

Asthma Care Quick Reference

DIAGNOSING AND MANAGING ASTHMA

Guidelines from the National Asthma Education and Prevention Program

EXPERT PANEL REPORT 3

The goal of this asthma care quick reference guide is to help clinicians provide quality care to people who have asthma.

Quality asthma care involves not only initial diagnosis and treatment to achieve asthma control, but also long-term, regular follow-up care to maintain control.

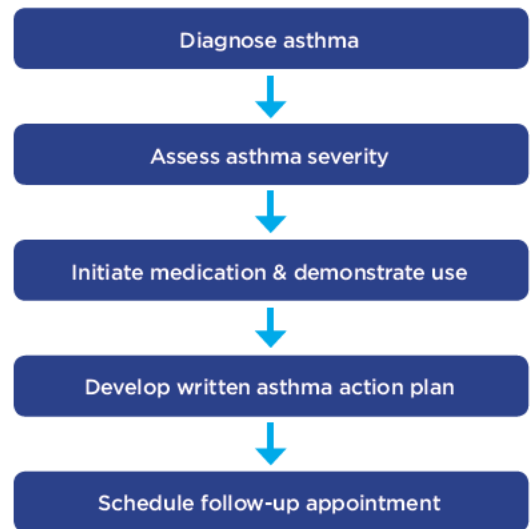
Asthma control focuses on two domains: (1) **reducing impairment**—the frequency and intensity of symptoms and functional limitations currently or recently experienced by a patient; and (2) **reducing risk**—the likelihood of future asthma attacks, progressive decline in lung function (or, for children, reduced lung growth), or medication side effects.

Achieving and maintaining asthma control requires providing appropriate medication, addressing environmental factors that cause worsening symptoms, helping patients learn self-management skills, and monitoring over the long term to assess control and adjust therapy accordingly.

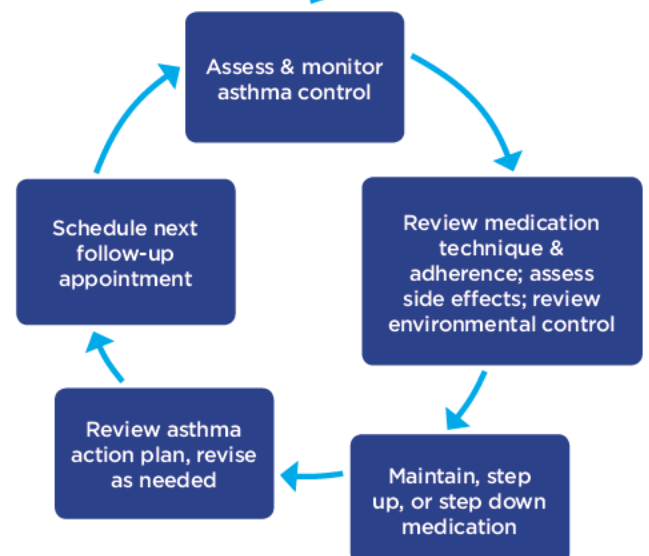
The diagram (right) illustrates the steps involved in providing quality asthma care.

This guide summarizes recommendations developed by the National Asthma Education and Prevention Program's expert panel after conducting a systematic review of the scientific literature on asthma care. See www.nhlbi.nih.gov/guidelines/asthma for the full report and references. Medications and dosages were updated in September 2011 for the purposes of this quick reference guide to reflect currently available asthma medications.

INITIAL VISIT



FOLLOW-UP VISITS



KEY CLINICAL ACTIVITIES FOR QUALITY ASTHMA CARE

(See complete table in *Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma* [EPR-3])

Clinical Issue	Key Clinical Activities and Action Steps
<p>➔ ASTHMA DIAGNOSIS</p>	
<p>Establish asthma diagnosis.</p> <ul style="list-style-type: none"> ▪ Determine that symptoms of recurrent airway obstruction are present, based on history and exam. <ul style="list-style-type: none"> • History of cough, recurrent wheezing, recurrent difficulty breathing, recurrent chest tightness • Symptoms occur or worsen at night or with exercise, viral infection, exposure to allergens and irritants, changes in weather, hard laughing or crying, stress, or other factors ▪ In all patients ≥ 5 years of age, use spirometry to determine that airway obstruction is at least partially reversible. ▪ Consider other causes of obstruction. 	
<p>➔ LONG-TERM ASTHMA MANAGEMENT</p>	
<p>GOAL: Asthma Control</p>	<p>Reduce Impairment</p> <ul style="list-style-type: none"> ▪ Prevent chronic symptoms. ▪ Require infrequent use of short-acting beta₂-agonist (SABA). ▪ Maintain (near) normal lung function and normal activity levels. <p>Reduce Risk</p> <ul style="list-style-type: none"> ▪ Prevent exacerbations. ▪ Minimize need for emergency care, hospitalization. ▪ Prevent loss of lung function (or, for children, prevent reduced lung growth). ▪ Minimize adverse effects of therapy.
<p>Assessment and Monitoring</p>	<p>INITIAL VISIT: Assess asthma severity to initiate treatment (see page 5).</p> <p>FOLLOW-UP VISITS: Assess asthma control to determine if therapy should be adjusted (see page 6).</p> <ul style="list-style-type: none"> ▪ Assess at each visit: asthma control, proper medication technique, written asthma action plan, patient adherence, patient concerns. ▪ Obtain lung function measures by spirometry at least every 1–2 years; more frequently for asthma that is not well controlled. ▪ Determine if therapy should be adjusted: Maintain treatment; step up, if needed; step down, if possible. <p>Schedule follow-up care.</p> <ul style="list-style-type: none"> ▪ Asthma is highly variable over time. See patients: <ul style="list-style-type: none"> • Every 2–6 weeks while gaining control • Every 1–6 months to monitor control • Every 3 months if step down in therapy is anticipated
<p>Use of Medications</p>	<p>Select medication and delivery devices that meet patient's needs and circumstances.</p> <ul style="list-style-type: none"> ▪ Use stepwise approach to identify appropriate treatment options (see page 7). ▪ Inhaled corticosteroids (ICSs) are the most effective long-term control therapy. ▪ When choosing treatment, consider domain of relevance to the patient (risk, impairment, or both), patient's history of response to the medication, and willingness and ability to use the medication. <p>Review medications, technique, and adherence at each follow-up visit.</p>

KEY CLINICAL ACTIVITIES FOR QUALITY ASTHMA CARE (continued)

Clinical Issue	Key Clinical Activities and Action Steps
Patient Education for Self-Management	<p>Teach patients how to manage their asthma.</p> <ul style="list-style-type: none"> ▪ Teach and reinforce at each visit: <ul style="list-style-type: none"> • Self-monitoring to assess level of asthma control and recognize signs of worsening asthma (either symptom or peak flow monitoring) • Taking medication correctly (inhaler technique, use of devices, understanding difference between long-term control and quick-relief medications) <ul style="list-style-type: none"> - Long-term control medications (such as inhaled corticosteroids, which reduce inflammation) prevent symptoms. Should be taken daily; will not give quick relief. - Quick-relief medications (short-acting beta₂-agonists or SABAs) relax airway muscles to provide fast relief of symptoms. Will not provide long-term asthma control. If used >2 days/week (except as needed for exercise-induced asthma), the patient may need to start or increase long-term control medications. • Avoiding environmental factors that worsen asthma <p>Develop a written asthma action plan in partnership with patient/family (sample plan available at www.nhlbi.nih.gov/health/public/lung/asthma/asthma_actplan.pdf).</p> <ul style="list-style-type: none"> ▪ Agree on treatment goals. ▪ Teach patients how to use the asthma action plan to: <ul style="list-style-type: none"> • Take daily actions to control asthma • Adjust medications in response to worsening asthma • Seek medical care as appropriate ▪ Encourage adherence to the asthma action plan. <ul style="list-style-type: none"> • Choose treatment that achieves outcomes and addresses preferences important to the patient/family. • Review at each visit any success in achieving control, any concerns about treatment, any difficulties following the plan, and any possible actions to improve adherence. • Provide encouragement and praise, which builds patient confidence. Encourage family involvement to provide support. <p>Integrate education into all points of care involving interactions with patients.</p> <ul style="list-style-type: none"> ▪ Include members of all health care disciplines (e.g., physicians, pharmacists, nurses, respiratory therapists, and asthma educators) in providing and reinforcing education at all points of care.
Control of Environmental Factors and Comorbid Conditions	<p>Recommend ways to control exposures to allergens, irritants, and pollutants that make asthma worse.</p> <ul style="list-style-type: none"> ▪ Determine exposures, history of symptoms after exposures, and sensitivities. (In patients with persistent asthma, use skin or in vitro testing to assess sensitivity to perennial indoor allergens to which the patient is exposed.) <ul style="list-style-type: none"> • Recommend multifaceted approaches to control exposures to which the patient is sensitive; single steps alone are generally ineffective. • Advise all asthma patients and all pregnant women to avoid exposure to tobacco smoke. • Consider allergen immunotherapy by trained personnel for patients with persistent asthma when there is a clear connection between symptoms and exposure to an allergen to which the patient is sensitive. <p>Treat comorbid conditions.</p> <ul style="list-style-type: none"> ▪ Consider allergic bronchopulmonary aspergillosis, gastroesophageal reflux, obesity, obstructive sleep apnea, rhinitis and sinusitis, and stress or depression. Treatment of these conditions may improve asthma control. ▪ Consider inactivated flu vaccine for all patients >6 months of age.

ASTHMA CARE FOR SPECIAL CIRCUMSTANCES

Clinical Issue	Key Clinical Activities and Action Steps
Exercise-Induced Bronchospasm	<p>Prevent EIB.*</p> <ul style="list-style-type: none"> Physical activity should be encouraged. For most patients, EIB should not limit participation in any activity they choose. Teach patients to take treatment before exercise. SABAs* will prevent EIB in most patients; LTRAs,* cromolyn, or LABAs* also are protective. Frequent or chronic use of LABA to prevent EIB is discouraged, as it may disguise poorly controlled persistent asthma. Consider long-term control medication. EIB often is a marker of inadequate asthma control and responds well to regular anti-inflammatory therapy. Encourage a warm-up period or mask or scarf over the mouth for cold-induced EIB.
Pregnancy	<p>Maintain asthma control through pregnancy.</p> <ul style="list-style-type: none"> Check asthma control at all prenatal visits. Asthma can worsen or improve during pregnancy; adjust medications as needed. Treating asthma with medications is safer for the mother and fetus than having poorly controlled asthma. Maintaining lung function is important to ensure oxygen supply to the fetus. ICSs* are the preferred long-term control medication. Remind patients to avoid exposure to tobacco smoke.

MANAGING EXACERBATIONS

Clinical Issue	Key Clinical Activities and Action Steps
Home Care	<p>Develop a written asthma action plan (see Patient Education for Self-Management, page 3).</p> <p>Teach patients how to:</p> <ul style="list-style-type: none"> Recognize early signs, symptoms, and PEF* measures that indicate worsening asthma. Adjust medications (increase SABA* and, in some cases, add oral systemic corticosteroids) and remove or withdraw from environmental factors contributing to the exacerbation. Monitor response. Seek medical care if there is serious deterioration or lack of response to treatment. Give specific instructions on who and when to call.
Urgent or Emergency Care	<p>Assess severity by lung function measures (for ages ≥ 5 years), physical examination, and signs and symptoms.</p> <p>Treat to relieve hypoxemia and airflow obstruction; reduce airway inflammation.</p> <ul style="list-style-type: none"> Use supplemental oxygen as appropriate to correct hypoxemia. Treat with repetitive or continuous SABA,* with the addition of inhaled ipratropium bromide in severe exacerbations. Give oral systemic corticosteroids in moderate or severe exacerbations or for patients who fail to respond promptly and completely to SABA. Consider adjunctive treatments, such as intravenous magnesium sulfate or heliox, in severe exacerbations unresponsive to treatment. <p>Monitor response with repeat assessment of lung function measures, physical examination, and signs and symptoms, and, in emergency department, pulse oximetry.</p> <p>Discharge with medication and patient education:</p> <ul style="list-style-type: none"> Medications: SABA, oral systemic corticosteroids; consider starting ICS* Referral to follow-up care Asthma discharge plan Review of inhaler technique and, whenever possible, environmental control measures

*Abbreviations: EIB, exercise induced bronchospasm; ICS, inhaled corticosteroid; LABA, long acting beta₂ agonist; LTRA, leukotriene receptor antagonist; PEF, peak expiratory flow; SABA, short acting beta₂ agonist.

INITIAL VISIT: CLASSIFYING ASTHMA SEVERITY AND INITIATING THERAPY (in patients who are not currently taking long-term control medications)

Level of severity (Columns 2-5) is determined by events listed in Column 1 for both impairment (frequency and intensity of symptoms and functional limitations) and risk (of exacerbations). Assess impairment by patient's or caregiver's recollection of events during the previous 2-4 weeks; assess risk over the past year. Recommendations for initiating therapy based on level of severity are presented in the last row.

Components of Severity	Intermittent					Persistent						
	Mild		Moderate		Severe		Mild		Moderate		Severe	
	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years
Symptoms	≤2 days/week		≤2x/month		3-4x/month but not daily		3-4x/month		3-4x/month but not nightly		Often 7x/week	
Nighttime awakenings	0		≤2x/month		3-4x/month		3-4x/month		>1x/week		Throughout the day	
SABA* use for symptom control (not to prevent EBT†)	≤2 days/week		≤2 days/week but not daily		>2 days/week but not daily and not more than once on any day		Daily		Daily		Several times per day	
Interference with normal activity	None		Minor limitation		Some limitation		Some limitation		Some limitation		Extreme limitation	
Lung function	Normal FEV ₁ between exacerbations		Normal FEV ₁ between exacerbations		Normal FEV ₁ between exacerbations		Normal FEV ₁ between exacerbations		Normal FEV ₁ between exacerbations		Normal FEV ₁ between exacerbations	
→ FEV ₁ * (% predicted)	Not applicable		>80%		>80%		>80%		60-80%		<60%	
→ FEV ₁ /FVC*	Not applicable		>85%		>80%		Normal†		60-80%		<60%	
Asthma exacerbations requiring oral systemic corticosteroids‡	0-1/year		≤2 exacerbations in 6 months, or wheezing year astng ≥4x per >1 day AND risk factors for persistent asthma		Generally, more frequent and intense events indicate greater severity.		Generally, more frequent and intense events indicate greater severity.		Generally, more frequent and intense events indicate greater severity.		Reduced >5%†	
Risk	Step 1		Step 2		Step 3		Step 3		Step 3		Step 3 or Step 4	
Recommended Step for Initiating Therapy (See "Stepwise Approach for Managing Asthma Long Term," page 7)	Step 1		Step 2		Step 3		Step 3		Step 3		Step 3 or Step 4	
The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.	Step 1		Step 2		Step 3		Step 3		Step 3		Step 3 or Step 4	
<p>Consider severity and interval since last asthma exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to FEV₁.*</p> <p>In 2-6 weeks, depending on severity, assess level of asthma control achieved and adjust therapy as needed. For children 0-4 years old, if no clear benefit is observed in 4-6 weeks, consider adjusting therapy or alternate diagnoses.</p>												

* Abbreviations: EBT, exercise-induced bronchospasm; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; CS, short-acting beta₂-agonist.

† Normal FEV₁/FVC by age: 8-19 years, 85%; 20-39 years, 80%; 40-59 years, 75%; 60-80 years, 70%.

‡ Data are insufficient to link frequencies of exacerbations with different levels of asthma severity. Generally, more frequent and intense exacerbations (e.g., requiring urgent care, hospital or intensive care admissions, and/or oral corticosteroids) indicate greater underlying disease severity. For treatment purposes, patients with ≥2 exacerbations may be considered to have persistent asthma, even in the absence of impairment consistent with persistent asthma.

FOLLOW-UP VISITS: ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY

Level of control (Columns 2-4) is based on the most severe component of impairment (symptoms and function) or risk (exacerbations). Assess impairment by patient's or caregiver's recollection during the previous 2-4 weeks and by spirometry and/or peak flow measures. Symptom assessment for ongoing problems should reflect a global assessment, such as noting whether the patient's asthma is better or worse since the last visit. Assess risk by recollection of exacerbations during the previous year and since the last visit. Recommendations for adjusting therapy based on level of control are presented in the last row.

Components of Control	Well Controlled			Not Well Controlled			Very Poorly Controlled		
	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years	Ages 0-4 years	Ages 5-11 years	Ages ≥12 years
Symptoms	≤2 days/week	≤2 days/week but not more than once on each day	≤2 days/week	>2 days/week	>2 days/week or multiple times on ≤2 days/week	>2 days/week	Throughout the day	Throughout the day	Throughout the day
Nighttime awakenings	≤1x/month	≤2x/month	≤2x/month	>1x/month	≥2x/month	1-3x/week	>1x/week	≥2x/week	≥4x/week
Interference with normal activity	None	None	None	Some limitation	Some limitation	Some limitation	Extreme limitation	Extreme limitation	Extreme limitation
SABA* use for symptom control (not to prevent EBF†)	≤2 days/week	≤2 days/week	≤2 days/week	>2 days/week	>2 days/week	>2 days/week	Severely limited	Severely limited	Severely limited
Lung function	>80%	>80%	>80%	Not appropriate	60-80%	60-80%	<60%	<60%	<60%
FEV ₁ (% predicted) or peak flow (% personal best)	>80%	>80%	>80%	Not appropriate	75-80%	75-80%	<75%	<75%	Not appropriate
FEV ₁ /FVC*	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate
Validated questionnaire†	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate	Not appropriate
ATAQ* ACQ* ACT*	Not appropriate	0-10 ≤0.75† ≥20	0-10 ≤0.75† ≥20	Not appropriate	Not appropriate	1-2 ≥15 16-19	Not appropriate	Not appropriate	3-4 Not appropriate ≤15
Asthma exacerbations requiring oral corticosteroids‡	0-1/year	2-3/year	2-3/year	2-3/year	≥2/year	≥2/year	>3/year	≥2/year	≥2/year
Reduction in lung growth/Progressive loss of lung function	Evaluate on request for follow-up care	Evaluate on request for follow-up care	Evaluate on request for follow-up care	Not appropriate	Evaluate on request for follow-up care	Evaluate on request for follow-up care	Not appropriate	Evaluate on request for follow-up care	Evaluate on request for follow-up care
Treatment-related adverse effects	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 (See "Stepwise Approach for Managing Asthma Long Term," page 7) The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.	Maintain current step. Regular follow-up every 1-6 months. Consider step down if well controlled for at least 3 months.			Step up 1 step	Step up at least 1 step	Step up 1 step	Consider short course of oral systemic corticosteroids. Step up 1-2 steps. Reevaluate in 2 weeks to achieve control.		
* Abbreviations: ACQ, Asthma Control Questionnaire; ACT, Asthma Control Test™; ATAQ, Asthma Therapy Assessment Questionnaire; EBF, forced expiratory volume in 1 second; SABA, short-acting beta ₂ -agonist. † Minimum important difference: 1.0 for the ATAQ; 0.5 for the ACQ; not determined for the ACT. ‡ ACQ values of 0.76-1.4 are indeterminate regarding wheezing and asthma. § Data are insufficient to link frequency of exacerbations with different levels of asthma control. Generally, more frequent and intense exacerbations (e.g., requiring urgent care, hospitalization, or intensive care admissions, and/or oral corticosteroids) indicate poorer asthma control.									

* Abbreviations: ACQ, Asthma Control Questionnaire; ACT, Asthma Control Test™; ATAQ, Asthma Therapy Assessment Questionnaire; EBF, forced expiratory volume in 1 second; SABA, short-acting beta₂-agonist.
† Minimum important difference: 1.0 for the ATAQ; 0.5 for the ACQ; not determined for the ACT.
‡ ACQ values of 0.76-1.4 are indeterminate regarding wheezing and asthma.
§ Data are insufficient to link frequency of exacerbations with different levels of asthma control. Generally, more frequent and intense exacerbations (e.g., requiring urgent care, hospitalization, or intensive care admissions, and/or oral corticosteroids) indicate poorer asthma control.

STEPWISE APPROACH FOR MANAGING ASTHMA LONG TERM

The stepwise approach tailors the selection of medication to the level of asthma severity (see page 5) or asthma control (see page 6). The stepwise approach is meant to help, not replace, the clinical decisionmaking needed to meet individual patient needs.

ASSESS CONTROL: ← **STEP UP IF NEEDED** (first, check medication adherence, inhaler technique, environmental control, and comorbidities) →

← **STEP DOWN IF POSSIBLE** (and asthma is well controlled for at least 3 months) →

	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	
At each step: Patient education, environmental control, and management of comorbidities							
0-4 years of age		Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 3 care or higher is required. Consider consultation at step 2.				
	Preferred Treatment†	SABA* as needed	low dose ICS*	medium dose ICS*	medium dose ICS* + either LABA* or montelukast	high dose ICS* + either LABA* or montelukast	high dose ICS* + either LABA* or montelukast + oral corticosteroids
	Alternative Treatment†‡		cromolyn or montelukast				
	Quick Relief Medication	<ul style="list-style-type: none"> If clear benefit is not observed in 4-6 weeks, and medication technique and adherence are satisfactory, consider adjusting therapy or alternate diagnoses. SABA* as needed for symptoms; intensity of treatment depends on severity of symptoms. With viral respiratory symptoms: SABA every 4-6 hours up to 24 hours (longer with physician consult). Consider short course of oral systemic corticosteroids if asthma exacerbation is severe or patient has history of severe exacerbations. Caution: Frequent use of SABA may indicate the need to step up treatment. 					
5-11 years of age		Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.				
	Preferred Treatment†	SABA* as needed	low dose ICS*	low dose ICS* + either LABA,* LTRA,* or theophylline ^(b)	medium dose ICS* + LABA*	high dose ICS* + LABA*	high dose ICS* + LABA* + oral corticosteroids
	Alternative Treatment†‡		cromolyn, LTRA,* or theophylline ^(b)	OR medium dose ICS	medium dose ICS* + either LTRA* or theophylline ^(b)	high dose ICS* + either LTRA* or theophylline ^(b)	high dose ICS* + either LTRA* or theophylline ^(b) + oral corticosteroids
	Quick Relief Medication	<ul style="list-style-type: none"> Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.** SABA* as needed for symptoms. The intensity of treatment depends on severity of symptoms: up to 3 treatments every 20 minutes as needed. Short course of oral systemic corticosteroids may be needed. Caution: Increasing use of SABA or use >2 days/week for symptom relief (not to prevent EIB*) generally indicates inadequate control and the need to step up treatment. 					
≥12 years of age		Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.				
	Preferred Treatment†	SABA* as needed	low dose ICS*	low dose ICS* + LABA* OR medium dose ICS*	medium dose ICS* + LABA*	high dose ICS* + LABA*	high dose ICS* + LABA* + oral corticosteroid ^(e)
	Alternative Treatment†‡		cromolyn, LTRA,* or theophylline ^(b)	low dose ICS* + either LTRA,* theophylline, ^(b) or zileuton ^(f)	medium dose ICS* + either LTRA,* theophylline, ^(b) or zileuton ^(f)	AND consider omalizumab for patients who have allergies ^(g)	AND consider omalizumab for patients who have allergies ^(g)
	Quick Relief Medication	<ul style="list-style-type: none"> Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.** SABA* as needed for symptoms. The intensity of treatment depends on severity of symptoms: up to 3 treatments every 20 minutes as needed. Short course of oral systemic corticosteroids may be needed. Caution: Use of SABA >2 days/week for symptom relief (not to prevent EIB*) generally indicates inadequate control and the need to step up treatment. 					

* Abbreviations: EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, inhaled long-acting beta₂-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta₂-agonist.

† Treatment options are listed in alphabetical order, if more than one.

‡ If alternative treatment is used and response is inadequate, discontinue and use preferred treatment before stepping up.

^(b) Theophylline is a less desirable alternative because of the need to monitor serum concentration levels.

** Based on evidence for dust mites, animal dander, and pollen; 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.

^(g) Clinicians who administer immunotherapy or omalizumab should be prepared to treat anaphylaxis that may occur.

^(f) Zileuton is less desirable because of limited studies as adjunctive therapy and the need to monitor liver function.

^(e) Before oral corticosteroids are introduced, a trial of high-dose ICS + LABA + either LTRA, theophylline, or zileuton, may be considered, although this approach has not been studied in clinical trials.

ESTIMATED COMPARATIVE DAILY DOSAGES: INHALED CORTICOSTEROIDS FOR LONG-TERM ASTHMA CONTROL

MEDICATION	0-4 years of age			5-11 years of age			≥12 years of age		
	Low	Medium*	High*	Low	Medium*	High*	Low	Medium*	High*
Beclomethasone MDI†									
40 mcg/puff	N/A	N/A	N/A	80-160 mcg	>160-320 mcg	>320 mcg	80-240 mcg	>240-480 mcg	>480 mcg
80 mcg/puff				1-2 puffs 2x/day	3-4 puffs 2x/day		1-3 puffs 2x/day	4-6 puffs 2x/day	
Budesonide DPI†									
90 mcg/ nha at on	N/A	N/A	N/A	1 puff 2x/day	2 puffs 2x/day	≥3 puffs 2x/day	1 puff am, 2 puffs pm	2-3 puffs 2x/day	≥4 puffs 2x/day
180 mcg/ nha at on				180-360 mcg	>360-720 mcg	>720 mcg	180-540 mcg	>540-1,080 mcg	>1,080 mcg
Budesonide Nebules									
0.25 mg	0.25-0.5 mg	>0.5-1.0 mg	>1.0 mg	1-2 nhs† 2x/day	3-4 nhs† 2x/day		1-3 nhs† 2x/day		
0.5 mg	1 neb†/day	2 nebs†/day	3 nebs†/day	2 nhs† 2x/day	2 nhs† 2x/day	≥3 nhs† 2x/day	1 nh† am, 2 nhs† pm	2-3 nhs† 2x/day	≥4 nhs† 2x/day
1.0 mg	1 neb†/day	1 neb†/day	2 nebs†/day	1 neb†/day	1 neb†/day	1 neb† 2x/day	N/A	N/A	N/A
Ciclesonide MDI†									
80 mcg/puff	N/A	N/A	N/A	80-160 mcg	>160-320 mcg	>320 mcg	160-320 mcg	>320-640 mcg	>640 mcg
160 mcg/puff				1-2 puffs/day	1 puff am, 2 puffs pm-2 puffs 2x/day	≥3 puffs 2x/day	1-2 puffs 2x/day	3-4 puffs 2x/day	
Flunisolide MDI†									
80 mcg/puff	N/A	N/A	N/A	1 puff/day	1 puff 2x/day	≥2 puffs 2x/day	2 puffs 2x/day	2 puffs 2x/day	≥3 puffs 2x/day
				160 mcg	320-480 mcg	≥480 mcg	320 mcg	>320-640 mcg	>640 mcg
				1 puff 2x/day	2-3 puffs 2x/day	≥4 puffs 2x/day	2 puffs 2x/day	3-4 puffs 2x/day	≥5 puffs 2x/day

* t s preferab e to use a h gher mcg/puff or mcg/ nha at on formu at on to ach eve as ow a number of puffs or nha at ons as poss b e.
 † Abbreviations: DP, dry powder nha er (requ res deep, fast nha at on); nh, nha at on; MD, metered dose nha er (re eases a puff of med cat on); neb, nebu e.

ESTIMATED COMPARATIVE DAILY DOSAGES: INHALED CORTICOSTEROIDS FOR LONG-TERM ASTHMA CONTROL (continued)

Daily Dose	0-4 years of age			5-11 years of age			≥12 years of age		
	Low	Medium*	High*	Low	Medium*	High*	Low	Medium*	High*
MEDICATION									
Fluticasone MDI†	176 mcg	>176-352 mcg	>352 mcg	88-176 mcg	>176-352 mcg	>352 mcg	88-264 mcg	>264-440 mcg	>440 mcg
44 mcg/puff	2 puffs 2x/day	3-4 puffs 2x/day	≥2 puffs 2x/day	1-2 puffs 2x/day	3-4 puffs 2x/day	≥2 puffs 2x/day	1-3 puffs 2x/day	2 puffs 2x/day	3 puffs 2x/day
110 mcg/puff		1 puff 2x/day			1 puff 2x/day			1 puffs 2x/day	≥2 puffs 2x/day
220 mcg/puff									
Fluticasone DPI†	N/A	N/A	N/A	100-200 mcg	>200-400 mcg	>400 mcg	100-300 mcg	>300-500 mcg	>500 mcg
50 mcg/nha at on				1-2 nhs* 2x/day	3-4 nhs* 2x/day		1-3 nhs* 2x/day		
100 mcg/nha at on				1 nh* 2x/day	2 nhs* 2x/day	>2 nhs* 2x/day		2 nhs* 2x/day	≥3 nhs* 2x/day
250 mcg/nha at on						1 nh* 2x/day		1 nh* 2x/day	≥2 nhs* 2x/day
Mometasone DPI†	N/A	N/A	N/A	110 mcg	220-440 mcg	>440 mcg	110-220 mcg	>220-440 mcg	>440 mcg
110 mcg/nha at on				1 nh*/day	1-2 nhs* 2x/day	≥3 nhs* 2x/day	1-2 nhs* pm	3-4 nhs* pm or 2 nhs* 2x/day	≥3 nhs* 2x/day
220 mcg/nha at on					1-2 nhs*/day	≥3 nhs* d v ded n 2 doses	1 nh* pm	1 nh* 2x/day or 2 nhs* pm	≥3 nhs* d v ded n 2 doses

* t s preferable to use a h gher mcg/puff or mcg/nha at on to achieve as ow a number of puffs or nha at ons as poss b e.
 † Abbreviations: DP , dry powder nha er (requ res deep, fast nha at on); nh , nha at on; MD , metered dose nha er (reases a puff of med cat on); neb, nebu e.

Therapeutic Issues Pertaining to Inhaled Corticosteroids (ICSs) for Long-Term Asthma Control

- **The most important determinant of appropriate dosing is the clinician's judgment of the patient's response to therapy.** The c n c an must mon tor the pat ent's response on severa c n ca parameters (e g , symptoms; act v ty eve ; measures of lung funct on) and adjust the dose accord ng y Once asthma contro s ach eved and susta ned at east 3 months, the dose shou d be carefu y t rated down to the m n m um dose necessary to ma nta n contro
- Some doses may be outs de package abe ng, espec a y n the h gh-dose range Budeson de nebu zer suspens on s the on y nha ed cort costero d (CS) w th FDA-approved abe ng for ch dren <4 years of age
- Metered-dose nha er (MD) dosages are expressed as the actuator dose (amount eav ng the actuator and de vered to the pat ent), wh ch s the abe ng requ red n the Un ted States Th s d fferent from the dosage expressed as the va ve dose (amount of drug eav ng the va ve, not a of wh ch s ava abe to the pat ent), wh ch s used n
- many European countr es and n some sc ent fic terature Dry powder nha er (DP) doses are expressed as the amount of drug n the nha er fo ow ng act vat on
 - For ch dren <4 years of age The safety and efficacy of CSs n ch dren <1 year of age has not been estab shed Ch dren <4 years of age genera y requ re de vey of CS (budeson de and flut casone MD) through a face mask that fits snug y over nose and mouth to avo d nebu z ng n the eyes Face shou d be washed after treatment to prevent oca cort costero d s de effects For budeson de, the dose may be g ven 1-3 t mes da y Budeson de suspens on s compat b e w th a butero , pratriop um, and eva butero nebu zer so ut ons n the same nebu zer Use on y jet nebu zers, as u trason c nebu zers are neffect ve for suspens ons For flut casone MD , the dose shou d be d v ded 2 t mes da y; the ow dose for ch dren <4 years of age s h gher than for ch dren 5-11 years of age because of ow dose de vered w th face mask and data on efficacy n young ch dren

USUAL DOSAGES FOR OTHER LONG-TERM CONTROL MEDICATIONS*

Medication	0–4 years of age	5–11 years of age	≥12 years of age
Combined Medication (inhaled corticosteroid + long-acting beta₂-agonist)			
Fluticasone/Salmeterol – DPI† 100 mcg/50 mcg, 250 mcg/50 mcg, or 500 mcg/50 mcg MDI† 45 mcg/21 mcg, 115 mcg/21 mcg, or 230 mcg/21 mcg	N/A†	1 inhalation 2x/day; dose depends on level of severity or control	1 inhalation 2x/day; dose depends on level of severity or control
Budesonide/Formoterol MDI† 80 mcg/4.5 mcg or 160 mcg/4.5 mcg	N/A†	2 puffs 2x/day; dose depends on level of severity or control	2 puffs 2x/day; dose depends on level of severity or control
Mometasone/Formoterol MDI† 100 mcg/5 mcg	N/A†	N/A†	2 inhalations 2x/day; dose depends on severity of asthma
Leukotriene Modifiers			
Leukotriene Receptor Antagonists (LTRAs) Montelukast 4 mg or 5 mg chewable tablet, 4 mg granule packets, 10 mg tablet	4 mg every night at bedtime (1–5 years of age)	5 mg every night at bedtime (6–14 years of age)	10 mg every night at bedtime
Zafirlukast 10 mg or 20 mg tablet <i>Take at least 1 hour before or 2 hours after a meal. Monitor liver function.</i>	N/A†	10 mg 2x/day (7–11 years of age)	40 mg daily (20 mg tablet 2x/day)
5-Lipoxygenase Inhibitor Zileuton 600 mg tablet <i>Monitor liver function.</i>	N/A†	N/A†	2,400 mg daily (give 1 tablet 4x/day)
Immunomodulators			
Omalizumab (Anti IgE†) Subcutaneous injection, 150 mg/1.2 mL following reconstitution with 1.4 mL sterile water for injection <i>Monitor patients after injections; be prepared to treat anaphylaxis that may occur.</i>	N/A†	N/A†	150–375 mg subcutaneous every 2–4 weeks, depending on body weight and pretreatment serum IgE level
Cromolyn			
Cromolyn Nebulizer: 20 mg/ampule	1 ampule 4x/day, N/A† <2 years of age	1 ampule 4x/day	1 ampule 4x/day
Methylxanthines			
Theophylline Liquids, sustained release tablets, and capsules <i>Monitor serum concentration levels.</i>	Starting dose 10 mg/kg/day; usual maximum: ▪ <1 year of age: 0.2 (age in weeks) + 5 = mg/kg/day ▪ ≥1 year of age: 16 mg/kg/day	Starting dose 10 mg/kg/day; usual maximum: 16 mg/kg/day	Starting dose 10 mg/kg/day up to 300 mg maximum; usual maximum: 800 mg/day
Inhaled Long-Acting Beta₂-Agonists (LABAs) – used in conjunction with ICS† for long-term control; LABA is NOT to be used as monotherapy			
Salmeterol DPI† 50 mcg/blister	N/A†	1 blister every 12 hours	1 blister every 12 hours
Formoterol DPI† 12 mcg/single use capsule	N/A†	1 capsule every 12 hours	1 capsule every 12 hours
Oral Systemic Corticosteroids			
Methylprednisolone 2, 4, 8, 16, 32 mg tablets	▪ 0.25–2 mg/kg daily in single dose in a.m. or every other day as needed for control ▪ Short course “burst”: 1–2 mg/kg/day, max 60 mg/d for 3–10 days	▪ 0.25–2 mg/kg daily in single dose in a.m. or every other day as needed for control ▪ Short course “burst”: 1–2 mg/kg/day, max 60 mg/d for 3–10 days	▪ 7.5–60 mg daily in single dose in a.m. or every other day as needed for control ▪ Short course “burst”: to achieve control, 40–60 mg/day as single or 2 divided doses for 3–10 days
Prednisolone 5 mg tablets; 5 mg/5 cc, 15 mg/5 cc			
Prednisone 1, 2.5, 5, 10, 20, 50 mg tablets; 5 mg/cc, 5 mg/5 cc			

* Dosages are provided for those products that have been approved by the U.S. Food and Drug Administration or have sufficient clinical trial safety and efficacy data in the appropriate age ranges to support their use.

† Abbreviations: DPI, dry powder inhaler; IgE, immunoglobulin E; MDI, metered-dose inhaler; N/A, not available (not approved, no data available, or safety and efficacy not established for this age group).

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 (e.g., symptoms; activity level; measures of lung function) and adjust the dose accordingly. Once asthma control is achieved and sustained at least 3 months, the dose should be carefully titrated down to the minimum dose necessary to maintain control.

RESPONDING TO PATIENT QUESTIONS ABOUT INHALED CORTICOSTEROIDS

Questions and varying beliefs about inhaled corticosteroids (ICSs) are common and may affect adherence to treatment. Following are some key points to share with patients and families.

- ICSs are the most effective medications for long-term control of persistent asthma. Because ICSs are inhaled, they go right to the lungs to reduce chronic airway inflammation. In general, ICSs should be taken every day to prevent asthma symptoms and attacks.
- The potential risks of ICSs are well balanced by their benefits. To reduce the risk of side effects, patients should work with their doctor to use the lowest dose that maintains asthma control, and be sure to take the medication correctly.
 - Mouth irritation and thrush (yeast infection), which may be associated with ICSs at higher doses, can be avoided by rinsing the mouth and spitting after ICS use and, if appropriate for the inhaler device, by using a valved holding chamber or spacer.
- ICS use may slow a child's growth rate slightly. This effect on linear growth is not predictable and is generally small (about 1 cm), appears to occur in the first several months of treatment, and is not progressive. The clinical significance of this potential effect has yet to be determined. Growth rates are highly variable in children, and poorly controlled asthma can slow a child's growth.
- ICSs are generally safe for pregnant women. Controlling asthma is important for pregnant women to be sure the fetus receives enough oxygen.
- ICSs are not addictive.
- ICSs are not the same as anabolic steroids that some athletes use illegally to increase sports performance.

RESPONDING TO PATIENT QUESTIONS ABOUT LONG-ACTING BETA₂-AGONISTS

Keep the following key points in mind when educating patients and families about long-acting beta₂-agonists (LABAs).

- The addition of LABA (salmeterol or formoterol) to the treatment of patients who require more than low-dose inhaled corticosteroid (ICS) alone to control asthma improves lung function, decreases symptoms, and reduces exacerbations and use of short-acting beta₂-agonists (SABA) for quick relief in most patients to a greater extent than doubling the dose of ICS.
- A large clinical trial found that slightly more deaths occurred in patients taking salmeterol in a single inhaler every day in addition to usual asthma therapy* (13 out of about 13,000) compared with patients taking a placebo in addition to usual asthma therapy (3 out of about 13,000). Trials for formoterol in a single inhaler every day in addition to usual therapy* found more severe asthma exacerbations in patients taking formoterol, especially at higher doses, compared with those taking a placebo added to usual therapy. Therefore, the Food and Drug Administration placed a Black Box warning on all drugs containing a LABA.
- The established benefits of LABAs added to ICS for the great majority of patients who require more than low-dose ICS alone to control asthma should be weighed against the risk of severe exacerbations, although uncommon, associated with daily use of LABAs.
- LABAs should not be used as monotherapy for long-term control. Even though symptoms may improve significantly, it is important to keep taking ICS while taking LABA.
- Daily use should generally not exceed 100 mcg salmeterol or 24 mcg formoterol.
- It is not currently recommended that LABAs be used to treat acute symptoms or exacerbations.

* Usual therapy included a wide range of regimens, from those in which no other daily therapy was taken to those in which varying doses of other daily medications were taken.

EDUCATIONAL RESOURCES

National Heart, Lung, and Blood Institute

- Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma (EPR-3)
www.nhlbi.nih.gov/guidelines/asthma
- Physician Asthma Care Education (PACE): www.nhlbi.nih.gov/health/prof/lung/asthma/pace/
- National Asthma Control Initiative (NACI): <http://naci.nhlbi.nih.gov>

Allergy & Asthma Network Mothers of Asthmatics
800-878-4403
www.aanma.org

**American Academy of Allergy, Asthma,
and Immunology**
414-272-6071
www.aaaai.org

American Academy of Pediatrics
847-434-4000
www.aap.org

American Association of Respiratory Care
972-243-2272
www.aarc.org

American College of Chest Physicians
847-498-1400
www.chestnet.org

American College of Allergy, Asthma & Immunology
847-427-1200
www.acaai.org

American Lung Association
800-LUNG-USA (800-586-4872)
www.lungusa.org

American School Health Association
800-445-2742
www.ashaweb.org

Asthma and Allergy Foundation of America
800-7-ASTHMA (800-727-8462)
<http://aafa.org>

Centers for Disease Control and Prevention
800-CDC-INFO (800-232-4636)
www.cdc.gov/asthma

**Environmental Protection Agency/
Asthma Community Network**
www.asthmacommunitynetwork.org
800-490-9198 (to order EPA publications)
www.epa.gov/asthma/publications.html

National Association of School Nurses
240-821-1130
www.nasn.org

For more information contact:

NHLBI Information Center
P.O. Box 30105
Bethesda, MD 20824-0105
Phone: 301-592-8573
Fax: 301-592-8563
Web site: www.nhlbi.nih.gov



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