

## **Pediatric Asthma Care Guidelines 2008/Revised September 2011/ Revised February 6, 2013**

Texas Children's Health Plan

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Abbreviations used:

EIB: Exercise induced bronchospasm

ICS: Inhaled corticosteroid

SABA: Short acting beta agonist

LABA: Long acting beta agonist

OSA: Obstructive sleep apnea

ED: Emergency Department

TCHP: Texas Children's Health Plan

LTRA: Leukotriene Receptor Antagonist

### **I. What is asthma?**

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. In susceptible individuals, this inflammation causes recurrent episodes of coughing (particularly at night or early in the morning), wheezing, breathlessness, and chest tightness. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment.

Airflow limitation is caused by a variety of changes in the airway, all influenced by airway inflammation:

- ❑ **Bronchoconstriction**—bronchial smooth muscle contraction that quickly narrows the airways in response to exposure to a variety of stimuli, including allergens or irritants.
- ❑ **Airway hyperresponsiveness**—an exaggerated bronchoconstrictor response to stimuli.
- ❑ **Airway edema**—as the disease becomes more persistent and inflammation becomes more progressive, edema, mucus hyper secretion, and formation of inspissated mucus plugs further limit airflow.

### **II. Key Symptoms for considering a diagnosis of asthma.**

- ❑ Wheezing—high-pitched whistling sounds when breathing out.
- ❑ History of any of the following:
  - Cough (worse particularly at night)
  - Recurrent wheeze
  - Recurrent difficulty in breathing
  - Recurrent chest tightness
- ❑ Symptoms occur or worsen in the presence of:
  - Exercise

- Viral infection
- Inhalant allergens (e.g., animals with fur or feathers, house-dust mites, mold, pollen)
- Irritants (tobacco or wood smoke, airborne chemicals)
- Changes in weather
- Strong emotional expression (laughing or crying hard)
- Stress
- Menstrual cycles
- Symptoms occur or worsen at night, awakening the patient.
- Spirometry can demonstrate obstruction and assess reversibility in patients  $\geq 5$  years of age. Spirometry is an objective measure to establish the diagnosis of asthma,

### III. Managing asthma long term

#### A. Goals of Therapy:

- **Reduce Impairment**
  - Prevent chronic and troublesome symptoms (e.g., coughing or breathlessness in the daytime, in the night, or after exertion).
  - Require infrequent use ( $\leq 2$  days a week) of inhaled short acting beta agonist for quick relief of symptoms (not including prevention of exercise-induced bronchospasm).
  - Maintain (near) normal pulmonary function.
  - Maintain normal activity levels (including exercise and other physical activity and attendance at school or work).
  - Meet patients' and families' expectations of and satisfaction with asthma care.
- **Reduce Risk**
  - Prevent recurrent exacerbations of asthma and minimize the need for ED visits or hospitalizations.
  - Prevent loss of lung function; for children, prevent reduced lung growth.
  - Provide optimal pharmacotherapy with minimal or no adverse effects of therapy.

### IV. Assessment of asthma

**Initial Assessment:** The goal is to characterize the patient's asthma and guide decisions for initiating therapy

- Classify asthma severity.
- Identify precipitating factors (e.g., exposure at home, work, daycare, or school to inhalant allergens or irritants).
- Identify comorbid conditions that may impede asthma management (e.g., sinusitis, rhinitis, OSA, obesity, stress, or depression).
- Assess the patient's knowledge and skills for self-management.

#### **Ongoing monitoring:**

Visit Frequency:

— Visits at 2- to 6-week intervals are appropriate for patients who are just starting therapy or who require a step up in therapy to achieve or regain asthma control.

— Visits at 1- to 6-month intervals are recommended after asthma control is achieved, to monitor whether asthma control is maintained. The interval will depend on factors such as the duration of asthma control or the level of treatment required.

— Consider scheduling visits at 3-month intervals if a step down in therapy is anticipated.

### **Visit Content:**

- Assess asthma control
    - Use a validated questionnaire to aid in assessment of asthma control for children 4 years and over, such as the Asthma Control Test (ACT) and the Asthma Therapy Assessment Questionnaire (ATAQ).
    - If equipment and skill for use is available consider spirometry to obtain objective measures of lung function.
      - Spirometry with bronchodilator challenge is particularly important for adults to differentiate between asthma and COPD.
  - Assess exposure to asthma triggers
  - Assess medication technique and adherence
  - Assess and update the written asthma action plan
  - Address patient concerns
  
  - **Provide Patient Education**
    - **Teach and Reinforce Key Educational Messages at Every Opportunity**
- 1) Basic Facts about Asthma
    - The contrast between airways of a person who has and a person who does not have asthma
    - The role of inflammation.
    - What happens to the airways during an asthma attack?
  - 2) Role of Medications: Understanding the Difference Between:
    - Long-term control medications: prevent symptoms, often by reducing inflammation. Must be taken daily.
    - Quick-relief medications: short acting beta agonists relax airway muscles to provide prompt relief of symptoms.
    - Using short acting beta agonist quick relief medications >2 days a week to relieve asthma symptoms suggests the need to re-assess asthma control and consider escalation of asthma control therapy.
  - 3) Patient Skills
    - Taking medications correctly
      - Inhaler technique (demonstrates to the patient and has the patient return the demonstration).
      - Use of devices, as prescribed (e.g., inhalers, valved holding chamber or spacer, nebulizer).
    - Identifying and avoiding environmental exposures that worsen the patient's asthma (e.g., allergens, irritants, tobacco smoke).
    - Self-monitoring
      - Assess level of asthma control.
      - Monitor symptoms and, if prescribed, Peak Expiratory Flow measures.
      - Recognize early signs and symptoms of worsening asthma.
    - Using a written asthma action plan to know when and how to:
      - Take daily actions to control asthma.
      - Adjust medication in response to signs of worsening asthma.

- Seeking medical care as appropriate.
- Periodic monitoring to adjust therapy: Instruct patients to monitor their asthma control in an ongoing manner. All patients should be taught how to recognize inadequate asthma control.
  - Either symptom or peak flow monitoring is appropriate for most patients; evidence suggests the benefits are similar.
  - Consider daily peak-flow monitoring for patients who have moderate or severe persistent asthma, patients who have a history of severe exacerbations, and patients who poorly perceive airway obstruction or worsening asthma.

## **VI. Control of Environmental Factors and Comorbid Conditions That Affect Asthma**

### **Allergens and Irritants**

#### **Evaluate the potential role of allergens (particularly inhalant allergens) and irritants.**

- Identify allergen and pollutants or irritant exposures. The most important allergens for both children and adults appear to be those that are inhaled.
- For patients who have persistent asthma, consider referral for skin testing or in vitro (Allergen Specific IgE) testing to assess sensitivity to inhalant allergens. Assess the significance of positive tests in the context of the person's history of symptoms when exposed to the allergen.
  - Appropriate in vitro test panels to assess for inhalant allergens for the East Texas area include:
    - QUEST Diagnostics, Respiratory Allergy Profile Region X: Test Code 10651
    - LABCORP Allergen Profile, Regional Allergen Zone 6 : Test Number: 676569
- As involuntary tobacco smoke exposure is common, assess potential for tobacco smoke exposure inside and outside of the home. Provide recommendations and/or referral for tobacco dependence treatment if appropriate. Telephonic tobacco dependence treatment services are available from the National Quit Line at 1 800 QUIT NOW and the American Cancer Society at 1 800 ACS 2345.
- Advise patients who have asthma to reduce exposure to allergens to which they are sensitized and to reduce exposure to smoke, pollution, and strong chemicals.

### **Comorbid Conditions**

Identify and treat comorbid conditions that may impede asthma management. If these conditions are treated appropriately, asthma control may improve.

- **Obese or overweight patients** who have asthma may be advised that weight loss, in addition to improving overall health, might also improve asthma control.
  - **Obstructive Sleep Apnea (OSA)** may be considered in patients who have not well controlled asthma, particularly those who are overweight or obese and who have history of difficulty breathing with sleep.
- **Rhinitis or sinusitis** symptoms or diagnosis should be evaluated in patients who have asthma, because the interrelationship of the upper and lower airway suggests that therapy for the upper airway will improve asthma control.

- **Stress and depression** should be considered in patients who have asthma that is not well controlled. Additional education to improve self-management and coping skills may be helpful.

## VII. Medications for asthma:

Medications for asthma are categorized into two general classes: long-term control medication and quick-relief medication. Selection of medications includes consideration of the general mechanisms and role of the medication in therapy, delivery devices, patient preferences, and safety.

**General Mechanisms and Role in Therapy:** Long-term control medications are used daily to

achieve and maintain control of persistent asthma. The most effective are those that attenuate the underlying inflammation characteristic of asthma.

**Long-term control medications include the following:**

- **Inhaled Corticosteroids (ICS)** are the most consistently effective long-term control medication at all steps of care for persistent asthma. ICS medication, when used regularly, improves asthma control more effectively than any other single long-term control medication. **LABA** (salmeterol and formoterol) are inhaled bronchodilators that have a duration of bronchodilation of at least 12 hours after a single dose.
  - LABA medication is not **to be used as monotherapy** for long-term control of asthma.
  - LABA medication is an option for use in combination with ICS for long-term control of symptoms in moderate or severe persistent asthma who are not well controlled on an ICS medication alone> Initiation of therapy with a LABA/ICS combination can be considered for whose disease severity clearly warrants consideration of treatment with both an inhaled corticosteroid and a LABA (Step 3 care or higher in children ≥5 years of age and adults).
  - Note Black Box Warning for Long Acting Beta Agonists: “Long-acting beta2-adrenergic agonists (LABAs) increase the risk of asthma-related death ... Only prescribe (a LABA/ICS combination medication) for patients not adequately controlled on a long-term asthma control medication, such as an inhaled corticosteroid, or whose disease severity clearly warrants initiation of treatment with both an inhaled corticosteroid and a LABA. Once asthma control is achieved and maintained, assess the patient at regular intervals and step down therapy if possible.”
- **Leukotriene modifiers** include Leukotriene Receptor Antagonists (LRTAs) (montelukast and zafirlukast) and a 5-lipoxygenase inhibitor (zileuton). LTRAs are alternative therapy for the treatment of patients who require step 2 care (for mild persistent asthma). LTRAs also can be used as adjunctive therapy with ICSs. LTRAs can attenuate Exercise induced bronchospasm. Montelukast is the preferred leukotriene modifier for children due its improved safety profile relative to other Leukotriene modifiers.
- **Methylxanthines.** Sustained-release theophylline is a mild to moderate bronchodilator used as alternative, *not preferred*, therapy for step 2 care (for mild persistent asthma) or as adjunctive therapy with ICS in patients ≥5 years of age. Monitoring of serum theophylline concentration is essential.
  - **Immunomodulators.** Omalizumab (anti-IgE) is a monoclonal antibody that prevents binding of IgE to the high-affinity receptors on basophiles and mast cells. Omalizumab is used as adjunctive therapy for patients 12 years of age

who have sensitivity to relevant allergens (e.g., dust mite, cockroach, cat, or dog) and whose asthma is inadequately controlled the combination of high-dose ICS and LABA (step care (for severe persistent asthma) and potential asthma triggers have been investigated and managed. Clinicians who administer omalizumab should be prepared and equipped to identify and treat anaphylaxis that may occur.

- Omalizumab use is restricted to asthma specialists (pediatric pulmonologists, pulmonologists, and allergists).
- **Immunotherapy:** Subcutaneous immunotherapy may be considered for patients who have mild or moderate persistent asthma when there is a clear relationship between symptoms and exposure to an allergen to which the patient is sensitive. Clinicians should be skilled in the preparation and administration of immunotherapy and should be prepared to treat anaphylaxis that may occur.

**Quick-relief medications are used to treat acute symptoms and exacerbations. They include the following:**

**Short Acting Beta Agonists (SABA)** (albuterol, levalbuterol, and pirbuterol) are the treatment of choice for relief of acute symptoms and prevention of exercise induced bronchospasm. Regularly scheduled, daily, chronic use of SABA is not recommended.

- **Anticholinergics** (Ipratropium bromide) provide additive benefit to SABA in moderate or severe exacerbations in the emergency care setting.
- **Systemic corticosteroids.** Although not short acting, oral systemic corticosteroids are used for severe exacerbations in addition to SABA to speed recovery and to prevent recurrence of exacerbations.

**VIII: Stepwise approach to asthma therapy:**

- The stepwise approach incorporates all four components of care: assessment of severity to initiate therapy or assessment of control to monitor and adjust therapy; patient education; environmental control measures, and management of comorbid conditions at every step; and selection of medication.
- The type, amount, and scheduling of medication is determined by the level of asthma severity or asthma control. Therapy is increased (stepped up) as necessary and decreased (stepped down) when possible.
- Once asthma control is achieved, monitoring and follow-up are essential, because asthma often varies over time. A step up in therapy may be needed, or a step down may be possible, to identify the minimum medication necessary to maintain control.

If asthma control is not achieved, in addition to adjusting medications:

- Review the patient’s adherence to medications, inhaler technique, environmental control measures (or whether there are new exposures), and management of comorbid conditions.
- If lack of control persists, consider alternative diagnoses.
- If the patient experiences side effects, consider different treatment options.

Table 1: Classifying asthma therapy and initiating therapy (note that some criteria vary by age):

Components of Severity		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment	Symptoms	≤2 days/week	>2 days/week	Daily	Throughout the day

	Nighttime awakenings	0 ( $\leq$ 4 yrs) $\leq$ 2/month ( $\geq$ 5 yrs)	1-2/month ( $\leq$ 4 yrs) 3-4x/month ( $\geq$ 5 yrs)	3-4x/month ( $\leq$ 4 yrs) >1x/week ( $\geq$ 5 yrs)	>1x/week ( $\leq$ 4 yrs) Often 7x/week ( $\geq$ 5 yrs)
	SABA use for symptoms	$\leq$ 2 days/week	>2 days/week	Daily	Several times per day
	Limitation of normal activity	None	Minor	Some	Extreme
	Lung function*	FEV1>80% FEV1/FVC >85% (5-11 yrs) FEV1/FVC normal ( $\geq$ 12 yrs)	FEV1>80% FEV1/FVC >80% (5-11 yrs) FEV1/FVC normal ( $\geq$ 12 yrs)	FEV1 >60% FEV1/FVC >75% (5-11 yrs) FEV1/FVC reduced by 5% ( $\geq$ 12 yrs)	FEV1<60% FEV1/FVC<75% (5-11 yrs) FEV1/FVC reduced > 5% ( $\geq$ 12 yrs)
Risk	Exacerbations requiring oral corticosteroids	0-1/year	$\geq$ 2 in 6 months (0-4 yrs) ** $\geq$ 2/year ( $\geq$ 5 yrs)		
	Recommended step for initiating therapy ***	Step 1	Step 2	Step 3	Step 3 ( $\leq$ 4 yrs) Step 3 or 4 (5-11 yrs) Step 4 or 5 ( $\geq$ 12 yrs)

\* Note that some individuals with smaller lungs in relation to their height (such as a thin individual with narrow A-P diameter to their chest) may NORMALLY have FEV1 <80% and/or FEV1/FVC < 85%. Lung function measures should be correlated with clinical assessment of asthma severity.

\*\* For 0-4 yrs,  $\geq$  4 wheezing episodes per 1 year and lasting > 1 day AND risk factors for persistent asthma also meets RISK criteria for persistent asthma.

\*\*\* For initial therapy of moderate or severe persistent asthma consider short course of oral corticosteroids.

Table 2: Assessing Asthma Control and Adjusting Therapy

Components of Control		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤ 2 days/week	> 2 days/week or (if ≤ 11 yrs) multiple times on ≤ 2 days/week	Throughout the day
	Nighttime awakenings	≤ 1x/month (if ≤ 12 yrs), ≤2x/month (if >12 yrs)	≥ 2x/month (if ≤ 12 yrs), 1-3x/week (if >12 yrs)	≥2x/week (if ≤ 12 yrs), ≥4x/week (if >12 yrs)
	Interference with normal activity	None	Some limitation	Extremely limited
	SABA use for symptoms	≤2 days/week	>2 days/week	Several times per day
	Lung function	FEV1 > 80% FEV1/FVC >80%	FEV1 60- 80% FEV1/FVC 75- 80%	<60% <75%
Risk	Exacerbations requiring OCS	0-1x/year	2-3x/year (if 0-4 yrs) ≥2x/year (if ≥5 years)	>3x/year (if 0-4 yrs) ≥2x/year (if ≥5 yrs)
	Reduction in lung growth	Requires long term follow-up		
	Treatment related adverse effects	Medication side effects do not correlate with specific levels of control, but should be considered in overall assessment of risk.		
Recommended action for treatment*		Consider step down if well controlled for ≥ 3 months.	Step up 1 step. Re-evaluate in 2-6 weeks.	Consider short course oral corticosteroid. Step up 1-2 steps. Re-evaluate in 2 weeks

Table 3: Stepwise Approach to Managing Asthma.

**Before step up: Review adherence, inhaler technique, environmental control, and comorbid conditions**

	Preferred treatment	Alternative treatments
Step 1	SABA prn	
Step 2	Low dose ICS	0-4yrs: Cromolyn, montelukast ≥5 yrs: Cromolyn, nedocromil, LRTA, or theophylline
Step 3	0-4 yrs: Medium dose	Low dose ICS + theophylline

	ICS or [Low Dose ICS + Montelukast] Consider subspecialist referral ≥5 yrs: [Low Dose ICS + Montelukast] or [Low Dose ICS/ LABA* combination] or Medium dose ICS	
Step 4	Medium dose ICS/LABA* combination or Medium dose ICS + Montelukast Consider subspecialist referral	Medium dose ICS + theophylline
Step 5	Refer to subspecialist	
Step 6	Refer to subspecialist	corticosteroids

\*LABA medication is appropriate (in combination with ICS) if poor control is due to frequent symptoms (asthma symptoms >2x/week daytime or sleep interrupted from asthma >2x/month).

Note: The stepwise approach is meant to assist, not replace clinical decision making. If clear benefit is not observed within 4-6 weeks and technique + adherence is satisfactory, consider adjusting therapy and/or alternative diagnoses.

**Consider specialist referral if:** Difficulty in achieving or maintaining asthma control, immunotherapy or omalizumab is being considered, if the patient required 2 bursts of oral systemic corticosteroids in the past year or a hospitalization for asthma, if signs and symptoms are atypical, if there are problems with a differential diagnosis, or if additional testing is indicated.

### IX. Managing Exacerbations:

#### Patients at high risk of asthma-related death require

**special attention**—particularly intensive education, monitoring, and care. Such patients should be

advised to seek medical care early during an exacerbation. Risk factors for asthma-related death include:

- Previous severe exacerbation (e.g., intubation or ICU admission for asthma)
- Two or more hospitalizations or >3 ED visits in the past year
- Use of >2 canisters of SABA per month
- Difficulty perceiving airway obstruction or the severity of worsening asthma
- Low socioeconomic status or inner-city residence
- Illicit drug use
- Major psychosocial problems or psychiatric disease
- Comorbidities, such as cardiovascular disease or other chronic lung disease

Table 4: Classifying severity of asthma exacerbations

	Symptoms and signs	Initial PEF (or FEV1)	Clinical Course
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Mild	Dyspnea only with activity (assess tachypnea in young children)	PEF $\geq$ 70 percent predicted or personal best	<ul style="list-style-type: none"> <li>• Usually cared for at home</li> <li>• Prompt relief with inhaled SABA</li> <li>• Possible short course of oral systemic corticosteroids</li> <li>• May consider early escalation to high dose inhaled corticosteroid (1)</li> </ul>
Moderate	Dyspnea interferes with or limits usual activity	PEF 40–69 percent Predicted or personal best	<ul style="list-style-type: none"> <li>• Usually requires office or ED visit</li> <li>• Relief from frequent inhaled SABA</li> <li>• Oral systemic corticosteroids;</li> <li>• Some symptoms last for 1–2 days after treatment is begun</li> </ul>
Severe	Dyspnea at rest; interferes with conversation	PEF <40 percent predicted or personal best	<ul style="list-style-type: none"> <li>• Usually requires ED visit and likely hospitalization</li> <li>• Partial relief from frequent inhaled SABA</li> <li>• Oral systemic corticosteroids; some symptoms last for &gt;3 days after treatment is begun</li> <li>• Adjunctive therapies are helpful</li> </ul>
Life Threatening	Too dyspneic to speak; perspiring	PEF <25 percent predicted or personal best	<ul style="list-style-type: none"> <li>• Requires ED/hospitalization; possible ICU</li> <li>• Minimal or no relief from frequent inhaled SABA</li> <li>• Intravenous corticosteroids</li> <li>• Adjunctive therapies are helpful</li> </ul>

**Home Management:**

**Early treatment by the patient at home is the best strategy for managing asthma exacerbations. Patients should be instructed how to:**

- **Use a written asthma action plan** that notes when and how to treat signs of an exacerbation.
- **Recognize early indicators of an exacerbation**
- **Adjust their medications** by increasing SABA and, in some cases, adding a short course of oral corticosteroids. Recent research suggests that escalation to

high dose inhaled corticosteroid and/or addition of a leukotriene modifier EARLY in an exacerbation may be of benefit. Simply doubling an inhaled corticosteroid AFTER an exacerbation is established is unlikely to help.

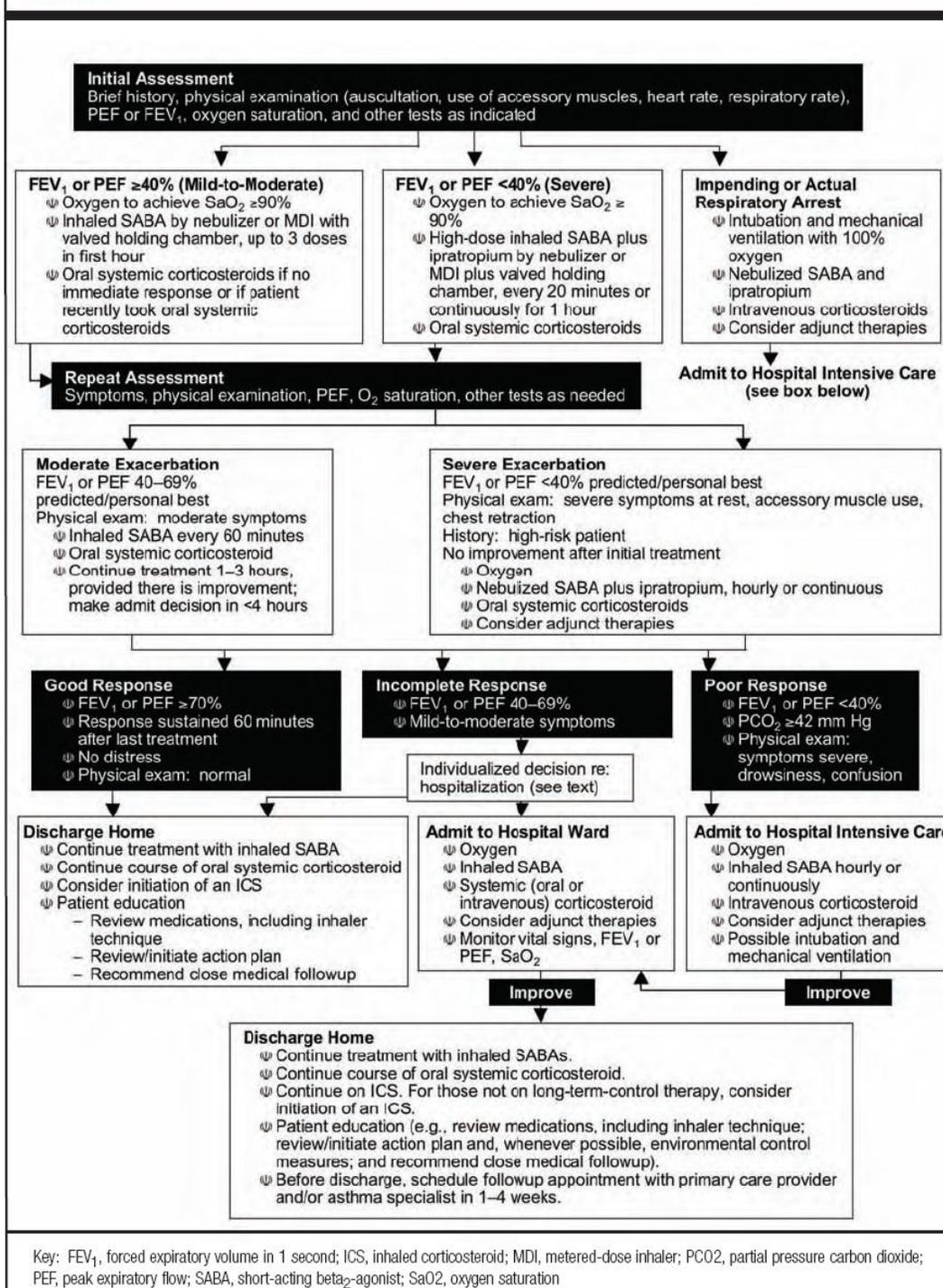
- **Remove or withdraw from allergens or irritants** in the environment that may contribute to the exacerbation.
- **Monitor response to treatment and promptly communicate with the clinician about any serious deterioration.**

ER/Hospital Management:

Principles of management of moderate or severe asthma exacerbations in the ER or hospital:

- **Administer supplemental oxygen** to correct significant hypoxemia in moderate or severe exacerbations.
- **Administer repetitive or continuous administration of SABA** to reverse airflow obstruction rapidly.
- **Administer oral systemic corticosteroids** to decrease airway inflammation in moderate or severe exacerbations or for patients who fail to respond promptly and completely to SABA treatment.
- **Monitor response to therapy with serial assessments.**
- **Consider adjunctive treatments, such as intravenous magnesium sulfate or heliox**, in severe exacerbations, if patients are unresponsive to the initial treatments listed above
- **Provide the following to prevent relapse of the exacerbation** and recurrence of another exacerbation:
  - Referral to follow-up asthma care within 1–4 weeks. In addition, encourage the patient to contact (e.g., by telephone) his/her asthma care provider during the first 3–5 days after discharge. A follow-up visit is essential to review the patient's written asthma action plan, adherence, and environmental control and to consider a step up in therapy. If appropriate, consider referral to an asthma self-management education program.
  - Basic asthma education
  - An ED asthma discharge plan.
  - Review of inhaler technique.
  - Consider initiating ICS medication.

**FIGURE 21. MANAGEMENT OF ASTHMA EXACERBATIONS: EMERGENCY DEPARTMENT AND HOSPITAL-BASED CARE**



Tables and guideline adapted from National Asthma Education and Prevention Program Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007. US Department of Health and Human Services, National

Institutes of Health, National Heart Lung and Blood Institute. NIH Publication Number  
08-5846. October 2007