Complete Summary

GUIDELINE TITLE

Control of environmental factors and comorbid conditions that affect asthma: Expert panel report 3: guidelines for the diagnosis and management of asthma.

BIBLIOGRAPHIC SOURCE(S)

Control of environmental factors and comorbid conditions that affect 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. 165-212. [301 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

DISEASE/CONDITION(S)

Asthma

GUIDELINE CATEGORY

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
- To discuss ways to reduce the effects of inhalant allergens, occupational exposure, irritants, comorbid conditions, and others factors on asthma

TARGET POPULATION

Infants, children, adolescents, and adults with asthma

INTERVENTIONS AND PRACTICES CONSIDERED

Evaluation

1. Evaluation of asthma patients for the role of allergens as contributing factors
2. Using patient's medical history to identify allergen sensitivity
3. Skin testing or in vitro testing
4. Evaluation of patients for presence of chronic comorbid conditions that may interfere with asthma management (e.g. allergic bronchopulmonary

aspergillosis, gastroesophageal reflux, obesity, obstructive sleep apnea, rhinitis/sinusitis, chronic stress/depression)
5. Evaluation for possible occupational exposure

Management

1. Avoidance or reduction of exposure to allergens and other agents that cause asthma symptoms
2. Allergen immunotherapy
3. Use of inactivated influenza vaccination
4. Avoidance of humidifies and evaporative (swamp) coolers
5. Management of comorbid conditions

MAJOR OUTCOMES CONSIDERED

- Effectiveness of avoidance measures in reducing asthma symptoms
- Effectiveness of immunotherapy in reducing asthma symptoms
- Effectiveness of control of comorbid conditions on asthma symptoms

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.
- 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.

Key Points: Control of Environmental Factors and Comorbid Conditions That Affect Asthma

- Exposure of patients who have asthma to allergens **(Evidence A)** or irritants **(EPR—2 1997)** to which they are sensitive has been shown to increase asthma symptoms and precipitate asthma exacerbations.

- For at least those patients who have persistent asthma, the clinician should evaluate the potential role of allergens, particularly indoor inhalant allergens **(Evidence A)**:
    - Use the patient's medical history to identify allergen exposures that may worsen the patient's asthma.
    - Use skin testing or in vitro testing to reliably determine sensitivity to perennial indoor inhalant allergens to which the patient is exposed.
    - Assess the significance of positive tests in the context of the patient's medical history.
    - Use the patient's history to assess sensitivity to seasonal allergens.
- Patients who have asthma at any level of severity should:
    - Reduce, if possible, exposure to allergens to which the patient is sensitized and exposed.
    - Know that effective allergen avoidance requires a multifaceted, comprehensive approach; individual steps alone are generally ineffective **(Evidence A)**.
    - Avoid exposure to environmental tobacco smoke and other respiratory irritants, including smoke from wood-burning stoves and fireplaces and, if possible, substances with strong odors **(Evidence C)**.
    - Avoid exertion outdoors when levels of air pollution are high **(Evidence C)**.
    - Avoid use of nonselective beta-blockers **(Evidence C)**.
    - Avoid sulfite-containing and other foods to which they are sensitive **(Evidence C)**.
    - Consider allergen immunotherapy when there is clear evidence of a relationship between symptoms and exposure to an allergen to which the patient is sensitive **(Evidence B)**. If use of allergen immunotherapy is elected, it should be administered only in a physician's office where facilities and trained personnel are available to treat any life-threatening reaction that can, but rarely does, occur.
- Adult patients who have severe persistent asthma, nasal polyps, or a history of sensitivity to aspirin or nonsteroidal anti-inflammatory drugs (NSAIDs) should be counseled regarding the risk of severe and even fatal exacerbations from using these drugs **(Evidence C)**.
- Clinicians should evaluate a patient for the presence of a chronic comorbid condition when the patient's asthma cannot be well controlled. Treating the conditions may improve asthma management: allergic bronchopulmonary aspergillosis (ABPA) **(Evidence A**), gastroesophageal reflux **(Evidence B)**, obesity **(Evidence B**, limited studies), obstructive sleep apnea (OSA) **(Evidence D)**, rhinitis/sinusitis **(Evidence B)**, chronic stress/depression **(Evidence D)**.
- Consider inactivated influenza vaccination for patients who have asthma. It is safe for administration to children more than 6 months of age and adults **(Evidence A)**.The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (CDC) recommends vaccination for persons who have asthma, because they are considered to be at risk for complications from influenza. However, the vaccine should not be given with the expectation that it will reduce either the frequency or severity of asthma exacerbations during the influenza season **(Evidence B)**.
- Use of humidifiers and evaporative (swamp) coolers is not generally recommended in homes of patients who have asthma and are sensitive to house-dust mites or mold **(Evidence C)**.

- Employed persons who have asthma should be queried about possible occupational exposures, particularly those who have new-onset disease **(EPR—2 1997)**.
- There is insufficient evidence to recommend any specific environmental strategies to prevent the development of asthma.

Key Differences from the 1997 Expert Panel Report

- Evidence strengthens recommendations that reducing exposure to inhalant indoor allergens can improve asthma control and notes that a multifaceted approach is required; single steps to reduce exposure are generally ineffective.
- Formaldehyde and volatile organic compounds (VOCs) have been implicated as potential risk factors for asthma and wheezing.
- Evidence shows that influenza vaccine, while having other benefits, does not appear to reduce either the frequency or severity of asthma exacerbations during the influenza season.
- The section has been expanded to include discussion of ABPA, obesity, OSA, and stress as chronic comorbid conditions, in addition to rhinitis, sinusitis, and gastroesophageal reflux, that may interfere with asthma management.

Inhalant Allergens

The Expert Panel recommends that patients who have asthma at any level of severity should be queried about exposures to inhalant allergens, particularly indoor inhalant allergens, and their potential effect on the patient's asthma **(Evidence A)**.

Diagnosis—Determine Relevant Inhalant Sensitivity

The Expert Panel recommends that, given the importance of allergens and their control to asthma morbidity and asthma management, patients who have persistent asthma should be evaluated for the role of allergens as possible contributing factors as follows **(EPR—2 1997)**:

- Determine the patient's exposure to allergens, especially indoor inhalant allergens. (See relevant questions in figure 3–17 in the original guideline document.)
- Assess sensitivity to the allergens to which the patient is exposed.
    - Use the patient's medical history, which is usually sufficient, to determine sensitivity to seasonal allergens.
    - Use skin testing or in vitro testing to determine the presence of specific immunoglobulin E (IgE) antibodies to the indoor allergens to which the patient is exposed year round. (See figure 3–18 in the original guideline document for a comparison of skin and in vitro tests.) Allergy testing is the only reliable way to determine sensitivity to perennial indoor allergens (See box 3–6 in the original guideline document for further explanation.).
    - For selected patients who have asthma at any level of severity, detection of specific IgE sensitivity to seasonal or perennial allergens may be indicated as a basis for education about the role of allergens for avoidance and for immunotherapy.

- Assess the clinical significance of positive allergy tests in the context of the patient's medical history (See figure 3–19 in the original guideline document).

Management—Reduce Exposure

The Expert Panel recommends that patients should reduce exposure, as much as possible, to allergens to which the patient is sensitized and exposed:

- The first and most important step in controlling allergen-induced asthma is to advise patients to reduce exposure to relevant indoor and outdoor allergens to which the patient is sensitive **(Evidence A)**
- Effective allergen avoidance requires a multifaceted, comprehensive approach; individual steps alone are generally ineffective **(Evidence A)**.
- Consider multifaceted allergen-control education interventions provided in the home setting that have been proven effective for reducing exposures to cockroach, dustmite, and rodent allergens for patients sensitive to those allergens **(Evidence A)**. Further research to evaluate the feasibility of widespread implementation of such programs will be helpful (See the NGC summary of the NAEPP guideline Education for a Partnership in Asthma Care).

Animal Allergens

The Expert Panel recommends the following actions to control animal antigens **(Evidence D):**

- If the patient is sensitive to an animal, the treatment of choice is removal of the exposure from the home.
- If removal of the animal is not acceptable:
    - Keep the pet out of the patient's bedroom.
    - Keep the patient's bedroom door closed.
    - Remove upholstered furniture and carpets from the home, or isolate the pet from these items to the extent possible.
    - Mouse allergen exposure can be reduced by a combination of blocking access, low-toxicity pesticides, traps, and vacuuming and cleaning.

House-Dust Mite Allergen

The Expert Panel recommends the following mite-control measures; effective allergen avoidance requires a multifaceted approach **(Evidence A)**.

- Recommended actions to control mites include:
    - Encase the mattress in an allergen-impermeable cover.
    - Encase the pillow in an allergen-impermeable cover or wash it weekly.
    - Wash the sheets and blankets on the patient's bed weekly in hot water.
    - A temperature of >130 degrees F is necessary for killing house-dust mites. Prolonged exposure to dry heat or freezing can also kill mites but does not remove allergen. If high temperature water is not available, a considerable reduction in live mites and mite allergens can still be achieved with cooler water and using detergent and bleach.
- Actions to *consider* to control mites include:

- Reduce indoor humidity to or below 60 percent, ideally between 30 and 50 percent.
- Remove carpets from the bedroom.
- Avoid sleeping or lying on upholstered furniture.
- Remove from the home carpets that are laid on concrete.
- In children's beds, minimize the number of stuffed toys, and wash them weekly.

Cockroach Allergen

The Expert Panel recommends that cockroach control measures should be instituted if the patient is sensitive to cockroaches and infestation is present in the home **(Evidence B)**.

Indoor Fungi (Molds)

The Expert Panel recommends consideration of measures to control indoor mold **(Evidence C)**.

Outdoor Allergens (Tree, Grass, and Weed Pollen; Seasonal Mold Spores)

The Expert Panel recommends that patients who are sensitive to seasonal outdoor allergens consider staying indoors, if possible, during peak pollen times—particularly midday and afternoon **(EPR—2 1997)**.

Immunotherapy

The Expert Panel recommends that allergen immunotherapy be considered for patients who have persistent asthma if evidence is clear of a relationship between symptoms and exposure to an allergen to which the patient is sensitive **(Evidence B)**.

Assessment of Devices that May Modify Indoor Air

The Expert Panel recommends the following actions to modify indoor air:

- Vacuuming carpets once or twice a week to reduce accumulation of house dust. Patients sensitive to components of house dust should avoid using conventional vacuum cleaners, and these patients should stay out of rooms where a vacuum cleaner is being or has just been used **(EPR—2 1997**; Murray et al., 1983).
- Air conditioning during warm weather, if possible, for patients who have asthma and are allergic to outdoor allergens **(Evidence C)**.
- Use of a dehumidifier to reduce house-dust mite levels in areas where the humidity of the outside air remains high for most of the year **(EPR—2 1997)**.
- There is insufficient evidence to recommend indoor air cleaning devices. They may reduce some, but not all airborne allergens, but evidence is limited regarding their impact on asthma control.
- There is insufficient evidence to recommend cleaning air ducts of heating/ventilation/air conditioning systems **(Evidence D)**.

The Expert Panel does not generally recommend use of humidifiers and evaporative (swamp) coolers for use in the homes of house-dust mite-sensitive patients who have asthma **(Evidence C)**.

Occupational Exposure

The Expert Panel recommends that clinicians query patients who are employed and have asthma about possible occupational exposures, particularly those who have new-onset disease **(EPR—2 1997)**.

Irritants

The Expert Panel recommends that clinicians query patients who have asthma at any level of severity about exposures to irritants that may cause their asthma to worsen, and advise them accordingly about reducing relevant exposures **(EPR—2 1997)**. (See sample assessment questions in figure 3–17 in the original guideline document.)

Environmental Tobacco Smoke (ETS)

The Expert Panel recommends that clinicians advise persons who have asthma not to smoke or be exposed to environmental tobacco smoke (ETS) **(Evidence C)**. Query patients about their smoking status and specifically consider referring to smoking cessation programs adults who smoke and have young children who have asthma in the household **(Evidence B)**.

Indoor/Outdoor Air Pollution and Irritants

The Expert Panel recommends that clinicians advise patients to avoid, to the extent possible, exertion or exercise outside when levels of air pollution are high **(Evidence C)**.

Gas Stoves and Appliances

The Expert Panel recommends that clinicians advise patients to avoid, if possible, exposure to gas stoves and appliances that are not vented to the outside, fumes from wood-burning appliances or fireplaces, sprays, or strong odors **(Evidence C)**.

Comorbid Conditions

The Expert Panel recommends that clinicians evaluate a patient for presence of a chronic comorbid condition when the patient's asthma cannot be well controlled. Treating the following conditions may improve asthma management: ABPA **(Evidence A)**, gastroesophageal reflux **(Evidence B)**, obesity **(Evidence B,** limited studies), OSA **(Evidence D)**, rhinitis/sinusitis **(Evidence B)**, chronic stress/depression **(Evidence D)**.

Allergic Bronchopulmonary Aspergillosis (ABPA)

The Expert Panel recommends that ABPA should be suspected in patients who have asthma and have the presence or a history of pulmonary infiltrates. It should also be specifically considered in patients who have evidence of IgE sensitization to *Aspergillus* (positive prick skin test or in vitro tests) and in corticosteroid-dependent patients who have asthma **(Evidence A)**.

Gastroesophageal Reflux Disease (GERD)

The Expert Panel recommends that medical management of GERD be instituted for patients who have asthma and complain of frequent heartburn or pyrosis, particularly those who have frequent episodes of nocturnal asthma **(Evidence B)**.

Obesity

The Expert Panel recommends that clinicians consider advising asthma patients who are overweight or obese that weight loss, in addition to improving overall health, might also improve their asthma control (**Evidence B**, limited studies).

Obstructive Sleep Apnea (OSA)

The Expert Panel recommends that clinicians consider evaluating patients who have unstable, not-well-controlled asthma, particularly those who are overweight or obese, to ascertain whether they have symptoms that suggest OSA **(Evidence D)**.

Rhinitis/Sinusitis

The Expert Panel recommends that clinicians evaluate patients who have asthma regarding the presence of rhinitis/sinusitis diagnosis or symptoms **(Evidence B)**. It is important for clinicians to appreciate the connection between upper and lower airway conditions and the part the connection plays in asthma management.

Stress, Depression, and Psychological Factors in Asthma

The Expert Panel recommends that clinicians consider inquiring about the potential role of chronic stress or depression in complicating asthma management for patients whose asthma is not well controlled **(Evidence C)**; additional patient education may be helpful **(Evidence D)**.

Other Factors

Medication Sensitivities

Aspirin

The Expert Panel recommends that clinicians query adult patients who have asthma regarding precipitation of bronchoconstriction by aspirin and other nonsteroidal anti-inflammatory drugs (NSAIDs) **(Evidence C)**. If patients have experienced a reaction to any of these drugs, they should be informed of the potential for all of these drugs to precipitate severe and even fatal exacerbations.

Adult patients who have severe persistent asthma or nasal polyps should be counseled regarding the risk of using these drugs **(Evidence C)**.

Beta-Blockers

The Expert Panel recommends that clinicians advise asthma patients to avoid nonselective beta-blockers, including those in ophthalmological preparations **(Evidence B)**.

Sulfite Sensitivity

The Expert Panel recommends that clinicians advise patients who have asthma symptoms associated with eating processed potatoes, shrimp, or dried fruit or with drinking beer or wine to avoid these products **(Evidence C)**.

Influenza Infection

The Expert Panel recommends that clinicians consider inactivated influenza vaccination for patients who have asthma. It is safe to administer in children over 6 months and adults who have asthma **(Evidence A)**, and the Advisory Committee on Immunization Practices of the CDC recommends the vaccine for persons who have asthma because they may be at increased risk for complications from influenza. However, the vaccine should not be given with the expectation that it will reduce either the frequency or severity of asthma exacerbations during the influenza season **(Evidence B)**.

Female Hormones and Asthma

In the opinion of the Expert Panel, no recommendation can be made at this time regarding female hormones and asthma.

Diet

In the opinion of the Expert Panel, there is insufficient evidence to make specific recommendations with regard to dietary constituents that should be consumed or avoided to affect asthma.

Primary Prevention of Allergic Sensitization and Asthma

In the opinion of the Expert Panel, there is insufficient evidence to recommend any specific strategies to prevent the development of asthma.

Definitions:

Levels of Evidence

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

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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.

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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.
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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

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

Successful long-term management of asthma may be achieved by identifying and reducing exposure to relevant allergens and irritants and by controlling other factors that have been shown to increase asthma symptoms and/or precipitate asthma exacerbations.

POTENTIAL HARMS

Severe and sometimes fatal reactions to immunotherapy, especially severe bronchoconstriction, are more frequent among patients who have asthma, particularly those who have poorly controlled asthma, compared with those who have allergic rhinitis. If use of allergen immunotherapy is elected, it should be administered only in a physician's office where facilities and trained personnel are available to treat any life-threatening reaction that can, but rarely does, occur.

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)

Control of environmental factors and comorbid conditions that affect 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. 165-212. [301 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: William W. Busse, MD (Chair), University of Wisconsin Medical School, Madison, WI; Homer A. Boushey, MD, University of California at San Francisco, San Francisco, CA; Carlos A. Camargo, MD, DrPH, Massachusetts General Hospital, Boston, MA; David Evans, PhD, AE-C., Columbia University, New York, NY; Michael B. Foggs, MD, Advocate Health Care, Chicago, IL; Susan Janson, DNSc, RN, University of California, San Francisco, California; H. William Kelly, PharmD, University of New Mexico Health Sciences Center, Albuquerque, NM; Robert F. Lemanske, MD, University of Wisconsin Hospital and Clinics, Madison, WI; Fernando D. Martinez, MD, University of Arizona Medical Center, Tucson, AZ; Robert J. Meyer, MD, U.S. Food and Drug Administration, Rockville, MD; Harold S. Nelson, MD, National Jewish Medical and Research Center, Denver, CO; Thomas A.E. Platts-Mills, MD, PhD, University of Virginia School of Medicine, Charlottesville, VA; Michael Schatz, MD, MS, Kaiser-Permanente Medical Center, San Diego, CA; Gail Shapiro, MD (deceased), Northwest Asthma and Allergy Center, Seattle, WA; Stuart Stoloff, MD, University of Nevada School of Medicine, Carson City, NV; Stanley Szefler, MD, National Jewish Medical and Research Center, Denver, CO; Scott T. Weiss, MD, MS, Brigham and Women's Hospital, Boston, MA; Barbara P. Yawn, MD, MSc, Olmstead Medical Center, Rochester, MN

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, Norvartis, 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. Szefler 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, 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

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 14, 2008.

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