



## Complete Summary

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### GUIDELINE TITLE

Managing exacerbations of asthma: Expert panel report 3: guidelines for the diagnosis and management of asthma.

### BIBLIOGRAPHIC SOURCE(S)

Managing exacerbations of asthma. 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. 373-417. [130 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  
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INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES  
IDENTIFYING INFORMATION AND AVAILABILITY  
DISCLAIMER

## SCOPE

### DISEASE/CONDITION(S)

Asthma exacerbations

### GUIDELINE CATEGORY

Diagnosis  
Evaluation  
Management  
Risk Assessment  
Treatment

### **CLINICAL SPECIALTY**

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

### **INTENDED USERS**

Advanced Practice Nurses  
Allied Health Personnel  
Emergency Medical Technicians/Paramedics  
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
- To present recommendations for the assessment and treatment of asthma exacerbations in the home, emergency department, and hospital

### **TARGET POPULATION**

Infants, children, adolescents, and adults with or at risk for asthma exacerbations

### **INTERVENTIONS AND PRACTICES CONSIDERED**

#### **Management/Treatment**

1. Early treatment of asthma exacerbations
  - Patient education, including written asthma action plan
  - Recognition of early signs of worsening asthma

- Appropriate intensification of therapy by increased inhaled short-acting beta<sub>2</sub>-agonists (SABA) and oral corticosteroids
  - Removal of environmental factors contributing to exacerbations
  - Prompt communication between patient and clinician about any serious deteriorations in symptoms or response to treatment
  - Special attention for patients at high risk for asthma-related death
  - Special attention for infants
2. Management of exacerbations in the home
    - Teaching patients to recognize signs of deterioration
    - Teaching patients to monitor lung function
    - Providing all patients with written asthma action plans
    - Advising patients to have medication for treating exacerbations at home
    - Treating exacerbations with increased SABA frequency, oral systemic corticosteroids, increasing doses of inhaled corticosteroids
  3. Prehospital management of exacerbations by emergency medical service personnel
    - Provision of supplemental oxygen
    - SABA administration
  4. Management of exacerbations requiring treatment in the emergency department or hospital
    - Initial assessment (history, physical exam, lung function, oxygen saturation, and other tests as indicated)
    - Oxygen administration
    - SABA administration
    - Inhaled ipratropium bromide
    - Systemic corticosteroids
    - Adjunct treatment such as intravenous magnesium sulfate or heliox
    - Serial measurements of lung function
    - Intubation
    - Preventing relapse by providing referral to follow-up asthma care, discharge plan with details on medication use and inhaler technique, and consideration of initiating inhaled corticosteroids

Treatments considered but not recommended: methylxanthines, antibiotics (except as needed for comorbid conditions), aggressive hydration, chest physical therapy, mucolytics, sedation

## **MAJOR OUTCOMES CONSIDERED**

- Lung function measurements
  - Forced expiratory volume in one second (FEV<sub>1</sub>)
  - 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:

- [Measures of asthma assessment and monitoring.](#)
- [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.](#)

### **Key Points: Managing Exacerbations of Asthma**

- Early treatment of asthma exacerbations is the best strategy for management. Important elements of early treatment at the patient's home include **(EPR—2 1997)**:
  - Patient education, including a written asthma action plan to guide patient self-management of exacerbations at home, especially for patients who have moderate or severe persistent asthma and any patient who has a history of severe exacerbations **(Evidence B)**. A peak-flow-based plan may be particularly useful for patients who have difficulty perceiving airflow obstruction and worsening asthma **(Evidence D)**.
  - Recognition of early signs of worsening asthma and taking prompt action **(Evidence A)**.
  - Appropriate intensification of therapy by increasing inhaled short-acting beta<sub>2</sub>-agonist (SABA) and, in some cases, adding a short course of oral systemic corticosteroids **(Evidence A)**.
  - Removal or withdrawal of the environmental factor contributing to the exacerbation.
  - Prompt communication between patient and clinician about any serious deterioration in symptoms or peak flow, decreased responsiveness to SABAs, or decreased duration of effect.
- Management of asthma exacerbations requiring urgent medical care (e.g., in the urgent care setting or emergency department [ED]) includes:
  - Oxygen to relieve hypoxemia in moderate or severe exacerbations **(EPR—2 1997)**.
  - SABA to relieve airflow obstruction, with addition of inhaled ipratropium bromide in severe exacerbations **(Evidence A)**.

- Systemic corticosteroids to decrease airway inflammation in moderate or severe exacerbations or for patients who fail to respond promptly and completely to a SABA (**Evidence A**).
- Consideration of adjunct treatments, such as intravenous magnesium sulfate or heliox, in severe exacerbations unresponsive to the initial treatments listed above (**Evidence B**).
- Monitoring response to therapy with serial measurements of lung function (**Evidence B**).
- Preventing relapse of the exacerbation or recurrence of another exacerbation by providing: referral to followup asthma care within 1 to 4 weeks; an ED asthma discharge plan with instructions for medications prescribed at discharge and for increasing medications or seeking medical care if asthma worsens; review of inhaler techniques whenever possible; and consideration of initiating inhaled corticosteroids (ICSs) (**Evidence B**).

### **Key Differences From 1997 and 2002 Expert Panel Reports**

- For the assessment of exacerbations, the current update (**EPR—3: Full Report 2007**):
  - Simplifies classification of severity of asthma exacerbations.
  - Reinstates, for use in the urgent or emergency care setting, the 1991 cut points of forced expiratory volume in 1 second (FEV<sub>1</sub>) or peak expiratory flow (PEF) to indicate the goal for discharge from the urgent care or emergency care setting ( $\geq 70$  percent predicted FEV<sub>1</sub> or PEF); patients for whom response to therapy is incomplete and who usually require continued treatment in the ED (40 to 69 percent predicted); and the exacerbation severity level where adjunct therapies may be considered ( $< 40$  percent predicted). These cut points differ from those used to determine long-term asthma control and treatments, thus underscoring the distinction between acute and chronic asthma management.
  - Acknowledges the limited value of pulmonary function measures in very severe exacerbations.
- For the treatment of exacerbations, the current update:
  - Adds levalbuterol as a SABA treatment for asthma exacerbations.
  - For home management of exacerbations, no longer recommends doubling the dose of inhaled corticosteroids (ICSs).
  - For prehospital management (e.g., emergency transport), encourages standing orders for albuterol and—for prolonged transport—repeated treatments and protocols to allow consideration of ipratropium and oral corticosteroids.
  - For ED management, reduces dose and frequency of administration of oral corticosteroids in severe exacerbations, adds consideration of magnesium sulfate or heliox for severe exacerbations, and adds consideration of initiating an ICS upon discharge.
  - For hospital management, no longer recommends ipratropium bromide.

### **General Considerations**

Based on the scientific literature and the opinion of the Expert Panel, the Panel recommends that clinicians consider the following general principles and goals for managing asthma exacerbations: early treatment, special attention to patients who are at high risk of asthma-related death, and special attention to infants **(EPR—2 1997)**.

- Early treatment is the best strategy for management of asthma exacerbations. Important elements of early treatment include:
  - A written asthma action plan (See the NGC-summary of the NAEPP guideline, [Education for a Partnership in Asthma Care](#)) to guide patient self-management, especially for patients who have moderate or severe persistent asthma and any patient who has a history of severe exacerbations.
  - Recognition of early indicators of an exacerbation, including worsening PEF. Patients are instructed to recognize early signs and symptoms of worsening asthma and to use quick-relief medications if symptoms occur or if PEF drops below 80 percent predicted or personal best. If PEF is 50 to 79 percent, the patient should carefully monitor the response to quick-relief medication and, based on the response, consider contacting a clinician. If PEF is below 50 percent, immediate medical care is usually required. In the urgent or emergency care setting, different parameters are used to classify the severity of the exacerbation and determine the clinical course; see figure 5–1 in the original guideline document. The Panel chose cut points of 40 percent and 70 percent of predicted (or personal best) because 40 percent denotes an exacerbation severity below which several adjunct therapies are effective, and 70 percent is a posttreatment goal for discharge from the ED or hospital.
  - Appropriate intensification of therapy, often including a short course of systemic corticosteroids.
  - Removal of or withdrawal from allergens or precipitating irritants in the environment that may be contributing to the exacerbation.
  - Prompt communication between patient and clinician about any serious deterioration in symptoms or peak flow, decreased responsiveness to SABA treatment, or decreased duration of effect.
- Patients who are at high risk for asthma-related death require special attention—particularly intensive education, monitoring, and care. Such patients should be counseled to seek medical care early during an exacerbation and instructed about the availability of ambulance services. Such patients include those who have identifiable risk factors (See figure 5–2a in the original guideline document).
- Infants require special attention, especially due to their greater risk for respiratory failure (See figure 5–2b in the original guideline document).

### **Treatment Goals**

The principal goals and Expert Panel recommendations for treating asthma exacerbations are:

- Correction of significant hypoxemia, in moderate or severe exacerbations, by administering supplemental oxygen. In rare instances, alveolar hypoventilation requires mechanically assisted ventilation **(EPR—2 1997)**.

- Rapid reversal of airflow obstruction (**Evidence A**).
- Reduction of the likelihood of relapse of the exacerbation or future recurrence of severe airflow obstruction by intensifying therapy (**Evidence A**).
- Achieving these goals requires careful assessment and monitoring (**Evidence B**).
  - Children
    - Serial measurements of lung function.
    - Pulse oximetry
    - Signs and symptoms scores
  - Adults
    - Serial measurements of lung function.
    - Pulse oximetry
    - Signs and symptoms scores

### Home Management of Asthma Exacerbations

The Expert Panel recommends preparing patients for home management of asthma exacerbations by taking the following actions (Also see the NGC summaries of the NAEPP guidelines, [Measures of Asthma Assessment and Monitoring](#), and [Education for a Partnership in Asthma Care](#)).

- Teach all patients how to monitor signs and symptoms so they can recognize early signs of deterioration and take appropriate action (**Evidence A**).
- Consider teaching how to monitor lung function, by using PEF to facilitate early and accurate assessment of exacerbations and response to treatment, to patients and parents of children who have moderate or severe persistent asthma or a history of severe exacerbations (**Evidence B**) and patients who are poor perceivers of airflow obstruction (**Evidence D**).
- Provide to all patients a written asthma action plan that includes daily management and recognizing and handling worsening asthma, including self-adjustment of medications in response to acute symptoms or changes in PEF measures in the event of an exacerbation. A written asthma action plan is particularly recommended for patients who have moderate or severe persistent asthma and any patient who has a history of severe exacerbations or poorly controlled asthma (**Evidence B**). A peak flow- based plan may be particularly useful for patients who have difficulty perceiving airflow obstruction and worsening asthma (**Evidence D**). (See the NGC summary of the NAEPP guideline, [Education for a Partnership in Asthma Care](#)). Children should also receive a plan appropriate to the school setting (See the NGC summary of the NAEPP guideline, [Education for a Partnership in Asthma Care](#)). The plan should direct the patient to adjust medications in response to particular signs, symptoms, and peak flow measurements and should state when to seek medical help. Review the plan with the patient and family. The clinician should tailor the plan to the needs of individual patients. Patients who are at risk for asthma death (See figure 5–2a in the original guideline document) require especially close monitoring.
- Advise patients who have moderate or severe persistent asthma or a history of severe exacerbations to have the medication (e.g., corticosteroid tablets or liquid) and equipment (e.g., peak flow meter, compressor-driven nebulizer for young children) for treating exacerbations at home (**Evidence A**).

The Expert Panel recommends the following pharmacologic therapy for home management of exacerbations:

- Increase the frequency of SABA treatment (**Evidence A**).
- Initiate oral systemic corticosteroid treatment under certain circumstances (**Evidence A**). The Expert Panel recommends that, unless working from a defined action plan, individuals contact their health care provider before instituting a course of oral systemic corticosteroids (**Evidence D**).
- Doubling the ICS dose is not sufficient (**Evidence B**).
- Continue more intensive treatment for several days (**EPR—2 1997**).

The Expert Panel does *not* recommend the following home management techniques, because no studies have demonstrated effectiveness, and it is the opinion of the Panel that these techniques may delay patients from obtaining necessary care (**EPR—2 1997**).

- Drinking large volumes of liquids or breathing warm, moist air (e.g., the mist from a hot shower).
- Using over-the-counter products such as antihistamines or cold remedies. Over-the-counter bronchodilators may provide transient bronchodilation, but their use should not delay seeking medical care.

The Expert Panel also notes that although pursed-lip and other forms of controlled breathing may help to maintain calm during respiratory distress, these methods do *not* bring about improvement in lung function.

### **Prehospital Management of Asthma Exacerbations**

The Expert Panel recommends that emergency medical services (EMS) providers administer supplemental oxygen and SABA to patients who have signs or symptoms of an asthma exacerbation (**Evidence A**).

### **Emergency Department and Hospital Management of Asthma Exacerbations**

#### **Assessment**

The Expert Panel recommends the following activities to assess exacerbations:

- All clinicians treating patients who have asthma should be prepared to treat an asthma exacerbation, be familiar with the symptoms and signs of severe and life threatening exacerbations (See figures 5–1, 5–2a, and 5-3 in the original guideline document.), and have procedures for facilitating immediate patient transfer to an emergency care facility (**EPR—2 1997**).
- Initial assessment should include a brief history, brief physical examination, and, for most patients, objective measures of lung function. Initial laboratory studies may be helpful, but they are not required for most patients, and they should not delay initiation of asthma treatment (**EPR—2 1997**).
- In the ED, all patients presenting with a reported asthma exacerbation must be evaluated and triaged immediately, based on at least vital signs and an overall physical assessment (e.g., ability to breathe well enough to talk).

- Treatment should begin immediately following recognition of a moderate, severe, or life-threatening exacerbation by assessment of symptoms, signs, or, when possible, lung function **(EPR–2 1997)**.
- While treatment is given, obtain a brief, focused history and physical examination pertinent to the exacerbation (See figure 5–3 in the original guideline document). Take a more detailed history and complete physical examination and perform laboratory studies only after initial therapy has been completed **(Evidence D)**.
  - The objectives of *functional assessment* (the frequency and number of measurements) will depend on the severity of the exacerbation and the response to treatment (See figure 5–6 in the original guideline document.) are to:
    - Obtain objective lung function measurements.
      - FEV<sub>1</sub> or PEF values provide important information about the level of airflow obstruction both initially and in response to treatment. Because low PEF values cannot distinguish between poor effort, restrictive ventilatory disorders (e.g., neuromuscular weakness, pneumonia), and obstructive ventilatory disorders (e.g., asthma), FEV<sub>1</sub> measurements are preferable if they are readily available **(Evidence D)**.
      - In the initial assessment of a life-threatening asthma exacerbation, FEV<sub>1</sub> or PEF are not indicated **(Evidence D)**.
      - Very severe exacerbations may preclude performance of a maximal expiratory maneuver and, in such cases, the clinical presentation should suffice for clinical assessment and prompt initiation of therapy **(Evidence D)**.
      - In less severe exacerbations, in the office or ED, FEV<sub>1</sub> or PEF should be obtained on arrival and 30 to 60 minutes after initial treatment **(Evidence B)**.
      - In the hospital, FEV<sub>1</sub> or PEF should be measured on admission and 15 to 20 minutes after bronchodilator therapy during the acute phase and at least daily thereafter until discharge **(Evidence C)**.
      - Any FEV<sub>1</sub> or PEF value <25 percent of predicted that improves by <10 percent after treatment or values that fluctuate widely are potential indications for intensive care unit (ICU) admission and close monitoring for respiratory failure **(Evidence C)**.
      - Flow-volume loops should be obtained to distinguish between upper and lower airway obstruction in patients who have atypical asthma symptoms (e.g., dysphonia) or findings on exam (e.g., stridor) or if response to therapy is inadequate **(Evidence D)**.
    - Monitor oxygen saturation.
      - Pulse oximetry is indicated for children unable to perform FEV<sub>1</sub> or PEF or for any patient who is in severe distress or has an FEV<sub>1</sub> or PEF <40 percent of predicted to assess the adequacy of arterial oxygen saturation (SaO<sub>2</sub>) (Connett & Lenney, 1993; Geelhoed, Landau, & Le Souef, 1994; Sole et al., 1999; Wright et al., 1997) **(Evidence C)**.
      - Serial pulse oximetry measurements can be useful to assess both the severity of the exacerbation and improvement with treatment **(Evidence B)**. By contrast, a single pulse oximetry value on admission is of relatively little value for predicting

hospital admission (Boychuk et al., 2006; Keahey et al., 2002; Wright et al., 1997).

- Objectives of the *brief history* are to determine **(EPR–2 1997)**:
  - Time of onset and any potential causes of current exacerbation.
  - Severity of symptoms, especially compared with previous exacerbations, and response to any treatment given before admission to ED.
  - All current medications and time of last dose, especially of asthma medications.
  - Estimate of number of previous unscheduled office visits, ED visits, and hospitalizations for asthma, particularly within the past year.
  - Any prior episodes of respiratory insufficiency due to asthma (loss of consciousness or intubation and mechanical ventilation).
  - Other potentially complicating illness, especially other pulmonary or cardiac disease or diseases that may be aggravated by systemic corticosteroid therapy (such as diabetes, peptic ulcer, hypertension, and psychosis).
- Objectives of the initial *brief physical examination* are to **(EPR–2 1997)**:
  - Assess the severity of the exacerbation, as indicated by the findings listed in figure 5–3 in the original guideline document.
  - Assess overall patient status, including level of alertness, fluid status, and presence of cyanosis, respiratory distress, and wheezing.
  - Identify possible complications (e.g., pneumonia, pneumothorax, or pneumomediastinum); although rare, these will influence management of the asthma exacerbation.
  - Rule out upper airway obstruction. Both intrathoracic and extrathoracic central airway obstruction can cause severe dyspnea and may be diagnosed as asthma.
- Laboratory studies. Most patients who have an asthma exacerbation do not require any initial laboratory studies. If laboratory studies are ordered, they must not delay initiation of asthma treatment **(EPR–2 1997)**.

Refer to the original guideline document for assessment considerations that are unique to children and infants.

## **Treatment**

The Expert Panel recommends as initial treatments: oxygen for most patients, SABA for all patients; adding multiple doses of ipratropium bromide for ED patients who have severe exacerbations (but ipratropium bromide is not recommended during hospitalization); and systemic corticosteroids for most patients. For severe exacerbations unresponsive to the initial treatments, adjunct treatments (magnesium sulfate or heliox) merit consideration to decrease the likelihood of intubation.

The Expert Panel does not recommend: methylxanthines, antibiotics (except as needed for comorbid conditions), aggressive hydration, chest physical therapy, mucolytics, or sedation.

The Expert Panel recommends the following treatments:

- Oxygen is recommended for most patients **(EPR–2 1997)**.

- SABA treatment is recommended for all patients (**Evidence A**) (For recommended doses, see figure 5–5 in the original guideline document).
- Inhaled ipratropium bromide.
  - *In the ED*: recommended (**Evidence A**).
  - *In the hospital*: not recommended (**Evidence A**).
- Systemic corticosteroids are recommended for most patients (For recommended doses, see figure 5–5 in the original guideline document):
  - *In the ED*: Give systemic corticosteroids to patients who have moderate or severe exacerbations and patients who do not respond completely to initial SABA therapy (**Evidence A**).
    - Oral administration of prednisone has been shown to have effects equivalent to those of intravenous methylprednisolone (**Evidence A**); (Harrison et al., 1986; Ratto et al., 1988) and, in the opinion of the Expert Panel, is usually preferred because it is less invasive.
    - Give a 5- to 10-day course following ED discharge to prevent early relapse (**EPR–2 1997**).
    - Intramuscular depot injections of corticosteroids may be considered as an alternative to oral corticosteroids for patients who are at high risk of nonadherence (**Evidence D**).
    - Give supplemental doses of oral corticosteroids to patients who take them regularly, even if the exacerbation is mild (**Evidence D**).
  - *In the hospital*: Give systemic corticosteroids to patients who are admitted to the hospital (**Evidence A**), because oral systemic corticosteroids speed the resolution of asthma exacerbations (Manser, Reid, & Abramson, 2001; Smith et al., 2003).
- High doses of an ICS may be considered in the ED, although current evidence is insufficient to permit conclusions about using ICSs rather than oral systemic corticosteroids in the ED (**Evidence B**).
- For severe exacerbations unresponsive to the initial treatments listed above, whether given before arrival at the acute care setting or in the ED, adjunct treatments may be considered to decrease the likelihood of intubation: intravenous magnesium or heliox may be useful (**Evidence B**). (These therapies are discussed below in the subsection on "Impending Respiratory Failure.")

**The following treatments are NOT recommended:**

- Methylxanthines are not recommended (**Evidence A**).
- Antibiotics are not generally recommended for the treatment of acute asthma exacerbations except as needed for comorbid conditions (**Evidence B**).
- Aggressive hydration is not recommended for older children and adults but may be indicated for some infants and young children (**Evidence D**).
- Chest physical therapy is not generally recommended (**Evidence D**).
- Mucolytics are not recommended (**Evidence C**).
- Sedation is not generally recommended (**Evidence D**).

**Repeat Assessment**

The Expert Panel recommends that repeat assessment of patients who have severe exacerbations be made after the initial dose of a SABA and that repeat

assessment of all patients be made after three doses of a SABA (60 to 90 minutes after initiating treatment) (**Evidence A**).

### **Hospitalization**

The Expert Panel recommends that the decision to hospitalize a patient be based on duration and severity of symptoms, severity of airflow obstruction, response to ED treatment (See earlier section on monitoring in "Treatment Goals."), course and severity of prior exacerbations, medication use at the time of the exacerbation, access to medical care and medications, adequacy of support and home conditions, and presence of psychiatric illness (**Evidence C**) (Pollack et al., 2002; Weber et al., 2002).

In general, the principles of care in the hospital and recommendation for treatment resemble those for care in the ED and involve both treatment (with oxygen, aerosolized SABA, and systemic corticosteroids and, perhaps, adjunct therapies) and frequent assessment, including clinical assessment of respiratory distress and fatigue as well as objective measurement of airflow (PEF or FEV<sub>1</sub>) and oxygen saturation (**EPR—2 1997**).

### **Impending Respiratory Failure**

The Expert Panel recommends that intubation not be delayed once it is deemed necessary; exactly when to intubate is based on clinical judgment (**Evidence D**).

The Expert Panel recommends that adjunct treatments such as magnesium sulfate or heliox may be considered to avoid intubation, but intubation should not be delayed once it is deemed necessary (**Evidence B**).

- *Intravenous magnesium sulfate.* Consider intravenous magnesium sulfate in patients who have life-threatening exacerbations and in those whose exacerbations remain in the severe category after 1 hour of intensive conventional therapy (**Evidence B**).
- *Heliox.* Consider heliox-driven albuterol nebulization for patients who have life-threatening exacerbations and for those patients whose exacerbations remain in the severe category after 1 hour of intensive conventional therapy (**Evidence B**).
- *Other adjunct therapies* to avoid intubation include intravenous beta<sub>2</sub>-agonists, intravenous leukotriene receptor antagonists (LTRAs), and noninvasive ventilation; however, insufficient data are available to make recommendations regarding these possible adjunct therapies (**Evidence D**).

The Expert Panel recommends the following actions regarding intubation:

- Patients who present with apnea or coma should be intubated immediately (**EPR—2 1997**). There are no other absolute indications for endotracheal intubation, but persistent or increasing hypercapnia, exhaustion, and depression of mental status strongly suggest the need for ventilatory support (**Evidence D**).
- Intubate semielectively, before the crisis of respiratory arrest, because intubation is difficult in patients who have asthma (**EPR—2 1997**).

- Intubation should be performed by a physician who has extensive experience in intubation and airway management **(EPR—2 1997)**.
- "Permissive hypercapnia" or "controlled hypoventilation" is the recommended ventilator strategy **(Evidence C)**.

### **Patient Discharge**

The Expert Panel recommends that clinicians, before patients' discharge from the ED or hospital, provide patients with necessary medications and education on how to use them, a referral for a followup appointment, and instruction in an ED asthma discharge plan for recognizing and managing relapse of the exacerbation or recurrence of airflow obstruction **(Evidence B)**.

The Expert Panel recommends the following actions for discharging patients from the ED:

- Release of the patient from the ED depends on the patient's response to treatment **(EPR—2 1997)**.
  - In general, discharge is appropriate if FEV<sub>1</sub> or PEF has returned to  $\geq 70$  percent of predicted or personal best and symptoms are minimal or absent. Patients who have an incomplete response to therapy (FEV<sub>1</sub> or PEF 50 to 69 percent of predicted or personal best) and with mild symptoms should be assessed individually for their suitability for discharge home, with consideration given to factors listed in figure 5-2a in the original guideline document. **(Evidence C)**.
  - The Expert Panel's opinion is that patients who have a rapid response should be observed for 30 to 60 minutes after the most recent dose of bronchodilator to ensure their stability of response before discharge to home.
  - Extended treatment and observation in a holding area, clinical decision unit, or overnight unit to determine the need for hospitalization may be appropriate, provided there is sufficient monitoring and nursing care.
- Prescribe sufficient medications for the patient to continue treatment after discharge.
  - Patients given systemic corticosteroids should continue oral systemic corticosteroids for 3 to 10 days **(Evidence A)**.
  - Consider initiating an ICS at discharge, in addition to oral systemic corticosteroids **(Evidence B)**.
- Emphasize the need for continual, regular care in an outpatient setting, and refer the patient for a followup asthma care appointment (either primary care provider [PCP] or asthma specialist) within 1 to 4 weeks **(Evidence B)**. If appropriate, consider referral to an asthma self-management education program **(Evidence B)**.
- Review discharge medications with the patient and provide patient education on correct use of an inhaler **(Evidence B)** (See the NGC summary of the NAEPP guideline, [Education for a Partnership in Asthma Care](#)).
- Give the patient an ED asthma discharge plan with instruction for medications prescribed at discharge and for increasing medications or seeking medical care if asthma should worsen **(Evidence B)**. (See figure 5–7 in the original guideline document for a sample ED asthma discharge plan and also the NGC

summary of the NAEPP guideline, [Education for a Partnership in Asthma Care](#)).

- Consider issuing a peak flow meter and giving appropriate education on how to measure and record PEF to patients who have difficulty perceiving airflow obstruction or symptoms of worsening asthma (**Evidence D**).

The Expert Panel recommends the following actions for discharging patients from the hospital:

- Prior to discharge, adjust the patient's medication to an outpatient regimen (**EPR—2 1997**).
- Discharge medications should include a SABA and sufficient oral systemic corticosteroids to complete the course of therapy (**Evidence A**) and instructions to continue long-term control therapy until the followup appointment (**Evidence B**). Consider initiating ICS therapy for patients who did not use an ICS prior to the hospital admission (**Evidence B**).
- Provide patient education:
  - Review patient understanding of the causes of asthma exacerbations, the purposes and correct uses of treatment (including inhaler technique), and the actions to be taken for worsening symptoms or peak flow measures (**Evidence B**) (See the NGC summary of the NAEPP guideline, [Education for a Partnership in Asthma Care](#)).
  - Educate patients about their discharge medications and the importance of taking medications as prescribed and attending their follow up visit (**Evidence B**).
  - Referral to an asthma specialist should be considered for patients who have a history of life-threatening exacerbations or multiple hospitalizations (**Evidence B**) (Harish et al., 2001; Mahr & Evans, 1993; Mayo, Richman, & Harris, 1990; Sperber et al., 1995).
  - Consider issuing a peak flow meter and giving appropriate education on peak flow monitoring to patients who are  $\geq 5$  years of age (and parents) who have a history of severe exacerbations or who have moderate or severe persistent asthma (**Evidence B**) and those who poorly perceive airflow obstruction or worsening asthma (**Evidence D**).
  - Review or develop a written plan for managing either relapse of the exacerbation or recurrent symptoms or exacerbations (**Evidence B**).

### **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)**

Clinical algorithms are provided in the original guideline document for the following:

- Management of asthma exacerbations: home treatment
- Management of asthma exacerbations: emergency department and hospital-based care

**EVIDENCE SUPPORTING THE RECOMMENDATIONS****REFERENCES SUPPORTING THE RECOMMENDATIONS**

[References open in a new window](#)

## **TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS**

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

## **BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS**

### **POTENTIAL BENEFITS**

Recognition and treatment of asthma exacerbations may correct significant hypoxemia, reverse airflow obstruction, and reduce the likelihood of relapse of the exacerbation or future recurrence of airflow obstruction.

### **POTENTIAL HARMS**

Adverse effects of medications used to control or prevent asthma exacerbations

## **CONTRAINDICATIONS**

### **CONTRAINDICATIONS**

Anxiolytic and hypnotic drugs are contraindicated in severely ill asthma patients because of their respiratory depressant effect.

## **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**

Chart Documentation/Checklists/Forms  
Clinical Algorithm  
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

Getting Better  
Living with Illness  
Staying Healthy

### IOM DOMAIN

Effectiveness  
Patient-centeredness  
Timeliness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

Managing exacerbations of asthma. 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. 373-417. [130 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**

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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.

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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.

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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.

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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](mailto: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](mailto:nhlbiic@dgsys.com).

Additionally, other implementation tools, including a sample emergency department discharge plan and a checklist for hospital discharge of patients with asthma, are available 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](mailto: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**

This summary was completed by ECRI on January 5, 1999. The information was verified by the guideline developer on April 30, 1999. This summary was updated by ECRI on January 31, 2003. This information was not verified by the guideline developer. This summary was updated by ECRI on December 5, 2005 following the U.S. Food and Drug Administration (FDA) advisory on long-acting beta2-adrenergic agonists (LABA). This NGC summary was updated by ECRI Institute on January 21, 2008.

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