



Complete Summary

GUIDELINE TITLE

Measures of asthma assessment and monitoring: Expert panel report 3: guidelines for the diagnosis and management of asthma.

BIBLIOGRAPHIC SOURCE(S)

Measures of asthma assessment and monitoring. In: National Asthma Education and Prevention Program (NAEPP). Expert panel report 3: guidelines for the diagnosis and management of asthma. Bethesda (MD): National Heart, Lung, and Blood Institute; 2007 Aug. p. 36-92. [134 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: National Asthma Education and Prevention Program Expert Panel Report: guidelines for the diagnosis and management of asthma update on selected topics-2002. J Allergy Clin Immunol 2002 Nov;110(5 pt 2):S141-219.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY
DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

Asthma

GUIDELINE CATEGORY

Diagnosis
Evaluation

Management
Risk Assessment

CLINICAL SPECIALTY

Allergy and Immunology
Emergency Medicine
Family Practice
Internal Medicine
Pediatrics
Pharmacology
Preventive Medicine
Pulmonary Medicine

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Health Plans
Nurses
Physician Assistants
Physicians
Respiratory Care Practitioners

GUIDELINE OBJECTIVE(S)

- To present recommendations for the diagnosis and management of asthma that will help clinicians and patients make appropriate decisions about asthma care
- To develop clinical practice tools and educational materials for patients and the public
- To revise the National Asthma Education and Prevention Program Expert Panel Report-2 Stepwise Approach for Managing Asthma in order to incorporate findings from the review of the scientific evidence

TARGET POPULATION

Infants, children, adolescents, and adults with asthma

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis

1. Medical history
2. Physical examination
3. Pulmonary function testing (spirometry)
4. Differential diagnosis of asthma
5. Characterization of asthma and classification of asthma severity

Management/Evaluation/Risk Assessment

1. Monitoring of asthma control
2. Establishing goals of therapy
3. Periodic assessment and monitoring of asthma control, including
 - Signs and symptoms
 - Pulmonary function, via spirometry or peak flow monitoring
 - Quality of life
 - History of exacerbations
 - Pharmacotherapy (adherence and side effects)
 - Patient-provider communication and patient satisfaction

MAJOR OUTCOMES CONSIDERED

- Lung function measurements
 - Forced expiratory volume in one second (FEV₁)
 - Peak expiratory flow (PEF)
- Symptom control as indicated by:
 - Symptom scores
 - Symptom frequency
 - Use of acute bronchodilator medication
 - Exacerbations
 - Use of oral corticosteroids

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

In October 2004, the Expert Panel assembled for its first meeting. Using the Expert Panel Report (EPR)—2 1997 and EPR—Update 2002 as the framework, the Expert Panel organized the literature searches and subsequent report around the four essential components of asthma care, namely: (1) assessment and monitoring, (2) patient education, (3) control of factors contributing to asthma severity, and (4) pharmacologic treatment. Subtopics were developed for each of these four broad categories.

Inclusion/Exclusion Criteria

The literature review was conducted in three cycles over an 18-month period (September 2004 to March 2006). Search strategies for the literature review initially were designed to cast a wide net but later were refined by using publication type limits and additional terms to produce results that more closely matched the framework of topics and subtopics selected by the Expert Panel. The searches included human studies with abstracts that were published in English in peer-reviewed medical journals in the MEDLINE database. Two timeframes were used for the searches, dependent on topic: January 1, 2001, through March 15, 2006, for pharmacotherapy (medications), peak flow monitoring, and written action plans, because these topics were recently reviewed in the EPR—Update

2002; and January 1, 1997, through March 15, 2006, for all other topics, because these topics were last reviewed in the EPR—2 1997.

Search Strategies

Panel members identified, with input from a librarian, key text words for each of the four components of care. A separate search strategy was developed for each of the four components and various key subtopics when deemed appropriate. The key text words and Medical Subject Headings (MeSH) terms that were used to develop each search string are found in an appendix posted on the National Heart, Lung, and Blood Institute (NHLBI) Web site.

Literature Review Process

The systematic review covered a wide range of topics. Although the overarching framework for the review was based on the four essential components of asthma care, multiple subtopics were associated with each component. To organize a review of such an expanse, the Panel was divided into 10 committees, with about 4 to 7 reviewers in each (all reviewers were assigned to 2 or more committees). Within each committee, teams of two ("topic teams") were assigned as leads to cover specific topics. A system of independent review and vote by each of the two team reviewers was used at each step of the literature review process to identify studies to include in the guidelines update. The initial step in the literature review process was to screen titles from the searches for relevancy in updating content of the guidelines, followed by reviews of abstracts of the relevant titles to identify those studies meriting full-text review based on relevance to the guidelines and study quality.

The combined number of titles screened from cycles 1, 2, and 3 was 15,444. The number of abstracts and articles reviewed for all three cycles was 4,747. Of these, 2,863 were voted to the abstract Keep list following the abstract-review step. A database of these abstracts is posted on the NHLBI Web site. Of these abstracts, 2,122 were advanced for full-text review, which resulted in 1,654 articles serving as a bibliography of references used to update the guidelines, available on the NHLBI Web site. Articles were selected from this bibliography for evidence tables and/or citation in the text. In addition, articles reporting new and particularly relevant findings and published after March 2006 were identified by Panel members during the writing period (March 2006–December 2006) and by comments received from the public review in February 2007.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

The system* used to describe the level of evidence is as follows:

Evidence Category A: Randomized controlled trials (RCTs), rich body of data.

Evidence is from end points of well-designed RCTs that provide a consistent pattern of findings in the population for which the recommendation is made. Category A requires substantial numbers of studies involving substantial numbers of participants.

Evidence Category B: RCTs, limited body of data.

Evidence is from end points of intervention studies that include only a limited number of patients, post hoc or subgroup analysis of RCTs, or meta-analysis of RCTs. In general, category B pertains when few randomized trials exist; they are small in size, they were undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent.

Evidence Category C: Nonrandomized trials and observational studies.

Evidence is from outcomes of uncontrolled or nonrandomized trials or from observational studies.

Evidence Category D: Panel consensus judgment.

This category is used only in cases where the provision of some guidance was deemed valuable, but the clinical literature addressing the subject was insufficient to justify placement in one of the other categories. The Panel consensus is based on clinical experience or knowledge that does not meet the criteria for categories A through C.

*Source: Jadad AR, Moher M, Browman GP, Booker L, Sigouin C, Fuentes M, Stevens R. Systematic reviews and meta-analyses on treatment of asthma: critical evaluation. *BMJ* 2000;320(7234):537-40.

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Preparation of Evidence Tables

Evidence tables were prepared for selected topics. It was not feasible to generate evidence tables for every topic in the guidelines. Furthermore, many topics did not have a sufficient body of evidence or a sufficient number of high-quality studies to warrant the preparation of a table. The Panel decided to prepare evidence tables on those topics for which an evidence table would be particularly useful to assess the weight of the evidence—e.g., topics with numerous articles, conflicting evidence, or which addressed questions raised frequently by clinicians. Summary findings on topics without evidence tables, however, also are included in the updated guidelines text. Evidence tables were prepared with the assistance of a methodologist who served as a consultant to the Expert Panel. Within their respective committees, Expert Panel members selected the topics and articles for

evidence tables. The evidence tables included all articles that received a "yes" vote from both the primary and secondary reviewer during the systematic literature review process. The methodologist abstracted the articles to the tables, using a template developed by the Expert Panel. The Expert Panel subsequently reviewed and approved the final evidence tables. A total of 20 tables, comprising 316 articles are included in the current update. Evidence tables are posted on the National Heart, Lung, and Blood Institute (NHLBI) Web site.

Ranking the Evidence

The Expert Panel agreed to specify the level of evidence used to justify the recommendations being made. Panel members only included ranking of evidence for recommendations they made based on the scientific literature in the current evidence review. They did not assign evidence rankings to recommendations pulled through from the Expert Panel Report (EPR)—2 1997 on topics that are still important to the diagnosis and management of asthma but for which there was little new published literature. These "pull through" recommendations are designated by EPR—2 1997 in parentheses following the first mention of the recommendation. For recommendations that have been either revised or further substantiated on the basis of the evidence review conducted for the EPR—3: Full Report 2007, the level of evidence is indicated in the text in parentheses following first mention of the recommendation. Refer to the "Rating Scheme for the Strength of the Evidence" for the system used to describe the level of evidence.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The steps used to develop this report include: (1) completing a comprehensive search of the literature; (2) conducting an in-depth review of relevant abstracts and articles; (3) preparing evidence tables to assess the weight of current evidence with respect to past recommendations and new and unresolved issues; (4) conducting thoughtful discussion and interpretation of findings; (5) ranking strength of evidence underlying the current recommendations that are made; (6) updating text, tables, figures, and references of the existing guidelines with new findings from the evidence review; (7) circulating a draft of the updated guidelines through several layers of external review, as well as posting it on the National Heart, Lung, and Blood Institute (NHLBI) Web site for review and comment by the public and the National Asthma Education and Prevention Program Coordinating Committee (NAEPP CC), and (8) preparing a final-report based on consideration of comments raised in the review cycle.

Panel Discussion

The first opportunity for discussion of findings occurred within the "topic teams." Teams then presented a summary of their findings during a conference call to all members of their respective committee. A full discussion ensued on each topic, and the committee arrived at a consensus position. Teams then presented their findings and the committee position to the full Expert Panel at an in-person

meeting, thereby engaging all Panel members in critical analysis of the evidence and interpretation of the data. A series of conference calls for each of the 10 committees as well as four in-person Expert Panel meetings (held in October 2004, April 2005, December 2005, and May 2006) were scheduled to facilitate discussion of findings and to dovetail with the three cycles of literature review that occurred over the 18-month period. Potential conflicts of interest were disclosed at the initial meeting.

Report Preparation

Development of the Expert Panel Report (EPR)—3: Full Report 2007 was an iterative process of interpreting the evidence, drafting summary statements, and reviewing comments from the various external reviews before completing the final report. In the summer and fall of 2005, the various topic teams, through conference calls and subsequent electronic mail, began drafting their assigned sections of the report. Members of the respective committees reviewed and revised team drafts, also by using conference calls and electronic mail. During the calls, votes were taken to ensure agreement with final conclusions and recommendations.

During the December 2005 meeting, Panel members reviewed and discussed all committee drafts. During the May 2006 meeting, the Panel conducted a thorough review and discussion of the report and reached consensus on the recommendations. For controversial topics, votes were taken to ensure that each individual's opinion was considered.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

In addition to specifying the level of evidence supporting a recommendation, the Expert Panel agreed to indicate the strength of the recommendation. When a certain clinical practice "is recommended," this indicates a strong recommendation by the panel. When a certain clinical practice "should, or may, be considered," this indicates that the recommendation is less strong.

This distinction is an effort to address nuances of using evidence ranking systems. For example, a recommendation for which clinical randomized controlled trial data are not available (e.g., conducting a medical history for symptoms suggestive of asthma) may still be strongly supported by the Panel. Furthermore, the range of evidence that qualifies a definition of "B" or "C" is wide, and the Expert Panel considered this range and the potential implications of a recommendation as they decided how strongly the recommendation should be presented.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

In July, using conference calls and electronic mail, the Panel completed a draft of the Expert Panel Report (EPR)—3: Full Report 2007 for submission in July/August to a panel of expert consultants for their review and comments. In response to their comments, a revised draft of the EPR—3: Full Report 2007 was developed and circulated in November to the National Asthma Education and Prevention Program (NAEPP) Guidelines Implementation Panel (GIP) for their comment. This draft was also posted on the National Heart Lung and Blood Institute (NHLBI) Web site for public comment in February 2007. The Expert Panel considered 721 comments from 140 reviewers. Edits were made to the documents, as appropriate, before the full EPR—3: Full Report 2007 was finalized and published.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Definitions of the levels of the evidence (A, B, C, D) and strength of recommendations ("is recommended" and "should or may, be considered") are presented at the end of the "Major Recommendations" field.

Note from the National Asthma Education and Prevention Program (NAEPP): Panel members only included ranking of evidence for recommendations they made based on the scientific literature in the current evidence review. They did not assign evidence rankings to recommendations pulled through from the Expert Panel Report (EPR)—2 1997 on topics that are still important to the diagnosis and management of asthma but for which there was little new published literature. These "pull through" recommendations are designated by EPR—2 1997 in parentheses following the first mention of the recommendation.

Note from the NAEPP and the National Guideline Clearinghouse (NGC): The Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma have been divided into individual summaries covering assessment, education, medications, and management. In addition to the current summary, the following are available:

- [Education for a partnership in asthma care.](#)
- [Control of environmental factors and comorbid conditions that affect asthma.](#)
- [Medications.](#)
- [Managing asthma long term in children 0-4 years of age and 5-11 years of age.](#)
- [Managing asthma long term in youths >12 years of age and adults.](#)
- [Managing asthma long term—special situations](#)
- [Managing exacerbations of asthma.](#)

Overview of Assessing and Monitoring Asthma Severity, Control, and Responsiveness in Managing Asthma

Key Differences from 1997 and 2002 Expert Panel

- The key elements of assessment and monitoring are refined to include the separate, but related, concepts of severity, control, and responsiveness to treatment. Classifying severity is emphasized for initiating therapy; assessing control is emphasized for monitoring and adjusting therapy. Asthma severity and control are defined in terms of two domains: impairment and risk.
- The distinction between the domains of impairment and risk for assessing asthma severity and control emphasizes the need to consider separately asthma's effects on quality of life and functional capacity on an ongoing basis (i.e., in the present) and the risks it presents for adverse events in the future, such as exacerbations and progressive loss of pulmonary function. These domains of asthma may respond differentially to treatment.

Key Points

- The functions of assessment and monitoring are closely linked to the concepts of severity, control, and responsiveness to treatment:
 - Severity: the intrinsic intensity of the disease process. Severity is measured most easily and directly in a patient not receiving long-term-control therapy.
 - Control: the degree to which the manifestations of asthma (symptoms, functional impairments, and risks of untoward events) are minimized and the goals of therapy are met.
 - Responsiveness: the ease with which asthma control is achieved by therapy.
- Both severity and control include the domains of current impairment and future risk:
 - Impairment: frequency and intensity of symptoms and functional limitations the patient is experiencing or has recently experienced
 - Risk: the likelihood of either asthma exacerbations, progressive decline in lung function (or, for children, reduced lung growth), or risk of adverse effects from medication
- The concepts of severity and control are used as follows for managing asthma:
 - During a patient's initial presentation, if the patient is not currently taking long-term control medication, asthma severity is assessed to guide clinical decisions on the appropriate medication and other therapeutic interventions.
 - Once therapy is initiated, the emphasis thereafter for clinical management is changed to the assessment of asthma control. The level of asthma control will guide decisions either to maintain or adjust therapy.
 - For population-based evaluations, clinical research, or subsequent characterization of the patient's overall severity, asthma severity can be inferred after optimal therapy is established by correlating levels of severity with the lowest level of treatment required to maintain control. For clinical management, however, the emphasis is on assessing asthma severity for initiating therapy and assessing control for monitoring and adjusting therapy.

Diagnosis of Asthma

Key Differences from 1997 and 2002 Expert Panel

- Discussions have been added on the use of spirometry, especially in children, and on the criteria for reversibility.
- Information has been added on vocal cord dysfunction (VCD) and cough variant asthma as an alternative diagnosis. Reference has been added to updated information in another component on comorbid conditions that may complicate diagnosis and treatment of asthma (e.g., allergic bronchopulmonary aspergillosis (ABPA), obstructive sleep apnea (OSA), and gastroesophageal reflux disease [GERD]).

Recommendations

The Expert Panel recommends that the clinician trying to establish a diagnosis of asthma should determine that **(EPR—2 1997)**:

- Episodic symptoms of airflow obstruction are present.
- Airflow obstruction is at least partially reversible.
- Alternative diagnoses are excluded.

Medical History

The Expert Panel recommends that a detailed medical history of the new patient who is thought to have asthma should address the items listed in the table below. **(EPR—2 1997)**

Key Indicators for Considering a Diagnosis of Asthma
<p>Consider a diagnosis of asthma and performing spirometry if any of these indicators is present.* These indicators are not diagnostic by themselves, but the presence of multiple key indicators increases the probability of a diagnosis of asthma. Spirometry is needed to establish a diagnosis of asthma.</p> <ul style="list-style-type: none"> • Wheezing—high-pitched whistling sounds when breathing out—especially in children. (Lack of wheezing and a normal chest examination do not exclude asthma.) • History of any of the following: <ul style="list-style-type: none"> • Cough, worse particularly at night • Recurrent wheeze • Recurrent difficulty in breathing • Recurrent chest tightness • Symptoms occur or worsen in the presence of: <ul style="list-style-type: none"> • Exercise • Viral infection • Animals with fur or hair • House-dust mites (in mattresses, pillows, upholstered furniture, carpets) • Mold • Smoke (tobacco, wood) • Pollen • Changes in weather • Strong emotional expression (laughing or crying hard) • Airborne chemicals or dusts • Menstrual cycles

Key Indicators for Considering a Diagnosis of Asthma

- | |
|---|
| <ul style="list-style-type: none">• Symptoms occur or worsen at night, awakening the patient. |
|---|

*Eczema, hay fever, or a family history of asthma or atopic diseases are often associated with asthma, but they are not key indicators.

Pulmonary Function Testing (Spirometry)

The Expert Panel recommends that spirometry measurements—forced expiratory volume in 1 second (FEV₁), forced expiratory volume in 6 seconds (FEV₆), forced vital capacity (FVC), FEV₁/FVC—before and after the patient inhales a short-acting bronchodilator should be undertaken for patients in whom the diagnosis of asthma is being considered, including children ≥ 5 years of age (**EPR—2 1997**).

The Expert Panel recommends that office-based physicians who care for asthma patients should have access to spirometry, which is useful in both diagnosis and periodic monitoring. Spirometry should be performed using equipment and techniques that meet standards developed by the American Thoracic Society (ATS) (**EPR—2 1997**).

The Expert Panel recommends that when office spirometry shows severe abnormalities, or if questions arise regarding test accuracy or interpretation, further assessment should be performed in a specialized pulmonary function laboratory. (**EPR—2 1997**).

Differential Diagnosis of Asthma

The Expert Panel recommends consideration of alternative diagnoses, as appropriate. Box 3-3 in the original guideline document lists examples of possible alternative diagnoses for asthma that may be considered during the evaluation of medical history, physical examination, and pulmonary function. Additional studies are not routinely necessary but may be useful when considering alternative diagnoses (**EPR—2 1997**):

- Additional pulmonary function studies
- Bronchoprovocation
- Chest x ray
- Allergy testing
- Biomarkers of inflammation

Initial Assessment: Characterization of Asthma and Classification of Asthma Severity

Key Differences from 1997 and 2002 Expert Panel

- The severity classification for asthma changed the category of mild intermittent to intermittent in order to emphasize that even patients who have intermittent asthma can have severe exacerbations. A note of emphasis has also been added that acute exacerbations can be mild, moderate, or severe in any category of persistent asthma.

- Severity classification is defined in terms of two domains—impairment and risk—to emphasize the need to consider separately asthma's effects on quality of life and functional capacity on an ongoing basis (i.e., in the present) and the risks asthma presents for adverse events in the future, such as exacerbations and progressive loss of pulmonary function. These domains of asthma may respond differentially to treatment.
- A new emphasis on using FEV₁/FVC has been added for to classifying severity in children because it may be a more sensitive measure than FEV₁.

Recommendations

The Expert Panel recommends that clinicians use information obtained from the diagnostic evaluation, and any additional information, if necessary, to **(EPR—2 1997)**:

- Identify precipitating factors
- Identify comorbid conditions that may aggravate asthma
- Assess the patient's knowledge and skills for self-management
- Classify asthma severity

Classify Asthma Severity

The Expert Panel recommends that clinicians classify asthma severity by using the domains of current impairment and future risk (**Evidence B**— secondary analyses of clinical trials, and **Evidence C**—observational studies, for assessing impairment; **Evidence C**, for distinguishing intermittent versus persistent asthma by risk of exacerbations; **Evidence D**, for distinguishing different categories of persistent asthma by varying frequencies of exacerbations).

Periodic Assessment and Monitoring of Asthma Control Essential for Asthma Management

Key Differences from 1997 and 2002 Expert Panel

- Periodic assessment of asthma *control* is emphasized.
- This update (EPR—3: Full Report 2007) makes a stronger distinction than previous guidelines between classifying asthma severity and assessing asthma control. Interpretation of previous asthma guidelines raised questions about applying the severity classifications once treatment is established and also resulted in placing more emphasis on severity than on ongoing monitoring of whether therapeutic goals were met. This update (EPR—3: Full Report 2007) clarifies the issue:
 - For initiating treatment, asthma severity should be classified, and the initial treatment should correspond to the appropriate severity category.
 - Once treatment is established, the emphasis is on assessing asthma control to determine if the goals for therapy have been met and if adjustments in therapy (step up or step down) would be appropriate.
- Assessment of asthma control includes the two domains of impairment and risk.
- Peak flow monitoring: The recommendation to assess diurnal variation was deleted. New text was added regarding the patients most likely to benefit

- from routine peak flow monitoring. Emphasis was added that evidence suggests equal benefits to either peak flow or symptom-based monitoring; the important issue continues to be having a monitoring plan in place.
- Parameters for lung function, specifically FEV₁/FVC, were added as measures of asthma control for children.
 - Minimally invasive markers and pharmacogenetic approaches for monitoring asthma. New text was added. These approaches have gained increasing attention in clinical research, and some applications may be useful in the near future for the clinical management of asthma. The concepts are introduced here, although most require further evaluation before they can be recommended as tools for routine asthma management.

Recommendations

Goals of Therapy: Asthma Control

The Expert Panel recommends that asthma control be defined as follows **(Evidence A)**:

Asthma Control

- Reduce impairment
 - Prevent chronic and troublesome symptoms (e.g., coughing or breathlessness in the daytime, in the night, or after exertion)
 - Require infrequent use (≤ 2 days a week) of short-acting beta₂-agonists (SABA) for quick relief of symptoms
 - Maintain (near) "normal" pulmonary function
 - Maintain normal activity levels (including exercise and other physical activity and attendance at work or school)
 - Meet patients' and families' expectations of and satisfaction with asthma care
- Reduce risk
 - Prevent recurrent exacerbations of asthma and minimize the need for emergency department (ED) visits or hospitalizations
 - Prevent progressive loss of lung function; for children, prevent reduced lung growth
 - Provide optimal pharmacotherapy with minimal or no adverse effects

See figures 3–5a, b, and c in the original guideline document for classification of asthma control in three different age groups. Specific discussion of measures for assessment can also be found in the original guideline document.

Measures for Periodic Assessment and Monitoring of Asthma Control

The Expert Panel recommends that ongoing monitoring of asthma control be performed to determine whether all the goals of therapy are met—that is, reducing both impairment and risk **(Evidence B)**; see figures 3–5 a, b, and c in the original guideline document for assessing asthma control for different age groups.

The Expert Panel recommends that the frequency of visits to a clinician for review of asthma control is a matter of clinical judgment; in general, patients who have intermittent or mild persistent asthma that has been under control for at least 3 months should be seen by a clinician about every 6 months, and patients who have uncontrolled and/or severe persistent asthma and those who need additional supervision to help them follow their treatment plan need to be seen more often **(EPR—2 1997)**.

Monitoring Signs and Symptoms of Asthma

The Expert Panel recommends that every patient who has asthma should be taught to recognize symptom patterns that indicate inadequate asthma control **(Evidence A)** (See also the NGC summary of the NAEPP guideline [Education for a Partnership in Asthma Care](#)).

The Expert Panel recommends that symptoms and clinical signs of asthma should be assessed at each health care visit through physical examination and appropriate questions **(EPR—2 1997)**.

The Expert Panel recommends that the detailed symptoms history should be based on a short (2 to 4 weeks) recall period **(EPR—2 1997)**.

The Expert Panel recommends that assessment of the patient's symptom history should include at least four key symptom expressions **(Evidence B)**, extrapolation from clinical trials; and **Evidence C**, from observational studies):

- Daytime asthma symptoms (including wheezing, cough, chest tightness, or shortness of breath)
- Nocturnal awakening as a result of asthma symptoms
- Frequency of use of SABA for relief of symptoms
- Inability or difficulty performing normal activities (including exercise) because of asthma symptoms

Monitoring Pulmonary Function

The Expert Panel recommends that, in addition to assessing symptoms, it is also important to assess pulmonary function periodically **(Evidence B)**, extrapolation from clinical trials; and **Evidence C**, from observational studies).

Spirometry

The Expert Panel recommends the following frequencies for spirometry measurements: (1) at the time of initial assessment **(Evidence C)**; (2) after treatment is initiated and symptoms and peak expiratory flow (PEF) have stabilized, to document attainment of (near) "normal" airway function; (3) during a period of progressive or prolonged loss of asthma control; and (4) at least every 1 to 2 years to assess the maintenance of airway function **(Evidence B)**, extrapolation from clinical trials). Spirometry may be indicated more often than every 1 to 2 years, depending on the clinical severity and response to management **(Evidence D)**. These spirometry measures should be followed over

the patient's lifetime to detect potential for decline and rate of decline of pulmonary function over time **(Evidence C)**.

Peak Flow Monitoring

The Expert Panel recommends the following:

- If peak flow monitoring is performed, the written asthma action plan should use the patient's personal best peak flow as the reference value **(EPR—Update 2002)**.
- Consider long-term daily peak flow monitoring for:
 - Patients who have moderate or severe persistent asthma **(Evidence B)**.
 - Patients who have a history of severe exacerbations **(Evidence B)**.
 - Patients who poorly perceive airflow obstruction and worsening asthma **(Evidence D)**.
 - Patients who prefer this monitoring method **(Evidence D)**.
- Long-term daily peak flow monitoring can be helpful to **(EPR—Update 2002)**:
 - Detect early changes in disease states that require treatment.
 - Evaluate responses to changes in therapy.
 - Afford a quantitative measure of impairment.
- Peak flow monitoring during exacerbations will help determine the severity of the exacerbations and guide therapeutic decisions in the home, school, clinicians' office, or ED (See the NGC summaries of the NAEPP guidelines [Education for a Partnership in Asthma Care](#) and [Managing Exacerbations of Asthma](#)).
- Consider home peak flow monitoring during exacerbations of asthma for:
 - Patients who have a history of severe exacerbations **(Evidence B)**.
 - Patients who have moderate or severe persistent asthma **(Evidence B)**.
 - Patients who have difficulty perceiving signs of worsening asthma **(Evidence D)**.

Peak Flow Versus Symptom-Based Monitoring Action Plan

The Expert Panel recommends the following:

- Either peak flow monitoring or symptom monitoring, if taught and followed correctly, may be equally effective **(Evidence B)**.
- Whether peak flow monitoring, symptom monitoring, or a combination of approaches is used, self-monitoring is important to the effective self-management of asthma **(Evidence A)**.
- Provide to all patients a written asthma action plan that includes daily treatment and recognizing and handling worsening asthma, including self-adjustment of medications in response to acute symptoms or changes in PEF measures. Written action plans are particularly recommended for patients who have moderate or severe persistent asthma, a history of severe exacerbations, or poorly controlled asthma **(Evidence B)**.

Monitoring Quality of Life

The Expert Panel recommends that several key areas of quality of life and related loss of physical function should be assessed periodically for each person who has asthma (**Evidence C**). These include:

- Any work or school missed because of asthma
- Any reduction in usual activities (either home/work/school or recreation/exercise)
- Any disturbances in sleep due to asthma
- Any change in caregivers' activities due to a child's asthma (for caregivers of children who have asthma)

See figure 3-7 in the original guideline document for sample questions that characterize quality-of-life concerns for persons who have asthma.

Monitoring History of Asthma Exacerbations

The Expert Panel recommends that, during periodic assessments, clinicians should question the patient and evaluate any records of patient self-monitoring (See figure 3-7 in the original guideline document) to detect exacerbations, both those that are self-treated and those treated by other health care providers (**Evidence C**).

Monitoring Pharmacotherapy for Adherence and Potential Side Effects

The Expert Panel recommends monitoring the following factors at each visit: patient's adherence to the regimen, inhaler technique, and side effects of medications (**Evidence C**). (See sample questions in figure 3-7 in the original guideline document for assessing the patient's adherence to, concerns about, or adverse experiences with the drug regimen. See the NGC summary of the NAEPP guideline [Education for a Partnership in Asthma Care](#) for further discussion of patient's adherence to treatment.)

Monitoring Patient–Provider Communication and Patient Satisfaction

The Expert Panel recommends that health care providers should routinely assess the effectiveness of patient–clinician communication (**Evidence D**). (See figure 3-7 in the original guideline document for sample questions.)

The Expert Panel recommends that two aspects of patient satisfaction should be monitored: satisfaction with asthma control and satisfaction with the quality of care (**Evidence D**). See figure 3-2, 3-7, and 3-8 for examples of questions to use in monitoring patient satisfaction.

Monitoring Asthma Control With Minimally Invasive Markers and Pharmacogenetics

The Expert Panel recommends some minimally invasive markers for monitoring asthma control—such as spirometry and airway hyperresponsiveness—that are appropriately used, currently and widely, in asthma care (**Evidence B**). Other markers, such as sputum eosinophils and fractional exhaled nitric oxide (FeNO), are increasingly used in clinical research and will require further evaluation in

adults and children before they can be recommended as a clinical tool for routine asthma management (**Evidence D**).

Methods for Periodic Assessment and Monitoring of Asthma Control

Clinician Assessment

The Expert Panel recommends that patients who have intermittent or mild or moderate persistent asthma (i.e., requiring steps 1, 2, 3, or 4 treatment) that has been under control for at least 3 months should be seen by a clinician about every 6 months. Patients who have uncontrolled and/or severe persistent asthma (i.e., requiring steps 5 or 6 treatment) and those who need additional supervision to help them follow their treatment plan should be seen more often (**EPR—2 1997**).

Patient Self-Assessment

The Expert Panel recommends that clinicians should encourage patients to use self assessment tools to determine from the perspective of the patient and/or the patient's family whether the asthma is well controlled (**EPR—2 1997**).

Referral to an Asthma Specialist for Consultation or Co-management

The Expert Panel recommends referral for consultation or care to a specialist in asthma care (usually, a fellowship-trained allergist or pulmonologist; occasionally, other physicians who have expertise in asthma management, developed through additional training and experience) when (**Evidence D**):

- Patient has had a life-threatening asthma exacerbation.
- Patient is not meeting the goals of asthma therapy after 3 to 6 months of treatment. An earlier referral or consultation is appropriate if the physician concludes that the patient is unresponsive to therapy.
- Signs and symptoms are atypical, or there are problems in differential diagnosis.
- Other conditions complicate asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, vocal cord dysfunction [VCD], gastroesophageal reflux disease [GERD], chronic obstructive pulmonary disease [COPD])
- Additional diagnostic testing is indicated (e.g., allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy).
- Patient requires additional education and guidance on complications of therapy, problems with adherence, or allergen avoidance.
- Patient is being considered for immunotherapy.
- Patient requires step 4 care or higher (step 3 for children 0 to 4 years of age). Consider referral if patient requires step 3 care (step 2 for children 0 to 4 years of age).
- Patient has required more than two bursts of oral corticosteroids in 1 year or has an exacerbation requiring hospitalization.
- Patient requires confirmation of a history that suggests that an occupational or environmental inhalant or ingested substance is provoking or contributing to asthma. Depending on the complexities of diagnosis, treatment, or the intervention required in the work environment, it may be appropriate in some

cases for the specialist to manage the patient over a period of time or to comanage with the primary care provider (PCP).

Definitions:

Levels of Evidence

The system* used to describe the level of evidence is as follows:

Evidence Category A: Randomized controlled trials (RCTs), rich body of data.

Evidence is from end points of well-designed RCTs that provide a consistent pattern of findings in the population for which the recommendation is made. Category A requires substantial numbers of studies involving substantial numbers of participants.

Evidence Category B: RCTs, limited body of data.

Evidence is from end points of intervention studies that include only a limited number of patients, post hoc or subgroup analysis of RCTs, or meta-analysis of RCTs. In general, category B pertains when few randomized trials exist; they are small in size, they were undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent.

Evidence Category C: Nonrandomized trials and observational studies.

Evidence is from outcomes of uncontrolled or nonrandomized trials or from observational studies.

Evidence Category D: Panel consensus judgment.

This category is used only in cases where the provision of some guidance was deemed valuable, but the clinical literature addressing the subject was insufficient to justify placement in one of the other categories. The Panel consensus is based on clinical experience or knowledge that does not meet the criteria for categories A through C.

*Source: Jadad AR, Moher M, Browman GP, Booker L, Sigouin C, Fuentes M, Stevens R. Systematic reviews and meta-analyses on treatment of asthma: critical evaluation. *BMJ* 2000;320(7234):537-40.

Strength of Recommendations

In addition to specifying the level of evidence supporting a recommendation, the Expert Panel agreed to indicate the strength of the recommendation. When a certain clinical practice "is recommended," this indicates a strong recommendation by the panel. When a certain clinical practice "should, or may, be considered," this indicates that the recommendation is less strong.

This distinction is an effort to address nuances of using evidence ranking systems. For example, a recommendation for which clinical RCT data are not available (e.g., conducting a medical history for symptoms suggestive of asthma) may still be strongly supported by the Panel. Furthermore, the range of evidence that qualifies a definition of "B" or "C" is wide, and the Expert Panel considered this

range and the potential implications of a recommendation as they decided how strongly the recommendation should be presented.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations" field).

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Effective medical management of asthma for patients and their families, including:

- Improved lung function
- Reduced use of medications
- Increased self-management and quality of life for patients and their families
- Reduced use of health care services/interventions

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

These guidelines are intended to inform, not replace, clinical judgment. Of course, the clinician and patient need to develop individual treatment plans that are tailored to the specific needs and circumstances of the patient.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Foreign Language Translations
Patient Resources

Quick Reference Guides/Physician Guides Resources

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness
Staying Healthy

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Measures of asthma assessment and monitoring. In: National Asthma Education and Prevention Program (NAEPP). Expert panel report 3: guidelines for the diagnosis and management of asthma. Bethesda (MD): National Heart, Lung, and Blood Institute; 2007 Aug. p. 36-92. [134 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1997 (revised 2007 Aug)

GUIDELINE DEVELOPER(S)

National Asthma Education and Prevention Program - Federal Government Agency
[U.S.]
National Heart, Lung, and Blood Institute (U.S.) - Federal Government Agency
[U.S.]

GUIDELINE DEVELOPER COMMENT

The National Asthma Education and Prevention Program Science Base Committee is a multidisciplinary group of clinicians and scientists with expertise in asthma management. The group includes health professionals in the areas of general medicine, family practice, pediatrics, emergency and critical care, allergy, pulmonary medicine, pharmacy, and health education.

SOURCE(S) OF FUNDING

The development of this report was entirely funded by the National Heart, Lung, and Blood Institute, National Institutes of Health.

GUIDELINE COMMITTEE

National Asthma Education and Prevention Program (NAEPP) Coordinating Committee
Third Expert Panel on the Diagnosis and Management of Asthma

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Third Expert Panel on the Diagnosis and Management of Asthma Members:
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See the original guideline document for members of the National Asthma Education and Prevention Program (NAEPP) Coordinating Committee, a list of consultant reviewers, and members of the National Heart, Lung, and Blood Institute and American Institutes for Research staffs.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Development of the resource document and the guidelines report was funded by the National Heart, Lung, and Blood Institute (NHLBI), and National Institutes of Health (NIH). Expert Panel members completed financial disclosure forms, and the Expert Panel members disclosed relevant financial interests to each other prior to their discussions. Expert Panel members participated as volunteers and were compensated only for travel expenses related to the Expert Panel meetings. Financial disclosure information covering the 3-year period during which the guidelines were developed is provided for each Panel member below.

Dr. Busse has served on the Speakers' Bureaus of GlaxoSmithKline, Merck, Novartis, and Pfizer; and on the Advisory Boards of Altana, Centocor, Dynavax,

Genentech/Novartis, GlaxoSmithKline, Isis, Merck, Pfizer, Schering, and Wyeth. He has received funding/grant support for research projects from Astellas, AstraZeneca, Centocor, Dynavax, GlaxoSmithKline, Novartis, and Wyeth. Dr. Busse also has research support from the NIH.

Dr. Boushey has served as a consultant for Altana, Protein Design Lab, and Sumitomo. He has received honoraria from (Boehringer-Ingelheim, Genentech, Merck, Novartis, and Sanofi-Aventis, and funding/grant support for research projects from the NIH.

Dr. Camargo has served on the Speakers' Bureaus of AstraZeneca, GlaxoSmithKline, Merck, and Schering-Plough; and as a consultant for AstraZeneca, Critical Therapeutics, Dey Laboratories, GlaxoSmithKline, MedImmune, Merck, Novartis, Praxair, Respironics, Schering-Plough, Sepracor, and TEVA. He has received funding/grant support for research projects from a variety of Government agencies and not-for-profit foundations, as well as AstraZeneca, Dey Laboratories, GlaxoSmithKline, MedImmune, Merck, Novartis, and Respironics.

Dr. Evans has received funding/grant support for research projects from the NHLBI.

Dr. Foggs has served on the Speakers' Bureaus of GlaxoSmithKline, Merck, Pfizer, Sepracor, and UCB Pharma; on the Advisory Boards of Alcon, Altana, AstraZeneca, Critical Therapeutics, Genentech, GlaxoSmithKline, and IVAX; and as consultant for Merck and Sepracor. He has received funding/grant support for research projects from GlaxoSmithKline.

Dr. Janson has served on the Advisory Board of Altana, and as a consultant for Merck. She has received funding/grant support for research projects from the NHLBI.

Dr. Kelly has served on the Speakers' Bureaus of AstraZeneca and GlaxoSmithKline; and on the Advisory Boards of AstraZeneca, MAP Pharmaceuticals, Merck, Novartis, and Sepracor.

Dr. Lemanske has served on the Speakers' Bureaus of GlaxoSmithKline and Merck, and as a consultant for AstraZeneca, Aventis, GlaxoSmithKline, Merck, and Novartis. He has received honoraria from Altana, and funding/grant support for research projects from the NHLBI and NIAID.

Dr. Martinez has served on the Advisory Board of Merck and as a consultant for Genentech, GlaxoSmithKline, and Pfizer. He has received honoraria from Merck.

Dr. Meyer has no relevant financial interests.

Dr. Nelson has served on the Speakers' Bureaus of AstraZeneca, GlaxoSmithKline, Pfizer, and Schering-Plough; and as a consultant for Abbott Laboratories, Air Pharma, Altana Pharma US, Astellas, AstraZeneca, Curalogic, Dey Laboratories, Dynavax Technologies, Genentech/Novartis, GlaxoSmithKline, Inflazyme Pharmaceuticals, MediciNova, Protein Design Laboratories, Sanofi-Aventis,

Schering-Plough, and Wyeth Pharmaceuticals. He has received funding/grant support for research projects from Altana, Astellas, AstraZeneca, Behringer, Critical Therapeutics, Dey Laboratories, Epigenesis, Genentech, GlaxoSmithKline, Hoffman LaRoche, IVAX, Medicinova, Novartis, Sanofi-Aventis, Schering-Plough, Sepracor, TEVA, and Wyeth.

Dr. Platts-Mills has served on the Advisory Committee of Indoor Biotechnologies. He has received funding/grant support for a research project from Pharmacia Diagnostics.

Dr. Schatz has served on the Speakers' Bureaus of AstraZeneca, Genentech, GlaxoSmithKline, and Merck; and as a consultant for GlaxoSmithKline on an unbranded asthma initiative. He has received honoraria from AstraZeneca, Genentech, GlaxoSmithKline and Merck. He has received funding/grant support for research projects from GlaxoSmithKline and Merck and Sanofi-Adventis.

Dr. Shapiro (deceased) served on the Speakers' Bureaus of AstraZeneca, Genentech, GlaxoSmithKline, IVAX Laboratories, Key Pharmaceuticals, Merck, Pfizer Pharmaceuticals, Schering Corporation, UCB Pharma, and 3M; and as a consultant for Altana, AstraZeneca, Dey Laboratories, Genentech/Novartis, GlaxoSmithKline, ICOS, IVAX Laboratories, Merck, Sanofi-Aventis, and Sepracor. She received funding/grant support for research projects from Abbott, AstraZeneca, Boehringer Ingelheim, Bristol-Myers-Squibb, Dey Laboratories, Fujisawa Pharmaceuticals, Genentech, GlaxoSmithKline, Immunex, Key, Lederle, Lilly Research, MedPointe Pharmaceuticals, Medtronic Emergency Response Systems, Merck, Novartis, Pfizer, Pharmaxis, Purdue Frederick, Sanofi-Aventis, Schering, Sepracor, 3M Pharmaceuticals, UCB Pharma, and Upjohn Laboratories.

Dr. Stoloff has served on the Speakers' Bureaus of Alcon, Altana, AstraZeneca, Genentech, GlaxoSmithKline, Novartis, Pfizer, Sanofi-Aventis, and Schering; and as a consultant for Alcon, Altana, AstraZeneca, Dey, Genentech, GlaxoSmithKline, Merck, Novartis, Pfizer, Sanofi-Aventis, and Schering.

Dr. Szeffler has served on the Advisory Boards of Altana, AstraZeneca, Genentech, GlaxoSmithKline, Merck, Novartis, and Sanofi-Aventis; and as a consultant for Altana, AstraZeneca, Genentech, GlaxoSmithKline, Merck, Novartis, and Sanofi-Aventis. He has received funding/grant support for a research project from Ross.

Dr. Weiss has served on the Advisory Board of Genentech, and as a consultant for Genentech and GlaxoSmithKline. He has received funding/grant support for research projects from GlaxoSmithKline.

Dr. Yawn has served on the Advisory Boards of Altana, AstraZeneca, Merck, Sanofi-Aventis, and Schering-Plough. She has received honoraria from Pfizer and Schering-Plough, and funding/grant support for research projects from the Agency for Healthcare Research and Quality, the CDC, the NHLBI, Merck, and Schering-Plough.

Financial disclosure information covering a 12 month period prior to the review of the guidelines is provided in the original guideline document for each consultant reviewer.

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: National Asthma Education and Prevention Program Expert Panel Report: guidelines for the diagnosis and management of asthma update on selected topics-2002. J Allergy Clin Immunol 2002 Nov;110(5 pt 2):S141-219.

GUIDELINE AVAILABILITY

Electronic copies: Available from the [National Heart, Lung, and Blood Institute Web site](#).

Print copies: Available from NHLBI Information Center, P.O. Box 30105, Bethesda, MD 20824-0105; e-mail: nhlbiic@dgsys.com.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Guidelines for the diagnosis and management of asthma. Summary report 2007. Bethesda (MD): National Heart, Lung, and Blood Institute; 2007. Available from the [National Heart, Lung, and Blood Institute Web site](#).
- Overall methods used to develop this report. Electronic copies: Available from the [National Heart, Lung, and Blood Institute Web site](#).
- Search strategies. Electronic copies: Available from the [National Heart, Lung, and Blood Institute Web site](#).
- Evidence tables. Electronic copies: Available from the [National Heart, Lung, and Blood Institute Web site](#).
- Lung diseases information. Information for health professionals. Electronic copies: Available from the [National Heart, Lung, and Blood Institute Web site](#).

Print copies: Available from NHLBI Information Center, P.O. Box 30105, Bethesda, MD 20824-0105; e-mail: nhlbiic@dgsys.com.

Additional tools, including sample assessment questions, validated instruments for assessment and monitoring of asthma, and a sample patient self-assessment sheet can be found in the [original guideline document](#).

PATIENT RESOURCES

The following is available:

- Lung diseases information. Information for patients and the public.

Electronic copies: Available from the [National Heart, Lung and Blood Institute Web site](#).

Print copies: Available from NHLBI Information Center, P.O. Box 30105, Bethesda, MD 20824-0105; e-mail: nhlbiic@dgsys.com.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC STATUS

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