Asthma Diagnosis and Management: A Review of the Updated National Asthma Education and Prevention Program Treatment Guidelines

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Citation

Abstract
Asthma is a common chronic inflammatory disorder of the airways. The National Asthma Education and Prevention Program guidelines provide recommendations for asthma management based on the components of assessment and monitoring of asthma severity and control, patient education, control of environmental factors and comorbid conditions affecting asthma, and pharmacologic therapy. The 2002 version of these guidelines was recently updated. The purpose of this review is to describe the major changes and to provide a concise summary of the key asthma diagnosis and management recommendations contained within this newly updated version.

Study funding: This article was supported by AstraZeneca LP.

INTRODUCTION
Recently, the National Asthma Education and Prevention Program (NAEPP) released updated guidelines for the treatment of patients with asthma. Although many recommendations in the guidelines remain unchanged, some key elements have been revised or introduced. This review summarizes this vital information as it relates to the diagnosis and treatment of asthma for the physician assistant (PA) audience. I begin with a brief description of the major changes from the previous version, followed by an integrated summary of recommendations for asthma diagnosis and management, according to the revised guidelines.

OVERVIEW OF MAJOR GUIDELINE CHANGES
The updated guidelines continue to recommend a stepwise approach to treating asthma symptoms; however, in contrast to the single-scheme approach used in previous guidelines, diagnosis and disease management have now been divided into 2 phases. In the first phase, asthma severity is evaluated to establish initial therapy and is determined by assessment of current impairment (eg, quality of life and functional capacity) and future risk (eg, exacerbations, loss of pulmonary function, and adverse events). In the second phase, responsiveness to asthma therapy and the achieved level of asthma control are routinely assessed, which may result in therapy adjustment over time based on the outcome of these assessments.

Several key revisions to the NAEPP guidelines involve changes to pharmacologic recommendations. Assessment and treatment are now stratified into 3 age groups (0–4 y, 5–11 y, and ≥12 y) instead of 2. Age stratification is appropriate because many children with asthma develop symptoms before the age of 5 years, yet clinical data for children aged <5 years are limited, making it difficult to draw firm conclusions regarding appropriate treatment in this age group. Furthermore, diagnosing children aged <5 years with asthma is difficult and may require different therapeutic approaches compared with older children because of the potential for reduced capability of the patient or caregiver to adequately use drug delivery devices. Moreover, children aged <5 years generally have different patterns of asthma symptoms than older children, suggesting that treatment approaches in the 2 populations should not be identical.

Finally, although the revised guidelines still recommend a stepwise approach for the combination of long-term and short-term anti-inflammatory medications, the recommendations for the individual steps have been substantially revised. Most importantly, the stepwise
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Treatment approach is now divided into 6 steps rather than 4. By doing this, the treatment steps were simplified to reduce the number of multiple treatment choices within a single step. Other revisions include changes regarding the appropriate time for the introduction of adjuvant therapy to an inhaled corticosteroid (ICS) regimen in the management of persistent asthma. The revised guidelines have changed the recommendations for the introduction of a long-acting β₂-agonist (LABA) for adults and adolescents aged ≥12 years whose asthma is not adequately controlled on low-dose ICS therapy, and equal emphasis is now placed on either increasing the dose of the ICS to a medium dose or to adding a LABA to a low-dose ICS.

**Diagnosis, Assessment of Severity, and Initiation of Treatment**

Diagnosis and assessment of asthma severity are based on patient history, physical examination, and laboratory findings (lung function tests), the results of which are used to guide initiation of therapy. Relevant factors in patient history include frequency and duration of symptoms, including nocturnal symptoms and seasonal variations; family history of asthma; home allergen exposure (eg, pets, mold, cockroach infestations, and dust mite exposure from furnishings and coverings); cigarette smoking or passive exposure to cigarette smoke; occupational risk factors; healthcare utilization (eg, required oral corticosteroid treatments, emergency room visits, and hospitalizations); and lost days of school or work.

Spirometry can help establish the diagnosis of asthma. Additionally, laboratory evaluations, including skin test reactivity or measuring serum levels of specific allergens via methods such as ImmunoCAP® (Phadia AB, Uppsala, Sweden) can also be used to help diagnose the disease, given the association between allergen sensitization and asthma, but these tests may not be readily accessible for all clinicians. In practical terms, a diagnosis of asthma is generally made based on evaluation of medical history, physical examination, and lung function tests.

After diagnosing the patient with asthma, the appropriate medication for initiation of therapy should be determined based on the assessed level of disease severity (Tables 1–3). Assessment of severity and the treatment choice for therapy initiation vary somewhat depending on patient age.

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**Table 1: Asthma Assessment and Treatment for Children Aged 0 to 4 Years**

<table>
<thead>
<tr>
<th>Component of Assessing Severity</th>
<th>Intermittent</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
</table>
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**Figure 2**
Table 2: Asthma Assessment and Treatment for Children Aged 5 to 11 Years

<table>
<thead>
<tr>
<th>Component of Assessing Severity</th>
<th>Intermittent</th>
<th>MILD</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom</td>
<td>G≥4/week</td>
<td>≥2/week but not daily</td>
<td>Daily</td>
<td>Throughout the day</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>G≥2/night</td>
<td>3–4/night</td>
<td>≥1/night</td>
<td>Other than O/A</td>
</tr>
<tr>
<td>SABA use</td>
<td>G≥2/week</td>
<td>≥2/week but not daily</td>
<td>Daily</td>
<td>Several times per day</td>
</tr>
<tr>
<td>Normal activity interference</td>
<td>None</td>
<td>Minor limitation</td>
<td>Some limitation</td>
<td>Extreme limitation</td>
</tr>
<tr>
<td>Long furance</td>
<td>FEV&lt; sub 80% predicted</td>
<td>FEV&lt; sub 60% predicted</td>
<td>FEV&lt; sub 40% predicted</td>
<td>FEV&lt; sub 20% predicted</td>
</tr>
<tr>
<td>Risk</td>
<td>0/1y</td>
<td>2–3 exacerbations per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended step for Initiation of Therapy</td>
<td>Step 1</td>
<td>Step 2</td>
<td>Step 3</td>
<td>Step 2 or 4</td>
</tr>
</tbody>
</table>

**Figure 3**
Table 3: Asthma Assessment and Treatment for Youths Aged ≥12 Years and Adults*

<table>
<thead>
<tr>
<th>Component of Assessing Severity</th>
<th>Well Controlled</th>
<th>Not Well Controlled</th>
<th>Very Poorly Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom</td>
<td>G≥4/week</td>
<td>≥2/week but not daily</td>
<td>Daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>G≥2/night</td>
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<td>Step 1</td>
<td>Step 2</td>
<td>Step 3</td>
</tr>
</tbody>
</table>

FEV<sub>1</sub>=forced expiratory volume in 1 second; FVC=forced vital capacity; ICS=inhaled corticosteroids; LABA=long-acting β<sub>2</sub>-adrenergic agonist; LTRA=leukotriene receptor antagonist; PRN=as needed; SABA=short-acting β<sub>2</sub>-adrenergic agonist.


ACQ=Asthma Control Questionnaire; ACT=Asthma Control Test; ATAQ=Asthma Therapy Assessment Questionnaire; FEV<sub>1</sub>=forced expiratory volume in 1 second; FVC=forced vital capacity; ICS=inhaled corticosteroids; LABA=long-acting β<sub>2</sub>-adrenergic agonist; LTRA=leukotriene receptor antagonist; PRN=as needed; SABA=short-acting β<sub>2</sub>-adrenergic agonist.

Adapted from National Heart Lung and Blood Institute,

* ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma.

Initiating daily long-term control therapy is recommended for children aged 0 to 4 years who have had ≥4 episodes of wheezing that lasted >1 day and affected sleep and who have had 1 of the following: a parental history of asthma, a diagnosis of atopic dermatitis, or aeroallergen sensitivity or 2 of the following: food sensitivity, ≥4% peripheral blood eosinophilia, or wheezing unrelated to colds. Long-term control therapy should also be considered if the child has required treatment for symptoms >2 times per week for more than 4 weeks or has had ≥2 exacerbations requiring systemic corticosteroids within the past 6 months. Children with less-severe symptoms may be able to be treated with short-acting \( \beta_2 \)-adrenergic agonists (SABAs) as needed.

For children and adults, intermittent asthma may be treated with as-needed SABAs. Initiation of daily long-term control therapy is recommended for treating patients who present with persistent asthma (Tables 1–3). After therapy initiation, patients should be monitored every 2 to 6 weeks until control is established.

**ASTHMA MANAGEMENT**

**GENERAL ASTHMA MANAGEMENT**

**CHANGES IN A PATIENT’S ASTHMA TREATMENT SHOULD BE BASED ON THE LEVEL OF DISEASE CONTROL (IE, ASSESSMENT OF IMPAIRMENT AND RISK). DISEASE SEVERITY WILL VARY OVER TIME IN INDIVIDUAL PATIENTS, SO THERAPY MAY NEED TO BE STEPPED UP OR DOWN TO ADJUST FOR OPTIMAL CONTROL OF SYMPTOMS. IDEALLY, PATIENTS SHOULD BE REASSESSED AT 1- TO 6-MONTH INTERVALS TO ENSURE ADEQUATE DISEASE MANAGEMENT. ACHIEVEMENT AND MAINTENANCE OF ASTHMA CONTROL FOR ≥3 MONTHS MAY WARRANT AN ATTEMPT TO STEP DOWN THERAPY TO REACH THE LEAST POSSIBLE PHARMACOLOGIC INTERVENTION NECESSARY TO MAINTAIN CONTROL.**

**PATIENTS SHOULD BE CLOSELY MONITORED DURING PERIODS IN WHICH STEP-DOWN THERAPY IS INITIATED BECAUSE OF THE HIGHLY VARIABLE RATE AT WHICH ASTHMA CONTROL CAN DETERIORATE. FIGURE 1 PRESENTS A GENERAL TREATMENT ALGORITHM FOR THE MANAGEMENT OF ASTHMA.**

**Figure 4**

Figure 4: Treatment algorithm for patients with asthma. NHLBI=National Heart, Lung, and Blood Institute. *A consultation with an asthma specialist should be sought if step 4 (step 3 if aged 0–4 y) or higher care is required. Consider a consultation with specialist at step 3 (step 2 if aged 0–4 y).

Questionnaires such as the Asthma Control Test™ are simple self-evaluations of asthma control that can easily be completed by the patient at home or in the waiting room. An example of an asthma control self-assessment is shown in Figure 2. These self-evaluations quickly determine the level of asthma control and indicate whether changes in asthma therapy are warranted. Additionally, the Childhood Asthma Control Test™ (C-ACT; Figure 3) is a recently validated self-administered test to assess asthma control in children aged 4 to 11 years. 14
Asthma Assessment

1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school, or home?
   - All of the time
   - Most of the time
   - Some of the time
   - A little of the time
   - None of the time

2. During the past 4 weeks, how often have you had shortness of breath?
   - More than once a day
   - Once a day
   - 2 to 6 times a week
   - Once or twice a week
   - Not at all

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?
   - 4 or more nights a week
   - 2 to 3 nights a week
   - Once a week
   - Once or Twice a week
   - Not at all

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as Albuterol, Ventolin®), Proventil®, Maxair® or Primatene Mist®)?
   - 3 or more times per day
   - 1 or 2 times per day
   - 2 or 3 times per week
   - Once a week or less
   - Not at all

5. How would you rate your asthma control during the past 4 weeks?
   - Not Controlled
   - Poorly Controlled
   - Somewhat Controlled
   - Well Controlled
   - Completely Controlled

6. In the past 4 weeks, how much did your asthma limit your usual activities or enjoyment of everyday life?
   - Not at all
   - A little
   - Moderately
   - Quite a lot
   - Extremely

7. In the past 4 weeks, how often did your asthma limit you in performing your usual daily activities, including housework, work, school, or social activities?
   - Never
   - Rarely
   - Sometimes
   - Very Often
   - Always

8. In the past 4 weeks, how often did your asthma keep you from socializing?
   - Never
   - Rarely
   - Sometimes
   - Very Often
   - Always

9. In the past 4 weeks, how often did you feel fed up or frustrated because of your asthma?
   - Never
   - Rarely
   - Sometimes
   - Very Often
   - Always

10. In the past 4 weeks, how often did your asthma leave you too tired to do work or daily activities?
    - Never
    - Rarely
    - Sometimes
    - Very Often
    - Always

The well-known expanded “rule of 2s” (Baylor Health System, Dallas, TX, USA) can also be used to assess asthma control. This rule states that if patients must use their rescue inhalers >2 times per week or are awakened by wheezing or coughing >2 times per month or require >2 rescue inhaler refills, require 2 courses of oral corticosteroids, or require 2 unscheduled visits for acute asthma care per year, then their asthma is not well controlled. Finally, it is important to include an analysis of environmental factors (eg, pets, smoking), of patient adherence to pharmacologic therapy, and of the potential development of comorbid conditions in the periodic assessments of control.

Importantly, the revised guidelines clearly state that ICSs are more effective for asthma control than leukotriene receptor antagonists (LTRAs) or other long-term monotherapies in patients who require maintenance therapy. However, as part of asthma management in these patients, clinicians must monitor and attempt to minimize adverse events associated with ICS use. If high doses of ICSs are required, vitamin D
and calcium intake should be reviewed and, if necessary, adjusted in any patients at risk for low bone density, particularly children and the elderly. Children should also be monitored carefully for any adverse effects on growth.

THE PHARMACOLOGIC STEPS

The preferred therapy for long-term control of persistent asthma is ICSs (Tables 1–3), because they are generally safe, especially at low doses. If the disease is not well controlled with low-dose ICS alone, the ICS dosage should be increased to medium levels for patients aged 0 to 4 years (step 3; Table 1), whereas low-dose ICSs plus a LABA, an LTRA, or theophylline can be considered equally to increasing the ICS dose to medium levels for patients aged 5 to 11 years. For patients aged ≥12 years, the step 3 treatment of equal preference to medium-dose ICS is low-dose ICSs plus a LABA. Low-dose ICSs plus an LTRA, theophylline, or zileuton are indicated as alternative but not preferred therapies.

The preferred treatment for asthma that is not well controlled on medium-dose ICSs alone is to add a LABA or montelukast, but not theophylline, for children aged 0 to 4 years (step 4). For patients aged ≥5 years, a LABA should be added to medium-dose ICSs (step 4); alternative (though not preferred) add-on therapies to medium-dose ICSs include an LTRA or theophylline (zileuton may also be considered for those aged ≥12 y).

For patients who are not well controlled on step 4 therapy, high doses of ICS plus either a LABA or montelukast is recommended for patients aged 0 to 4 years (step 5); in those aged ≥5 years, high-dose ICS plus a LABA should be administered. Alternative therapy for children aged 5 to 11 years is to add an LTRA or theophylline to high-dose ICS. Conversely, the use ofLTRAs has not proven beneficial in conjunction with high-dose ICSs in patients aged ≥12 years. Patients aged ≥12 years with allergies whose asthma remains uncontrolled with step 4 therapy may benefit from the addition of omalizumab therapy to high-dose ICS plus LABA treatment.

Patients whose disease continues to be refractory with step 5 therapies should be supplemented with oral systemic corticosteroids (step 6). Before initiating prolonged oral corticosteroid therapy as a control medication, consider using a 2-week short course of oral corticosteroids to assess patient response and confirm clinical reversibility.

For all patients, SABAs should be offered as needed at all steps, and SABA use should be tracked as a measure of disease control because increased SABA use is often a sign of reduced asthma control. After a change in therapy, patients should be re-evaluated within 2 to 6 weeks to monitor adverse events and effectiveness of treatment. Before stepping up therapy, medication adherence should be assessed, and preferred therapies should be substituted for alternative therapies, if applicable.

Consultation with a specialist should occur if step 3 care (in children aged 0–4 y) or step 4 care (in patients aged ≥5 y) or higher is required. Clinicians may also consider a referral at step 2 for children aged 0 to 4 years, at step 3 for patients aged ≥5 years, or at step 4 or higher for patients aged ≥12 years (and also in those for whom immunotherapy may be considered). Specialist consultation is also warranted if the patient has had a severe exacerbation that required hospitalization, additional tests are needed for diagnosis, or the patient cannot achieve or maintain adequate asthma control.

SPECIAL CONSIDERATIONS FOR CHILDREN AGED 0 TO 4 YEARS

Risk, rather than impairment, is generally the more important measure of asthma morbidity in children aged 0 to 4 years because they are often symptom-free between exacerbations. Risk should be assessed based on the history of exacerbations and the risk of pharmacologic adverse events. Control in this age group is assessed based on symptoms (Table 1). The C-ACT can be used as a tool to assess asthma control in children, but it has only been validated for use in those who are at least 4 years of age (Figure 3). As previously noted, the recommendations for the introduction of adjunct therapies differ in this age group. This is largely because of a lack of data available for children in this age group. Furthermore, young children may have difficulty with the coordinated breathing required for aerosol delivery and may not receive adequate drug delivery with aerosol inhalation. Therefore, unlike in older children and adults, if the child's disease is not well controlled with low-dose ICS, the guidelines recommend increasing to medium-dose ICS monotherapy before adding a LABA or an LTRA. At each visit, medication use and patient adherence should be reviewed with the child's parent or caretaker to ensure that appropriate choices for treatment are in place.
SPECIAL CONSIDERATIONS FOR CHILDREN AGED 5 TO 11 YEARS

Both impairment and risk should be used to assess control and guide treatment decisions (Table 2), and the C-ACT (Figure 3) can be used to quickly assess asthma control for all patients aged 5 to 11 years. There is no preferred order among the various adjunctive therapies because these recommendations are based on extrapolations from studies in adults, and there is insufficient clinical information to recommend any adjunct therapy over another in this age group. Children aged 5 to 11 years, especially those >9 years, should be involved as much as possible in their own asthma care. Participation in physical activity should be encouraged, and parents should be strongly encouraged to provide officials at school or care programs with a copy of the child’s written asthma action plan.

SPECIAL CONSIDERATIONS FOR ADULTS AND YOUTHS AGED ≥12 YEARS

For patients aged ≥12 years, asthma management is based on the patient’s level of asthma control, which is defined by symptoms, SABA use, lung function, patient-reported outcomes using questionnaires, the frequency and severity of exacerbations, and adverse events (Table 3). Patients with intermittent asthma and exercise-induced bronchospasm can take a SABA, cromolyn, or nedocromil shortly before exercise to prevent symptom onset. Adolescents should be involved as much as possible in developing their written asthma action plans, and parents should be encouraged to provide school officials with a copy of the plan. Elderly patients should be monitored for increased adverse events or changes in medication metabolism resulting from advancing age.

MANAGING EXACERBATIONS

Patients experiencing mild asthma exacerbations may be treated with SABAs and closely monitored to determine whether additional therapy is warranted. Oral corticosteroids are the preferred treatment option for moderate or severe exacerbations, but the use of >3 courses per year of oral corticosteroids for exacerbations should trigger a reassessment of the patient's current therapy (after first checking on the patient's adherence to medications). Other changes in the updated guidelines regarding exacerbation management include the addition of levalbuterol as a SABA option and the removal of the recommendation to double the ICS dose as a treatment option for exacerbation management at home. The guidelines also recommend that a specialist be consulted under certain circumstances to help manage exacerbations (eg, history of life-threatening exacerbations, comorbidities, or atypical disease presentation).

PATIENT EDUCATION AND SELF-MANAGEMENT

Optimal asthma therapy requires a partnership between clinicians and patients. Patients should be educated at multiple points of care, interacting with healthcare professionals, including PAs, to form a network of clinical support. Clinicians should teach patients about asthma control, the role of inflammation, environmental control measures, self-monitoring techniques, the effects of uncontrolled comorbid conditions that may exacerbate asthma, and how to use medications. As exemplified in Figure 4, an effective asthma control plan should incorporate all of the aforementioned components that may affect asthma control, as well as those that affect the daily management of asthma and of potential exacerbations. Action plans can be based on symptom recognition or peak flow measurements, although long-term peak flow monitoring should be considered for patients with moderate to severe disease. Clinicians should also be aware of issues related to health literacy and cultural/ethnic attitudes toward disease and treatment and tailor their approach to asthma education individually to account for these factors.
Figure 7
Figure 4: Example of a personalized Asthma Action Plan. Adapted with permission from the American Lung Association (New York, NY). (Permission pending)
CONCLUSION

Current treatment options control symptoms but do not prevent disease progression. The stepwise approach to treating asthma symptoms remains the foundation of recommended asthma treatment; however, the revised NAEPP guidelines now incorporate the duality of assessing asthma severity and risk before initiation of therapy and assessing responsiveness to therapy and severity control with ongoing management. Both severity and control are now measured through the related domains of current impairment and future risk.

Anti-inflammatory medications remain the preferred pharmacologic therapy options for the management of asthma; medication recommendations are now stratified into 3 age groups (0–4 y, 5–11 y, and ≥12 y). Healthcare providers should partner with patients to develop individually tailored written asthma action plans that emphasize patient education, appropriate use of pharmacologic therapies, and control of environmental factors and comorbid conditions. Treatment plans should be assessed at regular intervals—at least every 3 months—to account for natural variations in disease severity.

Good asthma control is important to reduce asthma morbidity for patients, and adherence to recommended treatment guidelines can help ensure optimal treatment. In familiarizing themselves with the revised treatment guidelines, PAs can play an integral role in managing asthma and improving the quality of care for patients of all ages.

ACKNOWLEDGMENTS

The author acknowledges Thomas W. Balon, PhD, and Rhonda L. Croxton, PhD, from Complete Healthcare Communications, Inc. (Chadds Ford, PA) for providing medical writing support funded by AstraZeneca LP.

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