

OUTPATIENT ASTHMA DIAGNOSIS AND MANAGEMENT

Sande Okelo MD, PhD

OBJECTIVES

1. Understand the epidemiology of asthma
2. Explain the pathophysiology of asthma
3. Discuss asthma diagnosis, assessment and monitoring based on the 2007 NAEPP Expert Panel Report
4. Discuss pharmacologic strategies for asthma management based on asthma classifications
5. Explain environmental control practices for prevention of asthma exacerbations
6. 2017 Addendum - Approaches to Guideline Adherence - Problem Solving Counseling, by Genna Vullo, MHS, Dr. Barbara Howard and Dr. Ray Sturner

Asthma Epidemiology

Approximately 6 million children in the United States have an asthma diagnosis, making it one of the most common diseases of childhood ([NAEPP 2007](#)). Incidence and prevalence are increasing, most likely due to: 1) better recognition and diagnosis; 2) changing environmental factors such as increased allergens, and 3) changing lifestyle factors including increased stress ([Guill 2004](#)).

Asthma can be diagnosed at any age, but the majority (80%) of children have symptoms within the first six years of life. During early and late childhood, approximately 60% of children with asthma are males, but by adulthood, asthma is more prevalent in females. Two-thirds to three-fourths of pre-school aged children who are “early wheezers” will *not* continue to wheeze beyond 5 years of age (Martinez 1995). However, risk of persistent asthma between six and 13 years significantly increases if the child has a history of eczema by 2-3 years of age, parental history of asthma OR two of the following including a) physician diagnosed allergic rhinitis by 2-3 years of age, b) >4% peripheral eosinophils, or c) wheezing *not* associated with URIs (Martinez 1995). Studies evaluating the effect of pets in the home on the likelihood of persistence of early wheezing continue to be inconclusive. ([Chen 2010](#))

Although asthma is more prevalent in African American and some Latino (e.g., U.S. Puerto Rican) ethnic populations, these children are three to four times more likely to be hospitalized for asthma and to die from asthma than Caucasian children—numbers that are out of proportion with the population differences in asthma prevalence. The reason for this disparity is not clear; there may be many contributing factors such as lack of access to health care; episodic care as opposed to consistent, preventive management; physician under-diagnosis and/or under-treatment of asthma (e.g., lack of use of daily anti-inflammatory therapy (Naqvi et al. 551-57)); and environmental factors (Guill 2004).

Recap

- Asthma is the most common chronic childhood illness, most often beginning before the age of 6 years, and affecting more than 1 in 10 children in the U.S.
- Asthma in the pre-school age group tends to persist among those who are atopic or whose parents have a history of atopy.
- Ethnic disparities exist in quality of asthma care, asthma hospitalizations, and asthma mortality.

Pathophysiology

In the past, bronchospasm was thought to be a major contributor to asthma pathophysiology, but now airway inflammation is believed to be the primary underlying mechanism. In 2007, the National Heart, Lung and Blood Institute’s National Asthma Education and Prevention Program (NAEPP) published their “Expert Panel

Report 3: Guidelines for the Diagnosis and Management of Asthma” which details current understanding of the pathophysiology and natural history of asthma (NAEPP 2007).

Asthma is a chronic inflammatory disorder of the lower airways in which inflammatory cells (mast cells, eosinophils, neutrophils), chemical mediators (histamine, leukotrienes, platelet-activating factor) and chemotactic factors (cytokines) all play a role (Lasley 2003). Airway inflammation causes airway hyper-responsiveness (bronchoconstriction/bronchospasm) and lower airway obstruction, as well as edema, mucus production and recruitment of inflammatory cells into the airway.

Viral respiratory infections are the most common cause of asthma exacerbations (accounting for upwards of 80% of all asthma exacerbations). For children not diagnosed with asthma, viral respiratory infections potentially increase future risk of developing this disease (NAEPP 2007). Allergen exposure also commonly precipitates asthma exacerbations, with the subsequent bronchospasm occurring in two phases. In the early phase, occurring approximately 15 minutes after exposure, mast cells degranulate, increasing histamine and leukotrienes and leading to bronchoconstriction. Released cytokines and chemokines also stimulate migration of inflammatory cells, such as eosinophils, neutrophils and lymphocytes, to the airways, thereby increasing edema and mucus production and causing a second phase (4-12 hours after the exposure) of bronchospasm. Chronic inflammation can lead to airway remodeling due to basement membrane thickening, epithelial cell injury, angiogenesis, and smooth muscle hypertrophy and hyperplasia; this remodeling results in irreversible structural changes and progressive loss of pulmonary function (NAEPP 2007; [Nelson 2006](#); Guill 2004).

Although anti-inflammatory medicines such as inhaled corticosteroids (ICS) control asthma exacerbations, they may not preclude further progression of disease severity, i.e., remodeling associated with decline in lung function (NAEPP 2007). There is also evidence that the trajectory of decline in lung function varies widely between individuals, and that any one individual’s trajectory of lung function may be determined very early in life (Sears 2007; Sears 2003; Guilbert 2003). While stressing the important role of inflammation in asthma pathogenesis, the 2007 NAEPP guidelines also note that individual patients demonstrate variability in their patterns of inflammation; such variability is likely related to genetics and has implications for the effectiveness of therapies (NAEPP 2007).

Recap:

- Asthma is a disease of lower airway inflammation that results in airway hyper-responsiveness and reversible lower airway obstruction—causing immediate and delayed symptoms. Patients with asthma may be at risk for the development of airway remodeling and irreversible lower airway obstruction—with resultant premature and/or accelerated lung function decline.

Diagnosis, Assessment and Monitoring

Diagnosis of Asthma

Asthma is primarily a clinical diagnosis. In order to diagnose asthma in *all* age groups, the NAEPP guidelines state physicians must determine (NAEPP 2007; p.40-41):

- Episodic symptoms of airflow obstruction or airway hyper-responsiveness are present.
- Airflow obstruction is at least partially reversible (as determined by spirometry in children ≥ 5 years).
- Alternative diagnoses are excluded.

The diagnosis is established through detailed medical history and exam, and spirometry for children ≥ 5 years to demonstrate reversible airflow obstruction. The NAEPP guidelines do not include a diagnosis for “reactive airways disease (RAD)”, which is a label given to many children with recurrent wheezing, particularly among the pre-school age group. RAD is one of a host of terms or diagnoses (others include bronchitis, wheezy bronchitis, recurrent pneumonia and/or recurrent URIs) that is frequently and inappropriately used in instances

when “asthma” or another more specific diagnosis (e.g., chronic aspiration syndrome) would be more specific and correct (Fahy, 2001).

Differential Diagnosis

The differential diagnosis of asthma should be considered during this initial visit and includes: chronic sinusitis, allergic rhinitis, foreign body obstruction, vocal cord paralysis or dysfunction, vascular rings or slings, laryngotracheomalacia, enlarged mediastinal lymph node or tumor, viral infection, CF, cardiac disease and aspiration (NAEPP 2007).

Signs and symptoms that make a diagnosis of asthma less likely include: respiratory symptoms that do not respond to albuterol, asymmetric wheezing, inspiratory wheezing only, respiratory symptoms get worse with eating, failure to thrive, or chronic diarrhea.

Initial History

The following history questions should be asked of the parent (NAEPP 2007; p 42):

1. History of any of the following:
 - Cough, worse particularly at night
 - Recurrent wheeze
 - Recurrent difficulty in breathing
 - Recurrent chest tightness
2. Symptoms occur or worsen in the presence of:
 - Exercise
 - Viral infection
 - Animals with fur or hair
 - House-dust mites (in mattresses, pillows, upholstered furniture, carpets)
 - Mold
 - Smoke (tobacco, wood)
 - Pollen
 - Changes in weather
 - Strong emotional expression (laughing or crying hard)
 - Airborne chemicals or dusts
 - Menstrual cycles
3. Symptoms occur or worsen at night, awakening the patient.
4. Explore the frequency and severity of respiratory symptoms.
 - The number of days per week
 - The number of nights per week or month
 - The number of days of school lost per month
 - Severity of symptoms: ≥ 2 ED wheezing/asthma visits or hospitalizations or any ICU admission in the past 5 years increases risk for morbidity and mortality
 - Albuterol use: a full albuterol MDI has 200 puffs = 100 doses, so even at one dose per day, it should last more than 3 months
5. Family history of allergic rhinitis, asthma and eczema
6. Child history of eczema or allergic rhinitis. *The strongest predictor for wheezing developing into asthma is a personal history of atopy* (Martinez 1995). Approximately 70-90% of children who have asthma and are older than 5 years of age have positive allergy skin tests (Lasley 2003).

Physical Examination and Lung Function Measurement

Physical findings vary. The exam may be significant for:

- 1) allergic rhinitis (allergic shiners, nasal mucosa swelling, nasal crease and allergic salute)
- 2) eczema;
- 3) wheezing—high-pitched whistling sounds when breathing out— or prolonged expiration (lack of

wheezing does NOT exclude the diagnosis);

- 4) reversible lower airway obstruction, as measured by peak flow or spirometry (for children ≥ 5 years). Obstruction is determined by the presence of an FEV₁/FVC ratio of less than 85% (i.e., lower airway obstruction is present if a given patient cannot exhale 85% of their lung capacity during the 1st second of exhalation). Reversibility is determined either by an increase in FEV₁ of $\geq 12\%$ from baseline (i.e., a 12% increase or higher between one visit and another visit) or by an increase $\geq 10\%$ of predicted FEV₁ immediately after inhalation of a short-acting bronchodilator.

NAEPP Classification of Asthma Severity and Control

The NAEPP Expert Panel Report (NAEPP 2007) classifies asthma into 4 categories (intermittent, mild persistent, moderate persistent and severe persistent). Proper classification of disease severity is necessary to direct appropriate therapy. The 2007 NAEPP guidelines recommend classifying severity of asthma when a child first presents with symptoms and is not on controller (anti-inflammatory) medicines. In considering asthma severity, providers should assess both current impairment (frequency and intensity of symptoms, low lung function, and limitations of daily activities) and future risk.

Impairment	Sign/Symptom to Assess	Time Frame to Assess
	Daytime symptoms	Per week
	Nighttime awakenings	Per week/month
	Rescue $\beta 2$ -agonist use	Per week
	Interference with normal activity	N/A
	Lung function (≥ 5 years of age)	
Risk (for poor future outcomes)	Exacerbations requiring systemic steroids	Per year

Note that the NAEPP has changed nomenclature such that what was formerly called “mild intermittent” asthma is now called “intermittent” asthma; this change was made with the recognition that some children have infrequent symptoms, but that when that these symptoms may be severe (NAEPP 2007). For example, a child who has had ≥ 2 exacerbations requiring oral steroids in 6 months, but no symptoms in between has minimal impairment but high risk; as such, he should be considered to have persistent asthma (and thereby should be prescribed a controller medicine).

One good, quick way of differentiating intermittent versus persistent is the “rule of 2s”: if a child is having symptoms more than twice a week, or is waking at night more than twice a month, he should be classified along the “persistent” scale (Guill 2004).

Asthma Severity (<5 years of age)

	Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent
Symptoms	≤ 2 days/wk	3-6 days/wk	7 days/wk (daily)	Throughout the day
Nighttime Awakenings	None	1-2x/month	3-4x/month	> 1 x/wk
Albuterol use	≤ 2 days/wk	3-6 days/wk	7 days/wk (daily)	Several times per day
Activity limitation	None	Minor limitation	Some limitation	Extremely limited
FEV1	N/A	N/A	N/A	N/A
Prednisone use	≤ 1 time/yr	≥ 2 x/6 months or ≥ 4 wheeze episodes/yr	≥ 2 x/6 months or ≥ 4 wheeze episodes/yr	≥ 2 x/6 months or ≥ 4 wheeze episodes/yr

Asthma Severity (5 – 11 Years of Age)

	Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent
Symptoms	≤2 days/wk	3-6 days/wk	7 days/wk (daily)	Throughout the day
Nighttime Awakenings	≤2x/month	3-4x/month	>1x/wk	Nightly
Albuterol use	≤2 days/wk	3-6 days/wk	7 days/wk (daily)	Several times per day
Activity limitation	None	Minor limitation	Some limitation	Extremely limited
FEV1	FEV1 >80% FEV1/FVC >85%	FEV1 >80% FEV1/FVC >80%	FEV1 60%-80% FEV1/FVC 75%-80%	FEV1 <60% FEV1/FVC <75%
Prednisone	≤1x/year	≥2x/year	≥2x/year	≥2x/year

Asthma Severity (≥12 Years of Age)

	Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent
Symptoms	≤2 days/wk	3-6 days/wk	7 days/wk (daily)	Throughout the day
Nighttime Awakenings	≤2x/month	3-4x/month	>1x/wk	Nightly
Albuterol use	≤2 days/wk	3-6 days/wk	7 days/wk (daily)	Several times per day
Activity limitation	None	Minor limitation	Some limitation	Extremely limited
FEV1	FEV1 >80% FEV1/FVC >85%	FEV1 >80% FEV1/FVC >85%	FEV1 60%-80% FEV1/FVC 80%-85%	FEV1 <60% FEV1/FVC <80%
Prednisone	≤ 1 time/yr	≥2x/yr	≥2x/yr	≥2x/yr

Asthma Control: Follow-up for children diagnosed with asthma

Once a diagnosis of asthma has been established, at subsequent visits, providers should establish the child's asthma control. As with establishing severity, assessing control involves determining both impairment and risk. Determining both impairment and risk ensures that the current impact of asthma on the child's quality of life and potential future adverse events are both considered.

For those who have been previously diagnosed, the following information should be reviewed at all visits:

1. Symptom frequency and severity
 - a. Number of days per week
 - b. Number of nights per week or month
 - c. Number of days of school lost per month
2. Pharmacotherapy (including need for albuterol and oral prednisone)
3. Recent ED visits, hospitalizations or acute care visits
4. Compliance with therapy
5. Side effects and any barriers to medication compliance
6. Patient satisfaction with current treatment
7. Assessment of psychosocial stressors which have been shown to increase asthma severity
8. Co-occurrence of a co-morbid condition that could exacerbate asthma symptoms (such as GERD, sinusitis, rhinitis, obstructive sleep apnea)
9. Peak flow measurements in terms of variability and % of baseline (for patients ≥ 5 years)
10. Quality of life concerns (What worries you most about your asthma? What do you want to be able to do that you can't do because of your asthma? What are your expectations?)

Summary of Control Assessment for All Age Groups

	Well Controlled ≤ 4 years of age	Well Controlled 5 – 11 years of age	Well Controlled ≥ 12 years of age
Symptoms	≤ 2 days/wk?	≤ 2 days/wk?	≤ 2 days/wk?
Nighttime Awakenings	< 1 x/month?	< 1 x/month?	≤ 2 x/month?
Albuterol use	≤ 2 days/wk?	≤ 2 days/wk?	≤ 2 days/wk?
Activity Limitation	None?	None?	None?
FEV1	N/A?	$> 80\%$ predicted/ personal best? FEV1 /FVC $> 80\%$?	$> 80\%$ predicted/ personal best?
Quality of Life (ATAQ, ACQ, ACT)	N/A	N/A	ATAQ = 0 ACQ ≤ 0.75 ACT ≥ 20
Prednisone	≤ 1 time/year?	≤ 1 time/year?	≤ 1 time/year?

Monitoring with Peak Flow

Although spirometry (for children ≥ 5 years) is preferred for asthma diagnosis and classification of severity, peak flow measurements can be helpful in following children's asthma. The peak expiratory flow rate (PEFR) is the greatest flow velocity that can be obtained during a forced expiration starting with fully inflated lungs. PEFR is a simple, quantitative, reproducible measure of airway obstruction that can be obtained using inexpensive, portable peak flow meters. Following peak flow measurements may be particularly useful for children with moderate or severe persistent asthma, or for parents and children who have difficulty detecting symptoms of exacerbations. The 2007 NAEPP guidelines suggest that a symptom monitoring plan may be an alternative to peak flow monitoring for certain patients (NAEPP 2007).

The peak flow meter assists in outpatient asthma management in the following ways:

- **Facilitating communication** by providing an objective assessment of asthma severity.
- **Providing objective feedback** to help patients who have poor perception of the severity of their obstruction.
- **Monitoring the course** of treatment, using objective information to begin or discontinue treatment.
- Determining when **emergency care** is needed through the “three zone system.” The “green zone” represents PEFr = 80-100% personal best; the “yellow zone” represents the PEFr = 50-80% personal best, the “red zone” represents the PEFr < 50% personal best.

The primary limitations of PEFr are 1) PEFr is effort-dependent, and 2) PEFr measures only *large airway function* and hence may be normal even in patients with a mild asthma exacerbation—whose disease may be limited to the smaller airways. Because PEFr is effort-dependent and because there are differences in lung function across racial and ethnic populations, patients should not be compared to a given standard but rather to their own “personal best.”

The following directions should be given to all patients:

- Place the indicator at the bottom of the numbered scale
- **Stand up**
- Take a deep breath, filling lungs completely
- Place the mouthpiece in the mouth and close the lips around it (do not put your tongue inside the hole)
- Blow out as hard and fast as you can in a single blow
- Repeat the process 2 or more times and record the highest of the three numbers achieved.

Encourage your patient to practice when well to determine his/her "personal best." One suggestion is to take readings 2 times a day for 2-3 weeks. It is also helpful to take readings before and after use of a quick acting beta₂-agonist. When recovering from an asthma attack or starting a new therapy, it should be measured twice a day and before and after bronchodilator therapy until the asthma is well controlled (i.e., PEFr 80 to 100 % of baseline). PEFr should be measured at each outpatient visit, preferably with the child's own peak flow meter in order to check technique and monitor asthma severity.

Recap: Summary of Definitions of Severity and Control

<p><u>Severity (DIAGNOSIS)</u></p> <ul style="list-style-type: none"> • How bad or serious a disease is • Assessed <u>before</u> a patient is on a controller medication (e.g., inhaled corticosteroids) • Consider impairment and risk • Use to determine initial treatment <p><u>Control (MONITORING)</u></p> <ul style="list-style-type: none"> • Fluctuations in severity of disease; • Assessed <u>after</u> a patient is on a controller medication • Consider impairment and risk • Use to determine changes in treatment regimen 	<p><u>Impairment</u></p> <ul style="list-style-type: none"> • Daytime symptoms • Night-time symptoms • Short acting beta2 agonist (Albuterol) use • Interference with normal activity • Lung function (≥5 years of age) • Quality of life <p><u>Risk</u> (for poor future outcomes)</p> <ul style="list-style-type: none"> • Exacerbations requiring steroids
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Patient Self-Assessment

The Expert Panel Report (EPR-3) recommends that clinicians incorporate use of patient self-assessment tools to determine from the perspective of the patient and/or the patient's family whether the asthma is well controlled and the impact of the asthma on patient quality of life.

The two general self-assessment methods are (1) a daily diary and/or (2) a periodic self-assessment form to be filled out by the patient and/or family member, usually at the time of the follow-up visit to the clinician. Patients are less likely to see completion of diaries and forms as a burden if they receive feedback from the clinician that allows them to see value in self-monitoring. The daily diary should include the key factors to be monitored at home: symptoms and/or peak flow, medication use, and restricted activity (See "Component 2: Education for a Partnership in Asthma Care."). The **self-assessment questionnaires** that can be completed at office visits are intended to capture the patient's and family's impression of asthma control, self-management skills, and overall satisfaction with care. Use of these types of questionnaires helps to standardize, expedite and improve the quality of information retrieved by the physician and thereby facilitate better decision-making about the patient's care (J Halterman, 2006). A number of asthma self-assessment questionnaires have been developed to assess patient asthma, although relatively few are for use in children:

- Pediatric Asthma Quality of Life Questionnaire (EF Juniper) www.qoltech.co.uk/paqlq.html
- Pediatric Asthma Caregiver Quality of Life Questionnaire (EF Juniper) www.qoltech.co.uk/paqlq.html
- Pediatric Asthma Therapy Assessment Questionnaire (Dette et al.)
http://www.asthmacontrolcheck.com/asthmacontrolcheck/hcp/documents/children_complete_qst.pdf
- Asthma Control Test (Nathan et al. 2004) www.asthmacontrol.com/
- Childhood Asthma Control Test (Shatz et al.) <http://www.asthmacontrol.com/child.html>
- ACCI- Asthma Control and Communication Instrument (Patino et al, 2008) www.pacci.net or www.pacci.info
www.pacci.info **Journal of Allergy and Clinical Immunology** - Volume 122, Issue 5 (November 2008)

A sample of the pediatric asthma control and communication instrument (PACCI) is included below as an example of a patient self-assessment questionnaire. The PACCI was developed for use with children 0 – 19 years of age with asthma (including reactive airway disease or recurrent wheezing that could be explained by asthma).

The PACCI assesses multiple dimensions of asthma health that physicians have reported as important in determining how to treat patients with asthma (Diette, 2007; Okelo, 2008) interval changes in the child's asthma since the last prior visit with the doctor (**direction**), the impact of the asthma on the parental quality of life (**bother**), recent asthma exacerbations (**risk**), adherence to daily controller/anti-inflammatory asthma medications (**adherence**) and **control** (frequency of daytime symptoms, rescue medication use, attacks, activity limitation, nocturnal symptoms). The PACCI also provides for classification of asthma symptoms (using NIH asthma severity and control categories) and a treatment algorithm for prescribing and adjusting asthma medications. The PACCI may be interview-administered or self-completed by parents of children with asthma with or without assistance from the child in providing answers.

Based on responses to questions 7 – 11, the PACCI classifies patients into 4 categories of control/severity ranging from intermittent/controlled to severe persistent/very poorly controlled; intermittent/controlled indicating better asthma disease status and severe-persistent/very poorly controlled indicating poorer asthma disease status. Consistent with NIH asthma guidelines, the category is assigned based on the most severely reported response (selected response that is furthest to the right) among questions 7 – 11.

The **treatment algorithm** on page 3 of the PACCI is linked to the PACCI Control/Severity Category as classified by the clinician. For each control/severity classification, there is a recommended and ≥ 1 alternative medication regimens provided, based on NIH Asthma Guidelines. For any patients with asthma that is persistent/not well-controlled, there is a list of suggested explanations for the clinician to consider besides increasing the patient's medication regimen (e.g., poor inhaler technique). At the bottom of the treatment algorithm is a table of low-, medium- and high-dose inhaled steroid dosing based on age (less than 12 years of

age or 12 years of age and older) to assist the clinician select an appropriate medication dose for the patient.

Pediatric Asthma Control & Communication Instrument

Asthma also includes reactive airway disease, regular coughing, wheezing, or difficulty breathing with or without colds.

Your child's name: _____ Today's Date: _____

When was your child's last asthma visit? _____ If your child has never had an asthma visit, check here

Please check one answer for each of the following questions.
Your answers will help your doctor give you the best asthma care.

Direction

- | | | | |
|--|---|----------------------------------|-----------------------------------|
| 1. Since your child's last visit to <u>this</u> doctor's office, how has your child's asthma been? | Better
<input checked="" type="checkbox"/> | Same
<input type="checkbox"/> | Worse
<input type="checkbox"/> |
|--|---|----------------------------------|-----------------------------------|

If your child has not seen a doctor, please answer about the past 2 months.

Bothered

- | | | | |
|--|---|---|---|
| 2. Since your child's last visit to <u>this</u> doctor's office, how much have you been bothered by your child's asthma? | Not bothered
<input checked="" type="checkbox"/> | Somewhat bothered
<input type="checkbox"/> | Very bothered
<input type="checkbox"/> |
|--|---|---|---|

If your child has not seen a doctor, please answer about the past 2 months.

Risk

- | | | | |
|---|-------------------------------------|--------------------------|--------------------------|
| 3-5. Since your child's last visit to <u>this</u> doctor's office, has your child: | | No | Yes |
| If your child has not seen a doctor, please answer about the past 2 months. | | | |
| 3. Been to the emergency room for asthma? | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Been hospitalized for asthma? | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Used prednisone (Orapred, steroid pill, steroid liquid or steroid syrup) for asthma? | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Forget to take medicine

- | | | | | | |
|--|--|---|---|---|--|
| 6. How often do you <u>forget</u> to give your child's <u>daily</u> asthma medicine when he/she feels fine? | My child is not supposed to take a daily asthma medicine
<input type="checkbox"/> | None of the time
<input checked="" type="checkbox"/> | Some of the time
1-2 days/week
<input type="checkbox"/> | Most of the time
3-4 days/week
<input type="checkbox"/> | All of the time
5-7 days/week
<input type="checkbox"/> |
| Daily asthma medicines include: Aerobid, Advair, Asmanex, Azmacort, Budesonide, Flovent, QVAR, Pulmicort, Singulair, Symbicort | | | | | |

FOR CLINICIAN USE
If any of the answers farthest to the right or in red are selected, this may be consistent with poorly controlled and/or undertreated asthma. Further assessment and **follow-up in 2-6 weeks** is recommended.

(OVER)

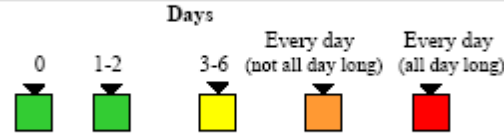
Asthma Symptoms

7. Over the **past week**, how many days has your child had asthma symptoms? For example:
- Cough
 - Chest tightness
 - Shortness of breath
 - Sputum (spit, mucous, phlegm when coughing)
 - Difficulty taking a deep breath
 - Wheezy or whistling sound in the chest



Reliever use

8. Over the **past week**, how many days have you had to give your child medicine to quickly relieve asthma symptoms? For example:
- Albuterol/Proventil/Proair/Ventolin/Xopenex via Inhaler/Spray/Pump or Machine/Nebulizer



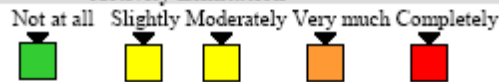
Attacks

9. Over the **past week**, how many days did your child have an asthma attack? For example:
- When it is harder to breathe for your child
 - When you give your child more quick-relief asthma medicine (e.g., Albuterol)
 - When the asthma medicine does not work



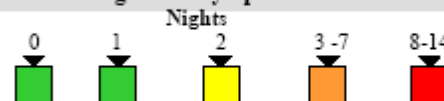
Activity Limitation

10. Over the **past week**, how much does asthma limit your child's activities?







Nighttime Symptoms

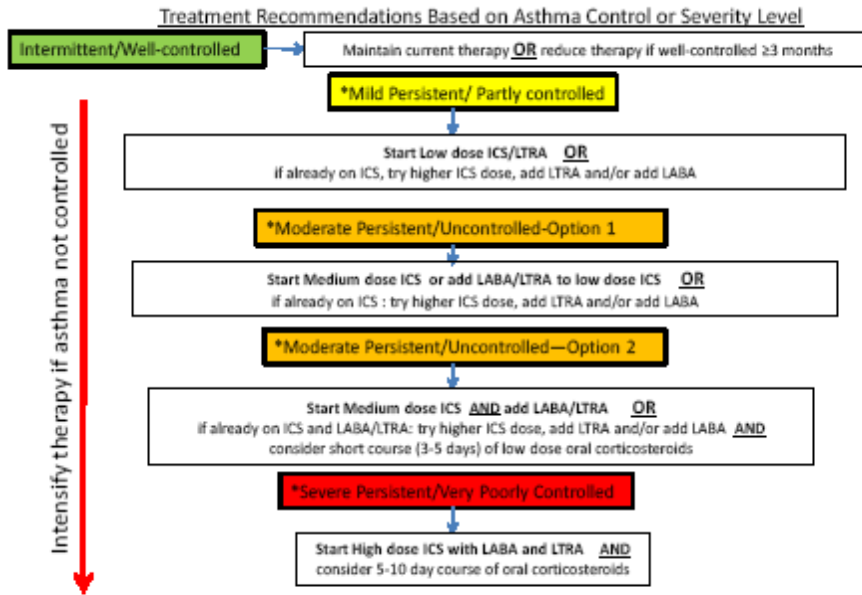
11. Over the **past TWO weeks**, how many nights did your child's asthma keep your child from sleeping or wake him/her up?



12. Please **write down any concerns or anything else** you would like your doctor to know about your child's asthma.

PLEASE GIVE THIS TO YOUR PROVIDER. Thank you.

<p>FOR CLINICIAN USE ONLY: Control/Severity Assignment</p> <p>Assign patient's current level of asthma control by looking at the box checked <i>farthest to the right</i> on questions 7-11 and match the box color to the level of asthma control in this section.</p> <p>The goal for all patients is to have controlled/intermittent asthma. If asthma is uncontrolled/persistent, possible explanations include: under-treatment, poor inhaler technique, poor adherence, environmental allergies and/or exposures, comorbid conditions (see treatment algorithm). Follow-up in 2 – 6 weeks is recommended.</p>				
	Controlled/ Intermittent	Partly Controlled/ Mild Persistent	Uncontrolled/ Moderate Pers.	Poorly Controlled Severe Pers.



*** IF ASTHMA IS NOT WELL-CONTROLLED/INTERMITTENT, ALSO CONSIDER EACH OF THE FOLLOWING:**
Inhaler technique: □patient using spacer with MDI? □have patient demonstrate inhaler technique
Medication adherence: □review patient PACCI response to adherence question □review pharmacy record of filled prescriptions
Environmental allergies and exposures: □allergy tested? □secondhand smoke exposure?
Comorbid conditions: □gastro-esophageal reflux □allergic rhinitis □sinusitis □ABPA
Asthma specialist: □systemic steroids ≥2 times/year □intubation/ICU admit □uncontrolled asthma on high dose ICS and LABA

Inhaled Corticosteroids (ICS)	<12 Years Old			>12 Years Old		
	Low Dose	Medium Dose	High Dose	Low Dose	Medium Dose	High Dose
Beclomethasone/QVar MDI	40 mcg 80 mcg	2-4 puffs/day 1-2 puffs/day	3-4 puffs/day	>4 puffs/day	2-6 puffs/day 1-3 puffs/day	3-6 puffs/day
Budesonide/Pulmicort DPI Flexhaler	90 mcg 180 mcg	2-4 puffs/day 1-2 puffs/day	2-4 puffs/day	>4 puffs/day	2-6 puffs/day 1-3 puffs/day	4-6 puffs/day
Budesonide/Pulmicort Respule	0.25mg neb 0.5mg neb	2 nebs/day 1 neb/day	2 nebs/day			
Fluticasone/Aerobid MDI	80 mcg 250 mcg	2 puffs/day 2-3 puffs/day	4 puffs/day 4-5 puffs/day	>5 puffs/day	4 puffs/day 2-4 puffs/day	
Fluticasone/Flovent MDI	44 mcg 110 mcg 220 mcg	2-4 puffs/day 1 puff/day N/A	N/A 2-3 puffs/day 1 puff/day	>3 puffs/day >1 puff/day	2-6 puffs/day 1-2 puffs/day 1 puff/day	3-4 puffs/day 2 puffs/day
Fluticasone/Flovent Diskus DPI	50 mcg 100 mcg 250 mcg	2-4 puffs/day 1-2 puffs/day N/A	N/A 2-4 puffs/day 1 puff/day	>4 puffs/day >1 puff/day	2-6 puffs/day 1-3 puffs/day 1 puff/day	N/A 4-5 puffs/day 2 puffs/day
Mometasone/Asmanex Twisthaler	220mcg				1 puff 2 puffs	>2 puffs
Combination Drugs—ICS + LABA: patient should not take more than: 2 puffs per dose of the combo MDI or 1 puff per dose of the combo DPI						
Fluticasone/Salmeterol (Advair) MDI	45/21 mcg 115/21 mcg 230/21 mcg	2 puffs/day	2-3 puffs/day 2 puffs/day	4 puffs/day 2-4 puffs/day 2-4 puffs/day	2 puffs/day 2 puffs/day	3-4 puffs/day 2 puffs/day 3-4 puffs/day
Fluticasone/Salmeterol Diskus (Advair) DPI	100/50 mcg 250/50 mcg 500/50 mcg	1 puff/day	2 puffs/day	2 puffs/day 2 puffs/day 2 puffs/day	1 puff/day 2 puffs/day	2 puffs/day 2 puffs/day
Budesonide/Formoterol (Symbicort)	80/4.5mcg MDI 160/4.5mcg MDI	1-2 puffs/day	2-4 puffs/day 1-2 puffs/day	2-4 puffs/day	1-3 puffs/day 2 puffs/day	4 puffs/day 2 puffs/day

Note: areas left blank above are because there are no recommended doses available or there are alternative formulations that are more ideal.
ICS: inhaled corticosteroid; **LTRA:** leukotriene receptor antagonist; **LABA:** long acting -agonist; **MDI:** metered dose inhaler; **DPI:** dry powder inhaler

Pharmacologic therapy

Treatment goals are to maximize the quality of life and minimize morbidity. In general, if a patient is classified with asthma that is “persistent” (mild, moderate or severe) or that is not “well-controlled” should either: a) start use of a daily controller medication (e.g., inhaled steroid or leukotriene modifier); or b) be placed on a more intensive daily controller medication regimen. The NAEPP guidelines suggest a stepwise approach that emphasizes initiating a higher level of therapy at the onset of persistent or uncontrolled symptoms to get prompt control and least damage to the airways and then stepping down when the symptoms are under control. This requires continued involvement of the primary care provider to assess the adequacy of treatment. Medications are now categorized into 2 classes: **quick relief** medications (short acting beta₂-agonists) to treat acute symptoms and exacerbations and **long-term-control** medications to achieve and maintain control and symptoms. Of note, in December 2008, the hydrogenated chlorofluorocarbons were removed from all MDIs, such that all MDIs are now labeled “HFA.” It appears that HFA inhalers deliver medicine more effectively to the lungs than non-HFA inhalers. However, importantly patients will not feel the same force (“puff”) upon actuation. Therefore, it is important to educate patients that they will be receiving medicine though the force of the medication “plume” may not feel the same as non-HFA inhalers. Whether the increased delivery to the lungs will lead to changes in dosing of inhaled corticosteroids remains to be elucidated.

Quick Relief Medications: Usual Dosages of Short Acting Beta₂-Agonists (National Asthma Education and Prevention Program 2002)

Medication	Dosage Form	Child Dose	Adult Dose	Comments
<u>Albuterol</u> Proventil Pro-Air Ventolin	<u>MDI:</u> 90 mcg/puff, 200 puffs	-1-2 puffs 5 min. prior to exercise -2 puffs tid-qid prn	-2 puffs 5 min. prior to exercise -2 puffs tid-qid prn	-An increasing use or lack of expected effect indicates diminished control of asthma
	<u>DPI (Rotahaler):</u> 200 mcg/capsule	1 capsule q4-6 hrs as needed and prior to exercise	1-2 capsules q4-6 hrs as needed and prior to exercise	-Not generally recommended for long-term treatment. Regular use on a daily basis indicates the need for additional long-term control therapy.
	<u>Nebulizer solution:</u> 5 mg/ml (0.5%) 2.5 mg/ml 1.25 mg/3 ml (premixed) 0.63 mg/3 ml	0.05 mg/kg (min. 1.25 mg, max 2.5 mg) in 3 cc of saline q4-6 hrs	1.25-5 mg in 3 cc of saline q 4-8 hrs	
<u>Pirbuterol</u>	<u>MDI:</u> 200 mcg/puff, 400 puffs	-1-2 puffs 5 min. prior to exercise -2 puffs tid-qid prn	-2 puffs 5 min. prior to exercise -2 puffs tid-qid prn	
<u>Levalbuterol</u> (R-albuterol)	<u>Nebulizer solution:</u> 0.31 mg/3 ml 0.63 mg/3 ml 1.25 mg/3 ml	0.025 mg/kg (min. 0.63 mg, max. 1.25 mg) q 4-8 hrs	0.63 mg-2.5 mg q4-8 hrs	0.63 mg of levalbuterol is equivalent in efficacy and side effects to 1.25 mg of racemic albuterol. The product is a sterile- filled unit dose vial.

Short acting “rescue” medications



Long term control medications



Inhaled corticosteroids (ICS): Strong evidence from clinical trials has established that inhaled corticosteroids improve control of asthma for children with mild or moderate persistent asthma compared to as needed beta₂-agonists. Studies comparing inhaled corticosteroids to cromolyn sodium, nedocromil, theophylline, and leukotriene receptor antagonists are limited, but available evidence show that none of these long-term control medications appear to be as effective as inhaled corticosteroids in improving asthma control (Sorkness 2007; Szelfer 2005). The 2007 Update on the Expert Panel Report on Asthma recommends inhaled corticosteroids as preferred first line treatment for mild-moderate asthma (National Asthma Education and Prevention Program 2007). Along with leukotriene receptor antagonists, inhaled steroids may take approximately 4 weeks before the full benefits of the medication are seen—so parents need to be counseled about a realistic time-frame for onset of action.

- Side Effects:
 - Concern of growth: Low-to-medium doses of inhaled corticosteroids may result in a transient decrease in the child's growth velocity, but likely do not affect growth in the long term (NAEPP 2007; The Childhood Asthma Management Program Research Group 2000; Chervinsky 1999; Agertoft 2000). In response to the concern of long-term adverse effects of chronic inhaled corticosteroid use in children on vertical growth, bone mineral density (BMD), ocular toxicity, and suppression of the adrenal/pituitary axis, the 2007 NAEPP asthma guidelines stated:

“The potential risks of ICS are well balanced by their benefits. The potential for adverse effects on linear growth from ICS appears to be dose dependent. In treatment of children who have mild or moderate persistent asthma, low-to medium ICS therapy may be associated with a possible, but not predictable, adverse effect on linear growth. The clinical significance of this potential systemic effect has yet to be determined. High doses of ICS have greater potential for growth suppression. In general, the efficacy of ICSs is sufficient to outweigh any concerns about growth or other systemic effects. However, ICSs, as with any medications, should be titrated to as low a dose as needed to maintain good control of the child’s asthma.” (p. 222; National Asthma Education and Prevention Program 2007)

- Oral thrush: patients should rinse out their mouth after taking a dose of their ICS.
- Starting dose:
 - Starting doses are dependent on the child’s age, and asthma severity. It is critical initially to have close follow-up with patients after starting an ICS to make sure that the patient is well controlled on the prescribed dose.

Long-acting Beta₂-agonists + Inhaled Corticosteroids: Long-acting beta₂-agonists—or LABAs—(e.g., Salmeterol or Fomoterol) provide bronchodilation and bronchoprotection effects lasting 8 – 12 hours. Because of concerns that LABAs are not anti-inflammatory medications and because of their black box label, their *isolated* use in asthma has fallen out of favor. LABAs are therefore available only in combination with inhaled steroids (Fluticasone/Salmeterol or Budesonide/Fomoterol) as dry powdered inhalers. Studies have shown that the addition of a LABA to a given dose of inhaled steroid provides similar improvement in symptom control and lung function to that seen in doubling the dose of inhaled steroid alone. Therefore, the regimen of combining LABA with an inhaled steroid has been suggested as a method of intensifying asthma therapy without increasing exposure to higher doses of inhaled steroids (a “steroid-sparing” approach to intensifying treatment). For children 6 years of age and older with persistent asthma, the 2007 NAEPP states that the addition of a long-acting inhaled beta₂-agonist to low to medium doses of inhaled corticosteroids is an acceptable option for a child who requires more than low dose ICS (NAEPP 2007).

- Side effects:
 - Isolated use of LABAs in asthma has been shown to be associated with an increased risk of death (Nelson 2006). Therefore, in November, 2005 an FDA warning was issued about the use of LABAs or drugs containing LABAs (e.g., Salmeterol). The mechanism for the increased risk of death with isolated use of LABAs in asthma is unknown, but may be related to the development of tolerance/tachyphylaxis to the bronchodilation and bronchoprotection effects (Simons 1997). There is no apparent risk of increased risk of death when LABAs are used in conjunction with inhaled steroids (e.g., Advair), although studies have been underpowered to detect mortality effect. In addition, evidence suggests that tachyphylaxis may still develop (Simons 1997) with regular use of LABAs even when used with inhaled steroids.
- Starting doses:
 - For Salmeterol: 21mcg (Advair HFA)/dose, one-two actuations BID or 50mcg (Advair Diskus)/dose, one actuation BID
 - For Formoterol: 9mcg (Symbicort HFA)/dose, one-two actuations BID or 12mcg (Foradil), one actuation BID
 - ICS dose dependent on child age and asthma severity

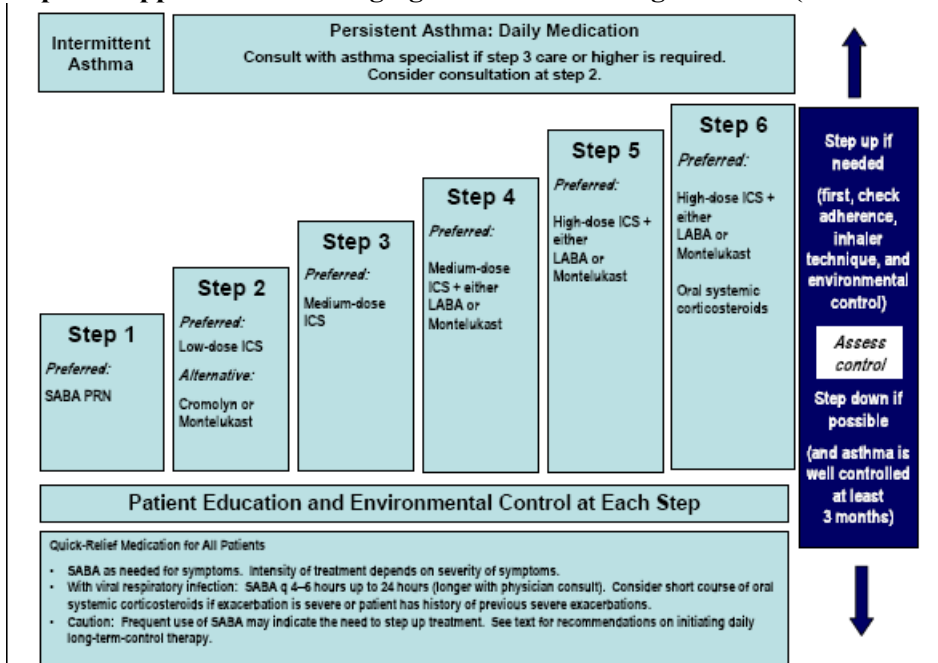
Mast cell stabilizers: Cromolyn sodium (Intal) and nedocromil (Tilade) inhalation aerosol are mast cell stabilizers, thereby limiting one of the inflammatory pathways that contribute to asthma symptoms. Although nedocromil has distinct properties from cromolyn, both have their mechanisms of action by blockade of chloride channels, and modulating mast cell mediator release. Nedocromil also inhibits early and late asthmatic response to allergen challenge. It is felt to be more effective than cromolyn in non-allergic patients on inhaled steroids. It is recommended for qid use but some effectiveness has been shown with bid use. Like cromolyn, it has a strong safety profile. However, this class of drugs may only be useful in those with mild asthma since the anti-inflammatory and clinical effects are modest compared with inhaled steroids. The QID dosing regimen is also likely to have a poorer adherence profile than the once- or twice-daily dosing of leukotriene antagonists and inhaled steroids.

- Side effects: No known side effects.
- Starting dose: 2 puffs or nebs QID. Does not offer the same opportunities to “titrate” dose up/down like inhaled steroids.

Leukotriene receptor antagonists have a role in controlling asthma, as leukotrienes contribute to the inflammatory cascade. *Montelukast (Singulair)*, and *zafirlukast (Accolate)* are leukotriene receptor antagonists that improve peak flows, reduce asthma symptoms, and attenuate the need for beta-adrenergic drugs. They have also been shown to partially block the asthmatic response to challenges with exercise or hyperventilation with dry, cold air, and to reduce the degree of exercise-induced bronchospasm. Zafirlukast and zileuton are only approved for children 12 years and older. Zylflo is a 5-lipoxygenase inhibitor (not an LTRA) and is metabolized by the p-450 enzymes and can increase the serum level of some drugs, including theophylline. This medication has also shown to prevent relapse for patients who presented to the ED for acute exacerbations (Silverman 2004). However, it requires QID dosing and Zafirlukast requires BID dosing. Montelukast can be taken as a tablet once daily, comes in a chewable tablet or granules, and is modestly effective in controlling mild-moderate persistent asthma. For asthma, it is FDA-approved for use in children starting at 12 months of age (unlike Zylflo or Accolate).

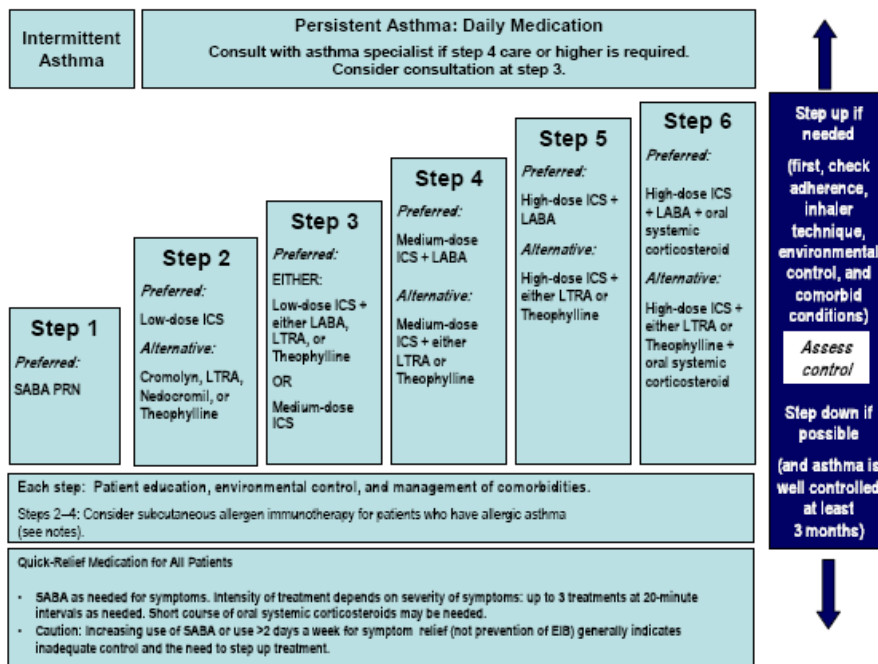
- Side effects: Anecdotally, patients (particularly pre-school age) may have nightmares. Earlier this year, FDA has started to examine if there is an increased risk of suicide.
- Starting dose: Dosing is based exclusively on age. For montelukast: 4mg for <5 years of age; 5mg for 5 – 15 years of age; 10mg for ≥15 years of age.

Pharmacologic stepwise approach by age Stepwise Approach for Managing Infants and Young Children (<5 Years of Age)



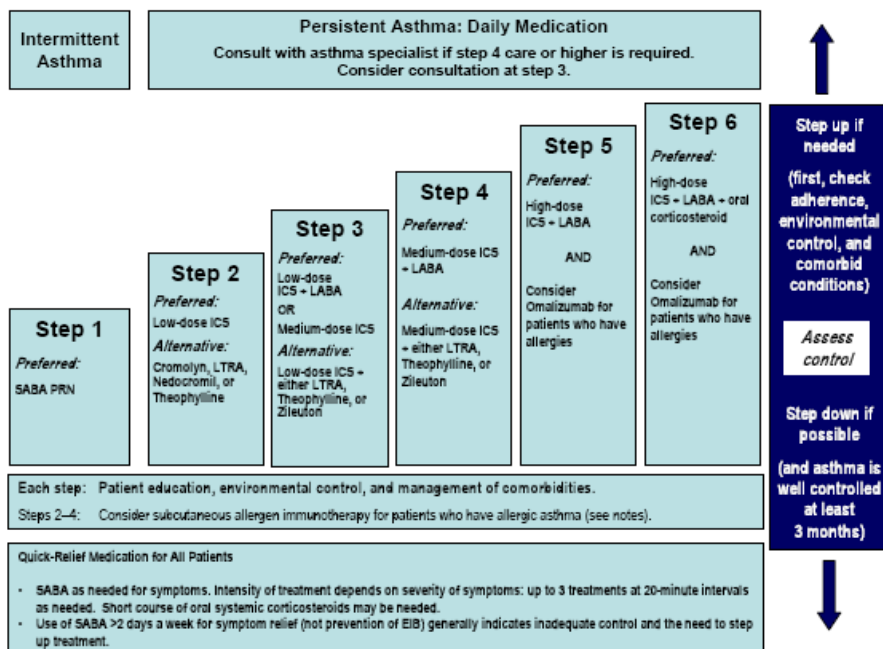
*See appendix 1 for definitions of low, medium and high inhaled corticosteroids

Stepwise Approach for Managing Young Children (5 – 11 Years of Age)



*See appendix 1 for definitions of low, medium and high inhaled corticosteroids

Stepwise Approach for Managing Adolescents and Adults (≥12 Years of Age)



*See appendix 1 for definitions of low, medium and high inhaled corticosteroids

Means of Administering Medications

- Inhaled therapy** is most efficacious and should be used in preference to oral therapy because the inhaled route is more effective, has a more rapid onset of action, and has fewer adverse reactions. Inhaled medication is available for nebulizer, metered-dose inhaler (MDI) or dry powder inhaler (disks/DPI).
 - A meta-analysis examining effectiveness of MDI with spacer as compared to nebulized albuterol concluded that MDI with spacer was at least as effective as nebulized solution for mild to moderate exacerbations, with length of stay in the ED actually decreased with MDI with spacer (Osmond 2004). MDIs also may be preferable in older children secondary to the MDI's portability and relative convenience.
- Spacers for MDIs:** Without a spacer, the inhaler delivers the aerosol at too fast a velocity for anyone to be able to inhale into their lungs. Many patients also have difficulty coordinating their inspiration with activation of the inhaler. Simply adding a spacer to the regimen may significantly reduce oral deposition (and reduce the risk for systemic side-effects) and significantly improve lung deposition—leading to improved asthma control. Aerochamber, which has a facemask and requires little patient cooperation, can be effective in children as young as several months of age, depending on both the child's cooperation and the parent's comfort level. Spacers come in various shapes and sizes. For a child who needs medication during the school day, they will need an additional spacer at school. Managed care organizations will pay for 2 spacers, but if one is lost, they will not replace it for a year. When using a spacer, only one medication should be delivered to the chamber at a time. The same chamber can be used for all medications. The usual order is beta₂-agonists first (if required), followed by corticosteroids or cromolyn sodium.

Written Action Plans

The 2007 NAEP guidelines recommend providing families with a written asthma action plan (NAEPP 2007). Specifically, the provider should include in the action plan daily medicines as well as how to recognize and respond to an exacerbation. These plans provide patients with clear information about the use of their

medicines, the actions they are to take at home for asthma attacks, and the actual peak flow measurements that they should use as a guide. An asthma action plan may be developed for school or day care as well.

Recap of Asthma Pharmacotherapy:

- Anti-inflammatory medications are the mainstay for treatment for persistent asthma
- Anti-inflammatory/long-term controller treatment options include inhaled steroids (+/- LABA), leukotriene receptor antagonists, and mast cell stabilizers
- Inhaled corticosteroids as preferred first line treatment for mild-moderate asthma
- Delivery of inhaled corticosteroids may be via MDI w/ spacer, nebulizer, or dry powder inhalers—leukotriene antagonists are oral.

Environmental Control

Atopy has been found to be one of the major predictors of persistent asthma (Martinez 1995). Therefore, environmental interventions are an important aspect of management for many patients. Essentially, this involves reducing exposure to irritants and allergens in the child's environment. Allergy testing is recommended for all patients with asthma >3 years of age.

Common Allergens:

Tobacco smoke: The incidence of asthma is increased in children who live in a home where the parent smokes. Such children have more frequent emergency room visits, a higher requirement for medication and poorer pulmonary function (Weitzman 1990). Parents need to be provided with this information and encouraged to be active about stopping smoking.

House dust mite: One gram of house dust may contain as many as 1,000 mites and 250,000 fecal pellets. The mites live on human dander and are found in high levels in dust obtained from mattresses, pillows, carpets, upholstered furniture, bed covers, clothes and soft toys. House dust mites are dependent upon a humid environment for their survival. Reducing exposure to house dust mites has been shown to reduce asthma symptoms. There are many different means of reducing exposure though many of these may be difficult due to the expense:

- 1) Encase the mattress in an airtight cover
- 2) Encase the pillow or wash it weekly
- 3) Wash the bedding in hot water weekly
- 4) Avoid sleeping or lying on upholstered furniture
- 5) Remove carpets that are laid on concrete
- 6) Remove carpet from the bedroom
- 7) Limit the number of soft toys in the bedroom
- 8) Use an under-blanket which is washed frequently.
- 9) Maintain a dry, cool environment

The type of mattress (foam, spring or water) does not appear to make a difference. Using an under blanket, however, does seem to reduce the dust mite concentration in the mattress, possibly by allowing human dander that collects on the under blanket to be removed when this blanket is washed (Martinez 1995).

Cockroach: Cockroach allergens appear to be particularly important in inner-city neighborhoods. Unfortunately, there are many negligent landlords who fail to exterminate patient's housing in a timely manner if at all. If available, a legal advocate can assist families in expediting the process.

Animal Allergens: All breeds of cats and dogs produce common allergens. The allergens are contained in the animal's dander and saliva. There is no "non-allergenic" dog: shorthaired dogs are just as allergenic as those with longer hair. To eliminate exposure to the allergens, the animal needs to be removed from the house. Relief may not be apparent for several months, as the allergens persist in dander and dried saliva for many months.

Pollens and molds: Exposure to outdoor allergens is best reduced by remaining indoors, but with cigarette smoking being as prevalent as it is, there are obvious disadvantages to staying indoors. Pollen and some mold counts tend to be highest during the midday and afternoon, so this may be a good time to be indoors. Children with a predictable seasonality to their asthma can be educated to limit the amount of time outdoors during their ‘asthma season’ or have their anti-inflammatory therapy increased in anticipation of an approaching season. Staying inside on the day after a heavy rainfall may also be useful. Grass pollen, which is abundant in the spring, is released into the atmosphere in greatly increased amounts on days following rainfall.

Asthma Exacerbations (and some additional information)

Identifying and treating an asthma exacerbation

There is no current consensus on what defines an asthma exacerbation or “attack”. The 2007 NIH Asthma Guidelines suggest that an exacerbation is characterized by shortness of breath, cough, wheezing, and chest tightness—or some combination of these symptoms.

“Exacerbations are characterized by decreases in expiratory airflow that can be documented and quantified by simple measurement of lung function (spirometry or PEF). These objective measures more reliably indicate the severity of an exacerbation than does the severity of symptoms.”

The American Thoracic Society and the European Respiratory Society have a joint publication that defines an exacerbation as: “events characterized by a change from the patient’s previous status.”

Exacerbations may be stratified by severity;

- **Severe** asthma exacerbations are events that require urgent action on the part of the patient and physician to prevent a serious outcome, such as hospitalization or death from asthma. The occurrence of severe asthma exacerbations should be used as a marker of poor asthma control. The definition should include at least one of the following:
 - (a) Use of systemic corticosteroids (tablets, suspension, or injection), or an increase from a stable maintenance dose, for at least 3 days. For consistency, courses of corticosteroids separated by 1 week or more should be treated as separate severe exacerbations.
 - (b) A hospitalization or ER visit because of asthma, requiring systemic corticosteroids.
- **Moderate** asthma exacerbations are events that should result in a temporary change in treatment, in an effort to prevent the exacerbation from becoming severe. It should include one or more of the following: deterioration in symptoms, deterioration in lung function, and increased rescue bronchodilator use. These features should last for 2 days or more, but not be severe enough to warrant systemic corticosteroid use and/or hospitalization, ER visits for asthma.

Practically speaking, patients classified with moderate or severe persistent asthma, or those classified as having very poorly controlled asthma—can be considered to be having some degree of an ongoing asthma exacerbation and therefore warrant treatment with some type(s) of rescue medication(s). Rescue medications may include short-acting beta₂ agonists (SABA) and systemic corticosteroids. The role of these two medications is:

1. SABA to relieve airflow obstruction, with addition of inhaled ipratropium bromide in severe exacerbations.
2. Systemic corticosteroids to decrease airway inflammation in moderate or severe exacerbations or for patients who fail to respond promptly and completely to a SABA.

Early recognition and appropriate treatment (e.g., increasing the frequency of SABA use) is important to successful management of an exacerbation. The following strategies are **not** effective in treating the exacerbation:

1. doubling the dose of inhaled steroid (for those prescribed an ICS prior to the exacerbation);
2. drinking large volumes of liquid
3. exposure to moist air (e.g., shower steam)
4. over-the-counter products such as cough suppressants, anti-histamines, or cold remedies.

Exercise Induced Bronchospasm:

This is a commonly under diagnosed variant of asthma. Exercise-induced bronchospasm (EIB) occurs in 80-90% of patients with asthma, and in 40-50% of children who have allergic rhinitis *without* a diagnosis of asthma. It is a transient increase in airway resistance following brief, rigorous activity. Factors affecting EIB include: intensity (especially bursts of intensive exercise lasting 2-8 minutes), duration, stress, and environment. Clinical symptoms of EIB include: coughing, wheezing, SOB, chest pain and itching or scratching sensation in chest. If untreated, it can limit and disrupt otherwise normal lives. The bronchospasm usually occurs during exercise, peaks 5-10 minutes after the exercise stops and lasts for about 20-45 minutes.

Pharmacologic treatment for Exercise Induced bronchospasm (EIB) includes:

- 1) Use of a beta₂-agonist shortly before exercise, which may help up to 2 hours
- 2) Cromolyn and nedocromil
- 3) Lengthy warm up (including breathing through the nose; breathing warm, humidified air and/or avoiding hyperventilation during warm-up); and
- 4) Long term therapy if appropriate for other symptoms such as anti-inflammatory agents.

When to refer to a specialist? For children younger than 5 years, consultation with an asthma specialist is recommended for moderate persistent or severe persistent disease. For all patients, the criteria include:

- Patient has had a life-threatening asthma exacerbation
- Patient is not meeting the goals of asthma therapy after 3 to 6 months of treatment
- Signs and symptoms are atypical or there are problems in differential diagnosis
- Other conditions complicate asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, vocal cord dysfunction, gastroesophageal reflux, chronic obstructive pulmonary disease)
- Additional diagnostic testing is indicated (e.g., allergy skin testing, rhinoscopy, complete pulmonary function studies, provocative challenge, bronchoscopy)
- Patient requires additional education and guidance on complications of therapy, problems with adherence or allergen avoidance
- Patient is being considered for immunotherapy
- Patient requires continuous oral corticosteroid therapy or high-dose inhaled corticosteroids or has required more than two bursts of oral corticosteroids in 1 year

WEBSITES: <http://www.nhlbi.nih.gov/guidelines/asthma/> to find 2007 asthma guideline updates.

www.aafa.org The asthma and allergy foundation of America

www.aanma.org The allergy and asthma network mothers of asthma

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Appendix 1. Estimated Comparative Daily Dosages of Inhaled Corticosteroids for Children ≤ 12 Years*

Drug	<u>Low Dose</u>	<u>Medium Dose</u>	<u>High Dose</u>
Beclomethasone CFC	84 - 336 mcg	336 - 672	> 672
Beclomethasone HFA	80 – 160	160 – 320	>320
Budesonide DPI	200 – 400	400 – 800	>800
Budesonide Nebs	500 (0.5mg)	1,000 (1mg)	2 mg
Flunisolide	500 – 750	1,000 – 1,250	>1,250
Fluticasone MDI	88 - 176	176 - 440	>440
Fluticasone DPI	100 – 200	200 – 400	>400
Triamcinolone	400 - 800 mcg	800 - 1,200	>1,200

*All doses in mcg unless otherwise noted

Estimated Comparative Daily Dosages of Inhaled Corticosteroids for Children >12 Years*

Drug	<u>Low Dose</u>	<u>Medium Dose</u>	<u>High Dose</u>
Beclomethasone CFC	168 - 504 mcg	504 – 840 mcg	> 840 mcg
Beclomethasone HFA	80 – 240	240 – 480	>480
Budesonide DPI	200 – 600	600 – 1,200	>1,200
Budesonide Nebs	n/a	n/a	n/a
Flunisolide	500 – 1,000 (1mg)	1,000 – 2,000	>2,000 (2mg)
Fluticasone MDI	88 - 264	264 - 660	>660
Fluticasone DPI	100 – 300	300 – 600	>600
Triamcinolone	400 – 1,000	1,000 - 1,200	>1,200

*All doses in mcg unless otherwise noted

2017 Addendum - Approaches to Guideline Adherence - Problem Solving Counseling, by Genna Vullo, MHS, Dr. Barbara Howard and Dr. Ray Sturner

Problem Solving Counseling appears to be one of the most effective means of improving adherence. Problem Solving Counseling (PSC) is an integral component of most cognitive-behavioral interventions designed to change behavior. PSC Theory is a 5 stage behavior change model consisting of: (1) Problem Definition (developing a clear and specific definition of the problem), (2) Generation of Alternatives (brainstorming to identify multiple and creative solutions), (3) Decision making (evaluating all the solutions to identify the most effective and feasible option), (4) Solution Implementation (carry out the plan) and (5) Solution Verification (evaluate the effectiveness of the solution and modify plan as necessary) (D'Zurilla & Goldfried, 1971). Poor PSC skills are associated with treatment non-adherence and poor health outcomes across several chronic illnesses including kidney transplant, diabetes, obesity and HIV (Gelb, Shapiro, Thornton, 2010; Lovejoy & Suhr, 2009). Indeed, PSC interventions that specifically target barriers to adherence have been shown to result in improved adherence (Perri, Nezu, McKelvey, et al, 2001; Hill-Briggs & Gemmell, 2001). Moreover, improved PSC skills as a result of intervention are associated with increased adherence (Murawski, Milsom, Ross et al, 2010) PSC interventions are focused and brief allowing them to feasibly be done in the clinic setting, by non-mental health professionals. While health professionals rarely engage in PSC with their patients (Hill-Briggs & Gemmell, 2001; Wilson, Laws, Safren et al, 2010), there is evidence that they can be taught to use this effective strategy without increasing the length of a visit (King, Gregory, Schlundt et al, 2007; Wilson, Strub, Buist, et al 2010).

The CHADIS Asthma Patient-Specific Template suggests teleprompter text for clinicians following the PSC paradigm, supporting clinician-parent-patient shared decision (SDM) making for adherence challenges. Sharing the view of the PACCI graphic in CHADIS also engages patients in reflecting on their own data. In SDM “the clinicians’ role is to help patients understand what the reasonable options are, then elicit, inform, and integrate patients’ informed preferences as they relate to the available options”. Shared decision making in asthma care has been shown to significantly improve adherence and clinical outcomes in asthma care (Wilson, Strub, et al, 2010).

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