on parent satisfaction/patient-centered outcomes in all research (ie, not LOS as the only measure)

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APPENDIX 1 SEARCH TERMS BY TOPIC

Introduction

MedLine

((“bronchiolitis”[MeSH]) OR (“respiratory syncytial viruses”[MeSH]) NOT “bronchiolitis obliterans”[All Fields])

1. and exp Natural History/
2. and exp Epidemiology/
3. and (exp economics/ or exp “costs and cost analysis”/ or exp “cost allocation”/ or exp cost-benefit analysis/ or exp “cost control”/ or exp “cost of illness”/ or exp “cost sharing”/ or exp health care costs/ or exp health expenditures/)
4. and exp Risk Factors/

Limit to English Language AND Humans AND (“all infant (birth to 23 months)” or “newborn infant (birth to 1 month)” or “infant (1 to 23 months)”)

CINAHL

(MM “Bronchiolitis+”) AND (“natural history” OR (MM “Epidemiology”) OR (MM “Costs and Cost Analysis”) OR (MM “Risk Factors”))

The Cochrane Library

Bronchiolitis AND (epidemiology OR risk factor OR cost)

Diagnosis/Severity

MedLine

exp BRONCHIOLITIS/di [Diagnosis] OR exp Bronchiolitis, Viral/di [Diagnosis]

limit to English Language AND (“all infant (birth to 23 months)” or “newborn infant (birth to 1 month)” or “infant (1 to 23 months)”)

CINAHL

(MH “Bronchiolitis/DI”)

The Cochrane Library

Bronchiolitis AND Diagnosis

*Upper Respiratory Infection Symptoms

MedLine

(exp Bronchiolitis/ OR exp Bronchiolitis, Viral/) AND exp *Respiratory Tract Infections/

Limit to English Language

Limit to “all infant (birth to 23 months)” OR “newborn infant (birth to 1 month)” OR “infant (1 to 23 months)”)

CINAHL

(MM “Bronchiolitis+”) AND (MM “Respiratory Tract Infections+”)

The Cochrane Library

Bronchiolitis AND Respiratory Infection

Inhalation Therapies

*Bronchodilators & Corticosteroids

MedLine

((“bronchiolitis”[MeSH]) OR (“respiratory syncytial viruses”[MeSH]) NOT “bronchiolitis obliterans”[All Fields])

AND (exp Receptors, Adrenergic, β-2/ OR exp Receptors, Adrenergic, β/ OR exp Receptors, Adrenergic, β-1/ OR β adrenergic*.mp. OR exp ALBUTEROL/ OR levalbuterol.mp. OR exp EPINEPHRINE/ OR exp Cholinergic Antagonists/ OR exp IPRATROPIUM/ OR exp Anti-Inflammatory Agents/ OR ics.mp. OR inhaled corticosteroid*.mp. OR exp Adrenal Cortex Hormones/ OR exp Leukotriene Antagonists/ OR montelukast.mp. OR exp Bronchodilator Agents/)

Limit to English Language AND (“all infant (birth to 23 months)” or “newborn infant (birth to 1 month)” or “infant (1 to 23 months)”)

CINAHL

(MM “Bronchiolitis+”) AND (MM “Bronchodilator Agents”)

The Cochrane Library

Bronchiolitis AND (bronchodilator OR epinephrine OR albuterol OR salbutamol OR corticosteroid OR steroid)

*Hypertonic Saline

MedLine

((“bronchiolitis”[MeSH]) OR (“respiratory syncytial viruses”[MeSH]) NOT “bronchiolitis obliterans”[All Fields])

AND (exp Saline Solution, Hypertonic/ OR (aerosolized saline.mp. OR (exp AEROSOLS/ AND exp Sodium Chloride/)) OR (exp Sodium Chloride/ AND exp “Nebulizers and Vaporizers”/) OR nebulized saline.mp.)

Limit to English Language

Limit to “all infant (birth to 23 months)” OR “newborn infant (birth to 1 month)” OR “infant (1 to 23 months)”)

CINAHL

(MM “Bronchiolitis+”) AND (MM “Saline Solution, Hypertonic”)

The Cochrane Library

Bronchiolitis AND Hypertonic Saline

Oxygen

MedLine

((“bronchiolitis”[MeSH]) OR (“respiratory syncytial viruses”[MeSH]) NOT “bronchiolitis obliterans”[All Fields])

1. AND (exp Oxygen Inhalation Therapy/ OR supplemental oxygen.mp. OR oxygen saturation.mp. OR *Oxygen/ad, st [Administration & Dosage, Standards] OR oxygen treatment.mp.)
2. AND (exp OXIMETRY/ OR oximeters.mp.) AND (exp “Reproducibility of Results”/ OR reliability.mp. OR function.mp. OR technical specifications.mp.) OR (percutaneous measurement*.mp. OR exp Blood Gas Analysis/)

Limit to English Language

Limit to “all infant (birth to 23 months)” OR “newborn infant (birth to 1 month)” OR “infant (1 to 23 months)”)