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# Guideline for the Diagnosis and Management of Chronic Childhood Asthma

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## Preface

Unless other noted, this guideline is based entirely on the National Institutes of Health (NIH) National Asthma Education and Prevention Program's (NAEPP) Expert Panel Report Panel Report 3 (EPR-3).<sup>1</sup> Childhood asthma is one of the most common chronic diseases of childhood. Six million children in the United States have asthma, based on the annual National Health Interview Survey (NHIS).<sup>2</sup> Investigators from the Arkansas Children's Center, Arkansas Children's Hospital, and University of Arkansas for Medical Sciences Department of Pediatrics have found the prevalence is higher when more robust interviews of parents/caregivers of Arkansas children are performed by local school nurses compared to the NHIS methods. In both rural and urban schools in Arkansas, a prevalence of 25%, or 1 of every 4 children has been documented, and published.<sup>3,4</sup>

Excluding prematurity, congenital anomalies, trauma, and homicide, after 1 year of age asthma is one of the leading natural causes of death in children.<sup>5</sup> According to the Arkansas Department of Health, 2-3 Arkansans (all ages) die each month (annualized average) from acute asthma. In the United States (U. S.), the annual direct costs of asthma including all ages is approximately \$37.2 billion in 2007 U.S. dollars.<sup>6</sup>

Failure to initiate treatment when the diagnosis is considered in young children increases the risks for morbidity and mortality in patients with chronic asthma.

## Definitions

- Asthma is a chronic obstructive lung disease characterized by
  - Airways inflammation
  - Airways obstruction that is at least partially reversible

- Increased airways responsiveness to a variety of stimuli
- Terms used in asthma management
  - **Severity** is the intrinsic intensity of the disease process, most easily and directly measured in a patient currently receiving long-term control treatment.
  - **Control** is the degree to which the manifestations of asthma are minimized and the goals of therapy are met including
    - Symptoms
    - Functional impairment
    - Risks of untoward event
  - **Responsiveness** is the ease with which control is achieved by treatment.

## Goals of Asthma Management

- Prevent symptoms
- Reduce/eliminate the use of short-acting beta<sub>2</sub> agonist ( $\leq 2$  days/week)
- Maintain normal or near normal pulmonary function
- Meet the patients'/families' treatment expectations
- Prevent or reduce the need for unscheduled visits for acute asthma
- Prevent progressive loss of lung function
- Optimize the therapeutic ratio of risk vs. benefit from pharmacotherapy

## Risk Factors for the Development of Asthma

- Eczema, atopy, or a family history of asthma among first degree relatives are the strongest risk factors for the development of asthma. Eighty percent (80%) of children with asthma are atopic.
- Prematurity
- Tobacco smoke exposure
- Poverty and race
- Obesity

## Triggers of Acute Asthma Symptoms/Exacerbations

- Viral respiratory infections
- Exertion
- Allergen exposure
- Environmental tobacco smoke
- Volatile organic compounds
- Poor air quality
  - Carbon monoxide
  - Particulate air pollution from internal combustion engines and industry
  - High ozone

## Diagnosis and Management of Asthma

### Determine

- Episodic symptoms of airflow obstruction present, usually manifested by cough or wheezing episodes
- Airflow obstruction is present, and at least partially reversible
- Alternative diagnoses excluded

## Conduct

- Detailed history
- Physical exam
  - Often normal between exacerbations
  - Signs of atopy in allergic patients
- Spirometry, to demonstrate the severity of airway obstruction and reversibility, in patients  $\geq 5$  years-of-age, which assists in the assessment of asthma severity and control

There may be no more than a 50% correlation of history + physical exam with objective measures of airway function.<sup>7,8</sup>

Objective measurement of lung function is required at the time of considering a diagnosis of asthma and in assessment of asthma control.

## Laboratory Evaluation

Laboratory evaluation is usually limited to

- Pulmonary function testing (PFT)
  - To detect obstruction and evaluate reversibility
  - Needed in classifying chronic asthma severity and to aid in assessing asthma control
  - Recommended for all adults and children  $\geq 5$  years-of-age
  - Can be conducted in office setting
  - Spirometry performed in accordance with the American Thoracic Society standards<sup>9</sup>
  - Normal PFTs do not exclude a diagnosis of asthma
- Chest X-Ray
  - Does NOT establish the diagnosis
  - May rule out other causes of wheezing/alternate diagnoses
  - NOT needed for most exacerbations
  - May be indicated when aspirated foreign body or pneumothorax is suspected at the time of considering an asthma diagnosis or for acute loss of control in a person known to have asthma
- Allergy testing to identify controllable/avoidable aeroallergens
- Final test may be a trial of medications based on severity assessment and the step-wise recommendations.

## Differential Diagnoses

The following may be alternate diagnoses or co-morbid conditions which may lead to poor asthma control in patients with known asthma, if not addressed and treated, in addition to asthma control medications.

- Allergic rhinitis/sinusitis
- Foreign body
- Laryngomalacia
- Tracheomalacia
- Subglottic/tracheal stenosis
- Bronchial stenosis
- Vascular ring and congenital anomalies of the airways
- Cardiomyopathy, including congestive heart failure
- Laryngeal web
- Mediastinal masses
- Functional syndromes
  - Vocal cord dysfunction
  - Psychogenic cough

- Hyperventilation syndrome
- Hypersensitivity pneumonitis
- Cystic fibrosis
- Bronchiolitis obliterans
- Aspiration syndromes
- Symptomatic gastro-esophageal reflux
- Obstructive sleep apnea
- Allergic bronchopulmonary aspergillosis
- Alpha-1 antitrypsin deficiency

## Assessing the Possibility of Asthma in Children <5 years-of-age

- ERP-3 includes indicators of possible asthma in young children.
- After alternate diagnoses are excluded, if a child <5 years-of-age exhibits any 1 of the following characteristics the child has an 80% chance of having asthma at school age:<sup>10,11</sup>
  - Recurring episodes of cough lasting more than 10 days, or
  - Recurring episodes of wheezing, or
  - Recurrent “chest colds” lasting >10 days, or
  - Recurring pneumonia, bronchiolitis, or bronchitis, in otherwise healthy children **and** one of the following:
    - Parental history of asthma
    - Physician-diagnosed eczema
    - Allergic sensitization to ≥1 aeroallergen **or** 2 of the following:
      - Wheezing unrelated to upper respiratory infections
      - Blood eosinophil counts >4%
      - Allergic sensitization to milk, eggs, or peanuts
  - To assess asthma at this age, a child who meets the above criteria, and who has 1 or more of the following characteristics should be strongly considered for initiation of asthma management
    - Four (4) or more episodes of wheezing within a 12-month period, or
    - Episodes of persistent cough >4 weeks of duration, or
    - Acute wheeze episodes <6 weeks apart, or
    - Cough/wheeze episodes (which respond to short-acting beta<sub>2</sub> agonists, SABA) requiring treatments with SABA >2 times/week, or
    - Requirement of oral corticosteroid bursts >2 times within 6 months
- Table I is provided to assist in classifying asthma in children <5 years-of-age:<sup>1</sup>
- If alternate diagnoses have been considered and excluded, controller medications should be started as causes of airways inflammation are identified and avoidance strategies initiated.
- Any characteristic shown in Table I places the patient in the corresponding highest severity category.
- In Figure 1, the recommended step-wise approach initiation of controllers to initiate therapy is listed based on the assessment of severity.
- After controller medications and avoidance strategies have been started, asthma control must be assessed at subsequent visits with the initial assessment 2-6 weeks after starting control treatments.
- As noted in Table 2, in children <5 years of age, a reduction or elimination of the frequency of exacerbations is the key indicator of control at this age as almost all acute episodes are triggered by viral respiratory infections in preschool children.
  - Between such viral respiratory infections the child is usually asymptomatic.
  - If the criteria in Table I are met, recurrent wheezing episodes with viral respiratory illnesses may indicate a young child has asthma.
  - Recurring episodes of wheezing after 2 years of age, unless there is an innate abnormality of the airway, is abnormal.
  - Asthma is the most common condition which predisposes an increased risk for recurring wheeze episodes.
  - Alternate diagnoses must be considered and excluded when asthma is considered at any age, or if patients with suspected asthma do not respond to currently recommended treatments.
  - Since >80% of children and >50% of adults who have asthma are atopic, identifying and avoiding aeroallergen triggers are imperative.
  - For highly allergic patients who do not respond to medical management of allergic rhinitis and

associated allergy-related chronic asthma, referral to an allergist for consideration of allergy immunotherapy is recommended at any age.

**Table 1. Classifying Asthma Severity and Initiating Treatment in Children 0-4 Years of Age: Assessing severity and initiating therapy in children who are not currently taking long-term control medication**

To view a larger image on your device, please click or touch the image.

**Table 1. Classifying Asthma Severity and Initiating Treatment in Children 0-4 Years of Age**

Assessing severity and initiating therapy in children who are not currently taking long-term control medication

Components of Severity		Classification of Asthma Severity (0-4 years of age)				
		Intermittent	Persistent			
			Mild	Moderate	Severe	
Impairment	Symptoms	≤ 2 days/week	>2 days/week but not daily	Daily	Throughout the day	
	Nighttime awakenings	0	1-2x/month	3-4x/month	>1x/week	
	Short-acting beta <sub>2</sub> -agonist use for symptom control (not prevention of EIB)	≤ 2 days/week	>2 days/week but not daily	Daily	Several times per day	
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited	
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	$\geq 2$ exacerbations in 6 months requiring oral systemic corticosteroids, or $\geq 4$ wheezing episodes/1 year lasting >1 day AND risk factors for persistent asthma			
		Consider severity and interval since last exacerbation ← Frequency and severity may fluctuate over time → Exacerbations of any severity may occur in patients in any severity category				
Recommended Step for Initiating Treatment		Step 1	Step 2	Step 3 and consider short course of oral systemic corticosteroids		
		In 2-6 weeks, depending on severity, evaluate level of asthma control that is achieved. If no clear benefit is observed in 4-6 weeks, consider adjusting therapy or alternative diagnosis.				

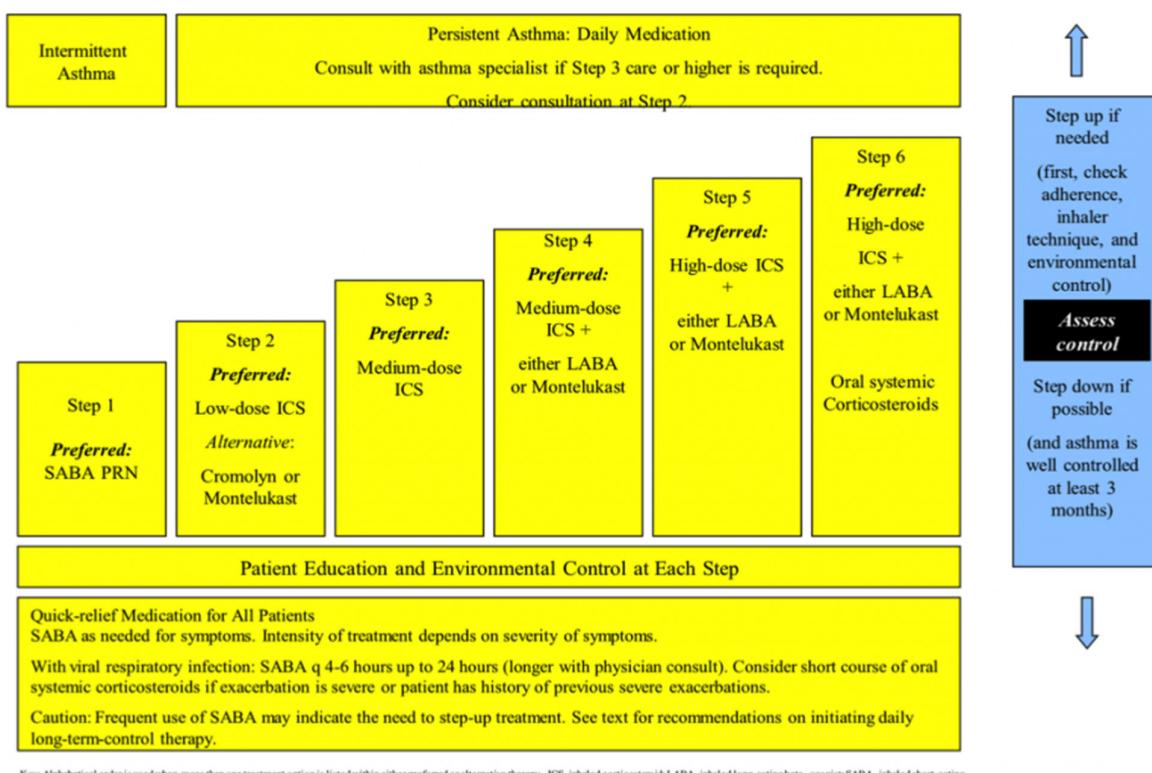
Key: EIB, exercise-induced bronchospasm

National Asthma Education and Prevention Program. Publication No. 07-4051. Available from: <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm>

**Figure 1. Step-wise Approach for Managing Asthma in Children 0-4 Years of Age**

To view a larger image on your device, please click or touch the image.

**Figure 1. Step-wise Approach for Managing Asthma in Children 0-4 Years of Age**



**Table 2. Assessing Asthma Control and Adjusting Therapy in Children 0-4 Years of Age**

To view a larger image on your device, please click or touch the image.

**Table 2. Assessing Asthma Control and Adjusting Therapy in Children 0-4 Years of Age**

Components of Control		Classification of Asthma Control (0-4 years of age)		
		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤ 2 days/week	>2 days/week	Throughout the day
	Nighttime awakenings	≤ 1x/month	>1x/month	>1x/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting beta <sub>2</sub> -agonist use for symptom control (not prevention of EIB)	≤ 2 days/week	>2 days/week	Several times per day
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	2-3/year	>3/year
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		
Recommended Action for Treatment		<ul style="list-style-type: none"> <li>• Maintain current treatment</li> <li>• Regular follow up every 1-6 months</li> <li>• Consider step down if well controlled for at least 3 months</li> </ul>	<ul style="list-style-type: none"> <li>• Step up (1 step) and Reevaluate in 2-6 weeks</li> <li>• If no clear benefit in 4-6 weeks, consider alternative diagnoses or adjusting therapy</li> <li>• For side effects, consider alternative treatment options</li> </ul>	<ul style="list-style-type: none"> <li>• Consider short course of oral systemic corticosteroids</li> <li>• Step up (1-2 steps), and Reevaluate in 2 weeks</li> <li>• If no clear benefit in 4-6 weeks, consider alternative diagnoses or adjusting therapy</li> <li>• For side effects, consider alternative treatment options</li> </ul>

Key: EIB, exercise-induced bronchospasm

National Asthma Education and Prevention Program. Publication No. 07-4051. Available from: <http://www.ncbi.nlm.nih.gov/guidelines/asthma/asthgdn.htm>

## Assessing the Possibility of Asthma in Children 5-11 years of age

- Recurrent episodes of wheezing or episodes of prolonged cough
- Nocturnal or early morning wheeze or cough
- Recurring “chest colds” lasting >10 days/episode
- Recurrent bronchiolitis, bronchitis, or pneumonia in otherwise healthy children
- Recurring episodes of chest pain, cough, shortness of breath, or dyspnea with exertion during
  - Running
  - Playing
  - Sports participation
  - Laughing
  - Crying/sobbing

At least 80% of patients with asthma exhibit acute symptoms with exertion.

Exertion-related symptoms in a patient with known asthma may indicate poor asthma control.<sup>12</sup>

- Table 3 is provided to assist in classifying asthma in children 5-11 years of age.
- For children 5-11 years of age, 6 areas of questioning must be asked to accurately assess asthma severity including
  - Symptoms
  - Nocturnal awakenings
  - Frequency of short-acting beta<sub>2</sub> agonists use
  - Physical activity limitations
  - Lung function testing results
  - Frequency of exacerbations requiring unscheduled visits for acute asthma

A positive response to these questions places the patient in the highest category for which there is a positive answer.<sup>o</sup>

Once asthma severity is assessed, the evidenced-based recommendations are found in the step-wise approach to initiating controller therapy (Figure 2).

- Asthma control is assessed 2-6 weeks after initiating controller therapy and at subsequent visits to the primary care or specialty provider (Table 4).
- Once asthma is well-controlled for at least 3-6 months, the medical provider should determine if control can be maintained by stepping down controller therapy to the next lower step.
  - Regarding inhaled corticosteroid therapy (ICS), this reduction should be no more than 50% of the current ICS dose per step down.
  - After step down, reassessment of control is required.
  - Step down to lower doses of controller therapy is more likely to be successful if strategies to identify and avoid triggers of airways inflammation have been implemented.
- Reassessments of control are required periodically based upon
  - Initial assessment of severity
  - Response to therapy

### **Table 3. Classifying Asthma Severity and Initiating Treatment in Children 5-11 Years of Age: Assessing severity and initiating therapy in children who are not currently taking long-term control medication**

To view a larger image on your device, please click or touch the image.

**Table 3. Classifying Asthma Severity and Initiating Treatment in Children 5 – 11 Years of Age  
Assessing severity and initiating therapy in children who are not currently taking long-term control medication**

Components of Severity		Classification of Asthma Severity ( 5-11 years of age )					
		Intermittent	Persistent				
			Mild	Moderate	Severe		
Impairment	Symptoms	? 2 days/week	>2 days/week but not daily	Daily	Throughout the day		
	Nighttime awakenings	? 2x/month	3-4x/month	>1x/week but not nightly	Often 7x/week		
	Short - acting beta agonist use for symptom control (not prevention of EIB)	? 2 days/week	>2 days/week but not daily	Daily	Several times per day		
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited		
	Lung function	<ul style="list-style-type: none"> <li>• Normal FEV<sub>1</sub> between exacerbations</li> <li>• FEV<sub>1</sub> &gt; 80% predicted</li> <li>• FEV<sub>1</sub>/FVC &gt;85%</li> </ul>	<ul style="list-style-type: none"> <li>• FEV<sub>1</sub> = &gt; 80% predicted</li> <li>• FEV<sub>1</sub>/FVC &gt;80%</li> </ul>	<ul style="list-style-type: none"> <li>• FEV<sub>1</sub> = 60-80% predicted</li> <li>• FEV<sub>1</sub>/FVC =75 - 80%</li> </ul>	<ul style="list-style-type: none"> <li>• FEV<sub>1</sub> &lt; 60% predicted</li> <li>• FEV<sub>1</sub>/FVC &lt;75%</li> </ul>		
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year (see note)	? 2/year (see note)	→			
		← Consider severity and interval since last exacerbation → Frequency and severity may fluctuate over time for patients in any severity category					
		Relative annual risk of exacerbations may be related to FEV <sub>1</sub>					
Recommended Step for Initiating Treatment		Step 1	Step 2	Step 3, medium -dose ICS option <sup>a</sup>	Step 3, medium -dose ICS or Step 4 and consider short course of oral systemic corticosteroids		
In 2-6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.							

Note: <sup>a</sup> At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity underlying disease severity. For treatment purposes, patients who had 7-2 exacerbations requiring oral systemic corticosteroids per year would be considered to have persistent asthma.

Table 3 from: National Asthma Education and Prevention Program. Publication No. 07

4051. Available from:

<http://www.nhlbi.nih.gov/guidelines/asthma/asthgdp.htm>

In general, more frequent and intense exacerbations (e.g. requiring urgent, unscheduled care, hospitalization, or ICU admission)

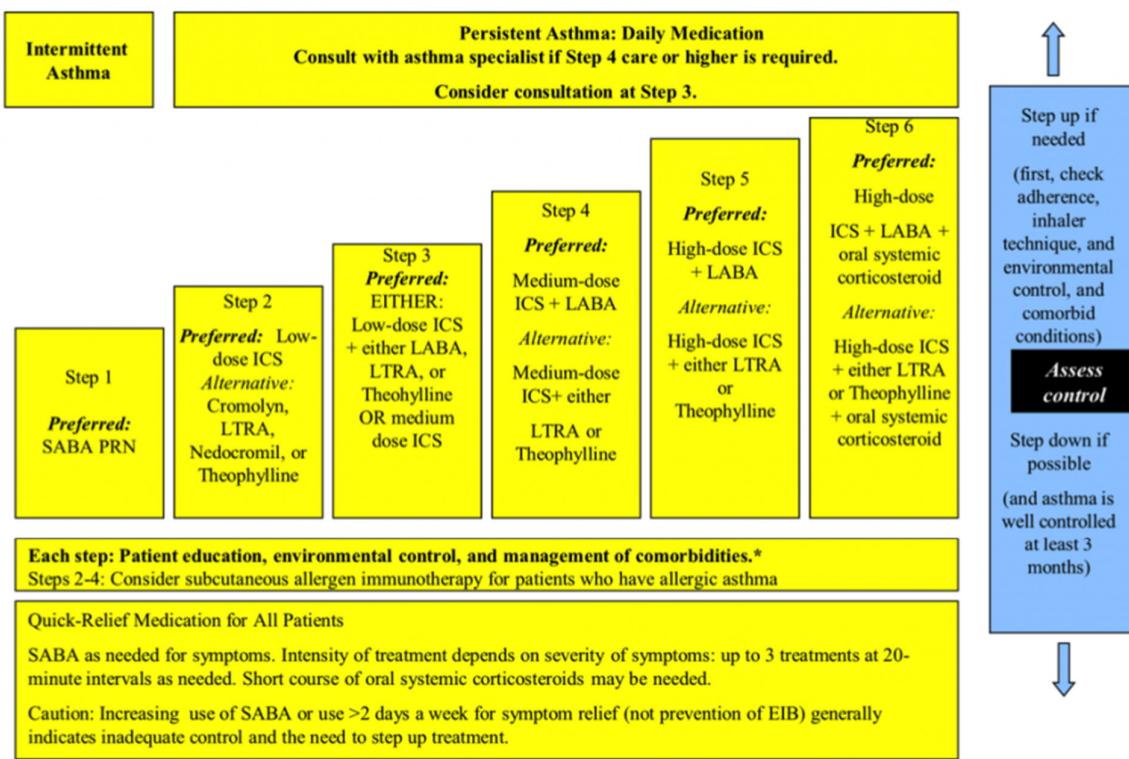
id: In the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels

<sup>a</sup> indicate greater co-existent with

### **Figure 2. Step-wise Approach for Managing Asthma in Children 5-11 Years of Age**

To view a larger image on your device, please click or touch the image.

**Figure 2. Step-wise Approach for Managing Asthma in Children 5-11 Years of Age**



**Table 4. Assessing Asthma Control and Adjusting Therapy in Children 5-11 Years of Age**

To view a larger image on your device, please click or touch the image.

**Table 4. Assessing Asthma Control and Adjusting Therapy in Children 5-11 Years of Age**

Components of Control		Classification of Asthma Control ( 5-11 years of age)				
		Well Controlled	Not Well Controlled	Very Poorly Controlled		
Impairment	Symptoms	≤ 2 days/week but not more than once on each day	>2 days/week or multiple times on ≤ 2 days/week	Throughout the day		
	Nighttime awakenings	≤ 1x/month	≥ 2x/month	≥ 2x/week		
	Interference with normal activity	None	Some limitation	Extremely limited		
	Short-acting beta <sub>2</sub> -agonist use for symptom control (not prevention of EIB)	≤ 2 days/week	>2 days/week	Several times per day		
	Lung function •FEV <sub>1</sub> or peak flow •FEV <sub>1</sub> /FEV	• >80% predicted/ personal best • >80%	• 60-80% predicted/ personal best • 75-80%	• <60% predicted/personal best • <75%		
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	≥ 2/year (see note) Consider severity and interval since last exacerbation			
	Reduction in lung growth	Evaluation requires long-term follow up.				
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk				
<b>Recommended Action for Treatment</b>		• Maintain current step • Regular follow up every 1-6 months • Consider step down if well controlled for at least 3 months	• Step up at least 1 step and • Reevaluate in 2-6 weeks • For side effects: consider alternative treatment options.	• Consider short course of oral systemic corticosteroids • Step up 1-2 steps, and • Reevaluate in 2 weeks • For side effects, consider alternative treatment options		

Key for Table 4: EIB, exercise-induced bronchospasm; FEV<sub>1</sub>, forced expiratory volume in 1 second; FVC, forced vital capacity.  
Note: At present, there are inadequate data to correspond frequency of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g., requiring urgent/unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥ 2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma. Table 4 from: National Asthma Education and Prevention Program. Publication No. 07-4051. Available from: <http://www.ncbi.nlm.nih.gov/guidelines/asthma/asthgdln.htm>

## Assessing the Possibility of Asthma in Youth ≥ 12 years of age and Adults

**Table 5. Classifying Asthma Severity and Initiating Treatment in Youth ≥ 12 Years of Age and Adults: Assessing severity and initiating treatment for patients who are not currently taking long-term control medications**

To view a larger image on your device, please click or touch the image.

**Table 5. Classifying Asthma Severity and Initiating Treatment in Youth  $\geq$  12 Years of Age and Adults**  
Assessing severity and initiating treatment for patients who are not currently taking long-term control medications

Components of Severity		Classification of Asthma Severity ( $\geq$ 12 years of age)				
		Intermittent	Persistent			
			Mild	Moderate	Severe	
<b>Impairment</b>  Normal FEV <sub>1</sub> /FVC: 8-19 yr 85% 20-39 yr 80% 40-59 yr 75% 60-80 yr 70%	Symptoms	$\leq$ 2 days/week	>2 days/week but not daily	Daily	Throughout the day	
	Nighttime awakenings	$\leq$ 2x/month	3-4x/month	>1x/week but not nightly	Often 7x/week	
	Short-acting beta <sub>2</sub> -agonist use for symptom control (not prevention of EIB)	$\leq$ 2 days/week	>2 days/week but not daily, and not more than 1x on any day	Daily	Several times per day	
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited	
	Lung function	<ul style="list-style-type: none"> <li>• Normal FEV<sub>1</sub> between exacerbations</li> <li>• FEV<sub>1</sub> &gt; 80% predicted</li> <li>• FEV<sub>1</sub>/FVC normal</li> </ul>	<ul style="list-style-type: none"> <li>• FEV<sub>1</sub> &gt; 60% but &lt;80% predicted</li> <li>• FEV<sub>1</sub>/FVC normal</li> </ul>	<ul style="list-style-type: none"> <li>• FEV<sub>1</sub> &gt; 60% but &lt;80% predicted</li> <li>• FEV<sub>1</sub>/FVC reduced &gt;5%</li> </ul>	<ul style="list-style-type: none"> <li>• FEV<sub>1</sub> &lt; 60% predicted</li> <li>• FEV<sub>1</sub>/FVC reduced &gt;5%</li> </ul>	
<b>Risk</b>	Exacerbations requiring oral systemic corticosteroids	0-1/year (see note)	$\geq$ 2/year(see note)	→		
		← Consider severity and interval since last exacerbation → Frequency and severity may fluctuate over time for patients in any severity category Relative annual risk of exacerbations may be related to FEV <sub>1</sub>				
<b>Recommended Step for Initiating Treatment</b>		Step 1	Step 2	Step 3 and consider short course of oral systemic corticosteroids	Step 4 or 5	
In 2-6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly						

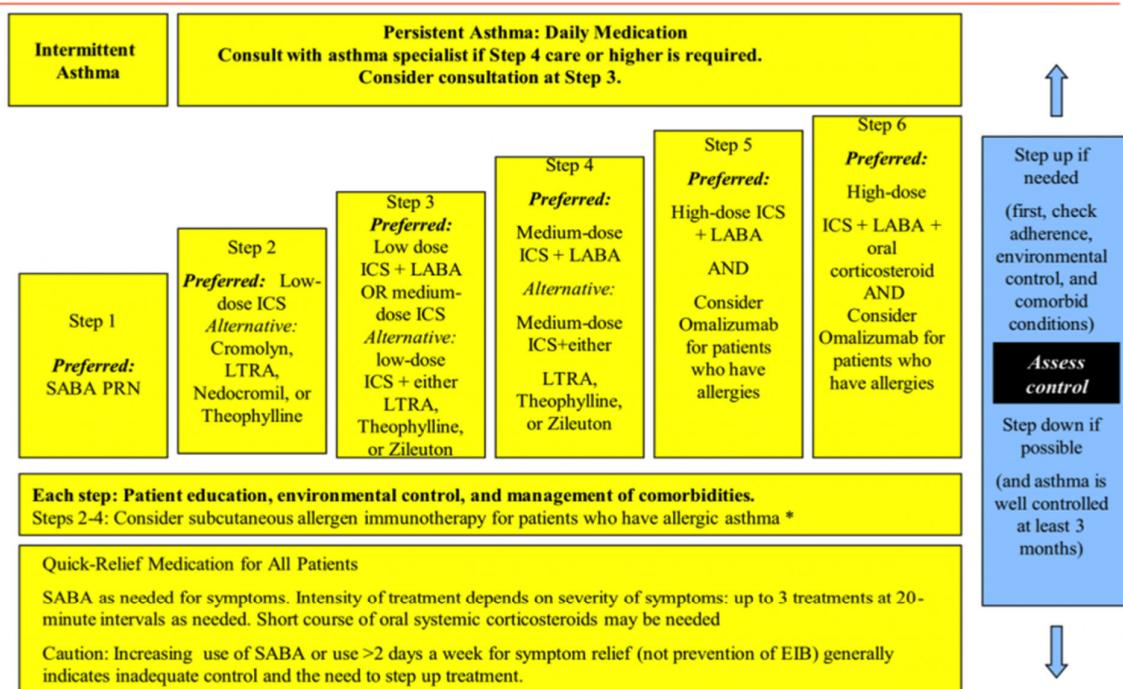
Key: FEV<sub>1</sub>, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit

Note: At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g. requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had  $\geq$  2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma. Table 5 from National Asthma Education and Prevention Program. Publication No. 07-4051. Available from: <http://www.nih.gov/guidelines/asthma/asthgdin.htm>

### Figure 3. Step-wise Approach for Managing Asthma in Youth $\geq$ 12 Years of Age and Adults

To view a larger image on your device, please click or touch the image.

**Figure 3. Step-wise Approach for Managing Asthma in Youth ≥ 12 Years of Age and Adults**



**Key:** Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy. EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, inhaled long-acting beta<sub>2</sub>-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta<sub>2</sub>-agonist

\*Immunotherapy for steps 2-4 is based on Evidence B for house-dust mites, animal danders, and pollens; evidence is weak or lacking for molds and cockroaches. Evidence is strongest for immunotherapy with single allergens. The role of allergy in asthma is greater in children than in adults. Clinicians who administer immunotherapy should be prepared and equipped to identify and treat anaphylaxis which may occur.

Figure 8 from National Asthma Education and Prevention Program. Publication No. 07-4051. Available from: <http://www.ncbi.nlm.nih.gov/guidelines/asthma/asthgdln.htm>

**Table 6. Assessing Asthma Control and Adjusting Therapy in Youth ≥ 12 Years of Age and Adults**

To view a larger image on your device, please click or touch the image.

**Table 6. Assessing Asthma Control and Adjusting Therapy in Youth ≥ 12 Years of Age and Adults**

Components of Control		Classification of Asthma Control (≥ 12 years of age)				
		Well Controlled	Not Well Controlled	Very Poorly Controlled		
Impairment	Symptoms	≤ 2 days/week	>2 days/week	Throughout the day		
	Nighttime awakenings	≤ 2x/month	1-3x/week	≥ 4x/week		
	Interference with normal activity	None	Some limitation	Extremely limited		
	Short-acting beta <sub>2</sub> -agonist use for symptom control (not prevention of EIB)	≤ 2 days/week	>2 days/week	Several times per day		
	FEV <sub>1</sub> or peak flow	>80% predicted/personal best	60-80% predicted/personal best	<60% predicted/personal best		
	Validated Questionnaires ATAQ ACQ ACT	0 ≤ 0.75* ≥ 20	1-2 ≥ 1.5 16-19	3-4 N/A ≤ 15		
Risk	Exacerbations requiring oral/systemic corticosteroids	0-1/year	> 2/year (see note) Consider severity and interval since last exacerbation			
	Progressive loss of lung function	Evaluation requires long-term follow-up care				
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.				
<b>Recommended Action for Treatment</b>		<ul style="list-style-type: none"> <li>• Maintain current step</li> <li>• Regular follow ups every 1-6 months to maintain control</li> <li>• Consider step down if well controlled for at least 3 months</li> </ul>	<ul style="list-style-type: none"> <li>• Step up 1 step and</li> <li>• Reevaluate in 2-6 weeks</li> <li>• For side effects, consider alternative treatment options</li> </ul>	<ul style="list-style-type: none"> <li>• Consider short course of oral/systemic corticosteroids</li> <li>• Step up 1-2 steps, and</li> <li>• Reevaluate in 2 weeks</li> <li>• For side effects, consider alternative treatment options</li> </ul>		

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

Key: EIB, exercise-induced bronchospasm; ICU, intensive care unit.

Note: At present, there are inadequate data to compare frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g. requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥ 2 exacerbations requiring oral/systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma even in the absence of impairment levels consistent with persistent asthma. Table 6 from: National Asthma Education and Prevention Program. Publication No. 07-40S. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1910483/>

## Reassessing Asthma Control

- The frequency of reassessment of asthma control is related to the initial asthma severity and responsiveness to treatment.
  - In general, visits will range from monthly to yearly depending on initial severity and response to treatment.
- At each visit, the following evaluations are recommended
- Signs and symptom
  - Pulmonary function testing
    - The flow volume loop is sufficient after initial assessment.
    - A bronchodilator challenge with a short-acting beta<sub>2</sub> agonist, in addition to a flow volume loop without bronchodilator, is recommended at least yearly.
  - Quality of life/functional status
  - History of exacerbations
  - Adherence and barriers to treatment
  - Revision/review of action plan at every visit
  - Review techniques for proper use of all inhaled devices
  - Communication and patient satisfaction
- Patients with well-controlled asthma rarely need short-acting beta<sub>2</sub> agonists and seldom (<1/year) need oral steroid bursts for acute asthma.

## Indications for Referral to an Asthma Specialist

- When control is not achieved with low-medium doses of ICS, either alone or in combination with recommended adjunctive therapies
- Children <5 years of age requiring >Step 2 therapy
- Older patient requiring >Step 3 therapy
- Difficulty in achieving or maintaining control
- Age-specific bone density for patients requiring treatment Steps 5-6
- Frequent oral/systemic steroid bursts for acute asthma episodes unresponsive to short-acting beta<sub>2</sub>

agonists

## Additional Testing Required

- Allergy evaluation
- Broncho-provocation test for patients with suspected asthma with normal office pulmonary function testing, even during exacerbations
- Evaluation to rule out alternate diagnoses or additional management of comorbid diagnoses
- Pulmonary functioning tests required to determine severity and guide treatment to achieve control

## Likelihood of Persistent, Poorly-Controlled Asthma

- Albuterol use >2 times/week, or
- Nocturnal awakening >2 times/month, or
- Albuterol refills >2 times/year, or
- Oral steroid use >2 times/year, or
- Acute symptoms requiring health care visits >2 times/year

## Table 7. Estimated Comparative Daily Dosages for Inhaled Corticosteroids in Children

To view a larger image on your device, please click or touch the image.

Estimated Comparative Daily Dosages for Inhaled Corticosteroids in Children

Drug	Low Daily Dose		Medium Daily Dose		High Daily Dose	
	Child 0-4	Child 5-11	Child 0-4	Child 5-11	Child 0-4	Child 5-11
<b>Bclomethasone HFA</b> 40 or 80 mcg/puff	NA	80-160 mcg	NA	>160-320 mcg	NA	>320 mcg
<b>Budesonide DPI</b> 90, 180, or 200 mcg/inhalation	NA	180-400 mcg	NA	>400-800 mcg	NA	>800 mcg
<b>Budesonide inhaled</b> Inhalation suspension for nebulization (child dose)	0.25-0.5 mg	0.5 mg	>0.5-1.0 mg	1.0 mg	>1.0 mg	2.0 mg
<b>Flunisolide</b> 250 mcg/puff	NA	500-750 mcg	NA	1,000-1,250 mcg	NA	>1,250 mcg
<b>Flunisolide HFA</b> 80 mcg/puff	NA	160 mcg	NA	320 mcg	NA	≥640 mcg
<b>Fluticasone</b> <b>HFA/MDI:</b> 44, 110, or 220 mcg/puff	176 mcg	88-176 mcg	>176-352 mcg	>176-352 mcg	>352 mcg	>352 mcg
<b>DPI:</b> 50, 100, or 250 mcg/inhalation	NA	100-200 mcg	NA	>200-400 mcg	NA	>400 mcg
<b>Mometasone DPI</b> 200 mcg/inhalation	NA	NA	NA	NA	NA	NA
<b>Triamcinolone acetonide</b> 75 mcg/puff	NA	300-600 mcg	NA	>600-900 mcg	NA	>900 mcg

Key: HFA, hydrofluoroalkane; NA, not approved and no data available for this age group

NOTES:

- The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy. The clinician must monitor the patient's response on several clinical parameters and adjust the dose accordingly. The stepwise approach to therapy emphasizes that once control of asthma is achieved, the dose of medication should be carefully titrated to the minimum dose required to maintain control, thus reducing the potential for adverse effect.
- Some doses may be outside package labeling, especially in the high-dose range. Budesonide nebulizer suspension is the only ICS with FDA approved labeling for children <4 years of age.
- Metered-dose inhaler (MDI) dosages are expressed as the actuator dose (the amount of the drug leaving the actuator and delivered to the patient), which is the labeling required in the United States. This is different from the dosage expressed as the valve dose (the amount of drug leaving the valve, not all of which is available to the patient), which is used in many European countries and in some scientific literature. Dry powder inhaler (DPI) doses are expressed as the amount of drug in the inhaler following activation.
- For children <4 years of age: The safety and efficacy of ICSs in children <1 year has not been established. Children <4 years of age generally require delivery of ICS (budesonide and fluticasone HFA) through a face mask that should fit snugly over nose and mouth and avoid nebulizing in the eyes. Wash face after each treatment to prevent local corticosteroid side effects. For budesonide, the dose may be administered 1-3 times daily. Budesonide suspension is compatible with albuterol, ipratropium, and levalbuterol nebulizer solutions in the same nebulizer. Use only jet nebulizers, as ultrasonic nebulizers are ineffective for suspensions.
- For fluticasone HFA, the dose should be divided 2 times daily; the low dose for children <4 years is higher than for children 5-11 years of age due to lower dose delivered with face mask and data on efficacy in young children.

*This guideline was developed to improve health care access in Arkansas and to aid health care providers in making decisions about appropriate patient care. The needs of the individual patient, resources available, and limitations unique to the institution or type of practice may warrant variations.*

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