Asthma Care **Quick Reference**

ASTHMA DIAGNOSIS AND MANAGEMENT

Guidance from the National Asthma Education and Prevention Program

EXPERT PANEL REPORT 3

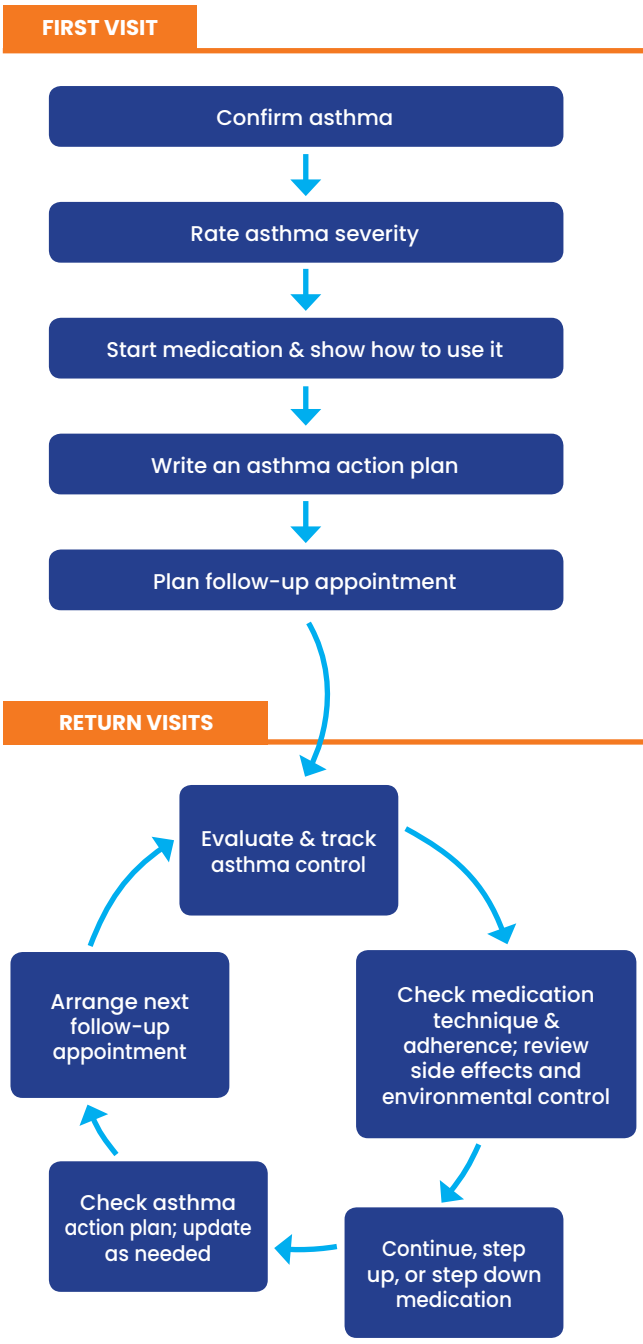
This quick reference on asthma care is designed to help clinicians deliver quality care to people who have asthma.

Quality asthma care starts with diagnosis and treatment to bring asthma under control, followed by long-term, regular follow-up to sustain that control.

Asthma control addresses two areas: (1) **reducing impairment**: the frequency and intensity of symptoms and functional limitations a patient has now or has recently experienced; and (2) **reducing risk**: the chance of future asthma attacks, progressive loss of lung function (or, in children, reduced lung growth), or medication side effects.

Reaching and maintaining asthma control calls for suitable medication, management of environmental factors that worsen symptoms, instruction in patient self-management skills, and ongoing monitoring to evaluate control and adjust treatment as needed.

The diagram at right shows the steps for delivering quality asthma care.



This guide outlines recommendations made by the National Asthma Education and Prevention Program's expert panel following a systematic review of the scientific literature on asthma care. For the full **report and references, visit** www.nhlbi.nih.gov/guidelines/asthma. Medicines and dosages were updated in September 2011 for this quick reference guide to reflect asthma medicines then available.

U.S. Department of Health and Human Services
National Institutes of Health
National Heart, Lung, and Blood Institute

ESSENTIAL CLINICAL TASKS FOR QUALITY ASTHMA CARE

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

Clinical Topic	Core Clinical Tasks and Action Steps
➡ DIAGNOSING ASTHMA	

	Confirm asthma diagnosis.
	▪ Confirm symptoms of recurrent airway obstruction using the patient's history and exam.
	  • History of cough, repeated wheezing, recurrent breathing difficulty, recurrent chest tightness
	  • Symptoms occur or intensify at night or with exercise, viral infection, exposure to allergens and irritants, weather changes, hard laughing or crying, stress, or other factors
	▪ For every patient ≥5 years of age, use spirometry to verify that airway obstruction is at least partly reversible.
	▪ Consider alternative causes of obstruction.

➡ LONG-TERM ASTHMA CARE	
AIM: Asthma Control	**Lessen Impairment** ▪ Avoid chronic symptoms. ▪ Require short-acting beta$_2$-agonist (SABA) only infrequently. ▪ Preserve (near) normal lung function and normal activity levels. **Lower Risk** ▪ Avoid exacerbations. ▪ Minimize need for emergency care and hospitalization. ▪ Prevent lung function loss (or, in children, prevent reduced lung growth). ▪ Minimize adverse effects of treatment.

Evaluation and Monitoring	**INITIAL VISIT: Gauge asthma severity to start treatment** (see page 5)**.**
	FOLLOW-UP VISITS: Evaluate asthma control to decide whether to adjust therapy (see page 6)**.**
	▪ At every visit, review: asthma control, proper medication technique, the written asthma action plan, adherence, and the patient's concerns.
	▪ Measure lung function using spirometry at least every 1–2 years, and more often when asthma is not well controlled.
	▪ Decide whether to adjust therapy: Maintain treatment, step up if needed, or step down when possible.
	
	Arrange follow-up care.
	▪ Asthma varies greatly over time. See patients:
	  • Every 2–6 weeks while achieving control
	  • Every 1–6 months to assess control
	  • Every 3 months when a step down in therapy is expected

Use of Medicines	**Choose medication and delivery devices suited to the patient's needs and circumstances.** ▪ Follow a stepwise approach to choose appropriate treatments (see page 7). ▪ Inhaled corticosteroids (ICSs) provide the most effective long-term control therapy. ▪ When selecting treatment, consider the relevant domain for the patient (risk, impairment, or both), the patient's prior response to the medication, and willingness and ability to use the medication. **Check medications, technique, and adherence at every follow-up visit.**

ESSENTIAL CLINICAL TASKS FOR QUALITY ASTHMA CARE *(continued)*

Clinical Topic	Core Clinical Tasks and Action Steps
Patient Education for Self-Management	**Show patients how to manage their asthma.** ▪ At each visit, teach and reinforce: • Self-monitoring to gauge asthma control and spot signs that asthma is worsening through symptom or peak flow monitoring • Correct medication use (inhaler technique, device use, and understanding the difference between long-term control and quick-relief medications) - *Long-term control medications* (such as inhaled corticosteroids, which reduce inflammation) prevent symptoms. Take them daily; they do not give quick relief. - *Quick-relief medications* (short-acting beta$_2$-agonists or SABAs) relax airway muscles for rapid symptom relief. They do not provide long-term asthma control. If used >2 days/week (except as needed for exercise-induced asthma), patients may need to begin or increase long-term control medications. • Avoidance of environmental factors that aggravate asthma **Create a written asthma action plan** jointly with the patient/family (a sample plan is at *www.nhlbi.nih.gov/health/public/lung/asthma/asthma_actplan.pdf*). ▪ Set treatment goals together. ▪ Teach patients to use the asthma action plan to: • Take everyday steps to control asthma • Modify medication when asthma worsens • Obtain medical care when appropriate ▪ Promote adherence to the asthma action plan. • Select treatment that achieves outcomes and addresses preferences important to the patient/family. • At each visit, discuss success in achieving control, concerns about treatment, difficulties following the plan, and steps that may improve adherence. • Offer encouragement and praise to strengthen patient confidence. Encourage family involvement for added support. **Incorporate education into every point of care that involves patient interaction.** ▪ Engage all health care disciplines (e.g., physicians, pharmacists, nurses, respiratory therapists, and asthma educators) to deliver and reinforce education at every point of care.
Managing Environmental Factors and Comorbid Conditions	**Suggest ways to limit exposure to allergens, irritants, and pollutants that worsen asthma.** ▪ Identify exposures, symptom history after exposure, and sensitivities. (For persistent asthma, use skin or in vitro tests to assess sensitivity to perennial indoor allergens to which the patient is exposed.) • Recommend multifaceted exposure control for substances to which the patient is sensitive; single measures alone are generally ineffective. • Advise all patients with asthma and all pregnant women to avoid tobacco smoke exposure. • Consider allergen immunotherapy delivered by trained personnel for persistent asthma when there is a clear link between symptoms and exposure to an allergen that the patient is sensitive to. **Treat comorbid conditions.** ▪ Consider allergic bronchopulmonary aspergillosis, gastroesophageal reflux, obesity, obstructive sleep apnea, rhinitis and sinusitis, and stress or depression. Treating these conditions may help improve asthma control. ▪ Consider inactivated flu vaccine for every patient >6 months of age.

ASTHMA CARE IN SPECIAL SITUATIONS

Clinical Topic	Core Clinical Tasks and Action Steps
Exercise-Induced Bronchospasm	**Prevent EIB.*** ▪ Promote physical activity. For most patients, EIB should not restrict participation in activities of their choice. ▪ Teach patients to use treatment before exercise. SABAs* prevent EIB in most patients; LTRAs,* cromolyn, or LABAs* also offer protection. Frequent or chronic LABA use to prevent EIB is discouraged, because it may mask poorly controlled persistent asthma. ▪ Consider long-term control medication. EIB often signals insufficient asthma control and responds favorably to regular anti-inflammatory therapy. ▪ Encourage a warm-up or a mask or scarf over the mouth for cold-induced EIB.
Pregnancy	**Keep asthma controlled throughout pregnancy.** ▪ Review asthma control at every prenatal visit. Asthma may worsen or improve during pregnancy; change medications as needed. ▪ Treating asthma with medication is safer for both mother and fetus than poorly controlled asthma. Preserving lung function is important to ensure oxygen supply to the fetus. ▪ For long-term control, ICSs* are the preferred medication. ▪ Remind patients to stay away from tobacco smoke.

EXACERBATION MANAGEMENT

Clinical Topic	Core Clinical Tasks and Action Steps
Care at Home	**Create a written asthma action plan** (see Patient Education for Self-Management, page 3)**.** **Show patients how to:** ▪ Spot early signs, symptoms, and PEF* readings that signal worsening asthma. ▪ Modify medication (increase SABA* and, in some cases, add oral systemic corticosteroids) and remove or move away from environmental factors contributing to the exacerbation. ▪ Track the response. ▪ Seek medical care for serious deterioration or failure to respond to treatment. Give clear instructions on whom to call and when.
Urgent or Emergency Care	**Gauge severity with lung function measures (for ages ≥5 years), physical examination, and signs and symptoms.** **Treat hypoxemia and airflow obstruction, and reduce airway inflammation.** ▪ Give supplemental oxygen when appropriate to correct hypoxemia. ▪ Use repeated or continuous SABA,* adding inhaled ipratropium bromide for severe exacerbations. ▪ Use oral systemic corticosteroids for moderate or severe exacerbations or when patients do not respond rapidly and completely to SABA. ▪ Consider adjunctive treatment, such as intravenous magnesium sulfate or heliox, for severe exacerbations that do not respond to treatment. **Track response by reassessing lung function measures, the physical examination, signs and symptoms, and, in the emergency department, pulse oximetry.** **Provide medication and patient education at discharge:** ▪ Medications: SABA, oral systemic corticosteroids; consider initiating ICS* ▪ Refer for follow-up care ▪ Asthma discharge plan ▪ Check inhaler technique and, whenever possible, environmental control measures

***Key abbreviations:** EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, long-acting beta$_2$-agonist; LTRA, leukotriene receptor antagonist; PEF, peak expiratory flow; SABA, short-acting beta$_2$-agonist.

INITIAL VISIT: DETERMINING ASTHMA SEVERITY AND STARTING THERAPY

(for patients not currently using long-term control medications)

Determine severity (Columns 2–5) from the events in Column 1 for both impairment (frequency and intensity of symptoms and functional limitations) and risk (of exacerbations). Evaluate impairment using the patient's or caregiver's recall over the previous 2–4 weeks; assess risk over the past year. Recommendations for starting therapy according to severity appear in the final row.

Elements of Severity		Intermittent			Persistent								
					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
Impairment	Symptoms	≤2 days/week			>2 days/week but not daily			Daily			All through the day		
	Awakenings at night	0	≤2x/month		1–2x/month	3–4x/month		3–4x/month	>1x/week but not nightly		>1x/week	Often 7x/week	
	SABA* taken for symptom relief (not to prevent EIB*)	≤2 days/week			>2 days/week but not daily	>2 days/week but not daily and not more than once on any day		Daily			Several times per day		
	Limitations in normal activity	None			Minor limitation			Some limitation			Extremely limited		
	Lung function												
	→ FEV_1* (% predicted)	Not applicable	Normal FEV_1 between exacerbations >80%	Normal FEV_1 between exacerbations >80%	Not applicable	>80%	>80%	Not applicable	60–80%	60–80%	Not applicable	<60%	<60%
	→ FEV_1/FVC*		>85%	Normal†		>80%	Normal†		75–80%	Reduced 5%†		<75%	Reduced >5%†
Risk	Asthma exacerbations needing oral systemic corticosteroids‡	0–1/year			≥2 exacerb. in 6 months, or wheezing ≥4x per year lasting >1 day AND risk factors for persistent asthma	≥2/year		*More frequent and intense events generally suggest greater severity.*			*More frequent and intense events generally suggest greater severity.*		
		*Weigh severity and time since the last asthma exacerbation. Frequency and severity may vary over time in any severity category. Relative annual exacerbation risk may be linked to FEV_1.**											
Recommended Step to Begin Treatment *(See "Stepwise Approach for Managing Asthma Long Term," page 7)* *The stepwise approach supports but does not replace the clinical judgment required to address each patient's needs.*		Step 1			Step 2			Step 3	Step 3 medium-dose ICS* option	Step 3	Step 3	Step 3 medium-dose ICS* option or Step 4	Step 4 or 5
								Consider a brief course of oral systemic corticosteroids.					
		In 2–6 weeks, according to severity, evaluate the degree of asthma control and adjust treatment as needed. For children 0–4 years old, if no clear benefit appears within 4–6 weeks, consider modifying treatment or alternative diagnoses.											

* **Abbreviations:** EIB, exercise-induced bronchospasm; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; ICS, inhaled corticosteroid; SABA, short-acting $beta_2$-agonist.

† Normal FEV_1/FVC values by age: 8–19 years, 85%; 20–39 years, 80%; 40–59 years, 75%; 60–80 years, 70%.

‡ Evidence is insufficient to associate exacerbation frequencies with distinct asthma severity levels. In general, more frequent and severe exacerbations (e.g., needing urgent care, hospital or intensive care admission, and/or oral corticosteroids) indicate more severe underlying disease. For treatment, patients with ≥2 exacerbations may be classified as having persistent asthma, even when impairment does not meet the criteria for persistent asthma.

FOLLOW-UP VISITS: EVALUATING ASTHMA CONTROL AND MODIFYING THERAPY

Control (Columns 2–4) depends on the most severe impairment (symptoms and functional limitations) or risk (exacerbations) component. Assess impairment from the patient's or caregiver's recall of Column 1 events over the previous 2–4 weeks and spirometry and/or peak flow readings. Assessment of symptoms over longer periods should use an overall appraisal, such as asking whether asthma has improved or worsened since the previous visit. Evaluate risk from recalled exacerbations over the previous year and since the last visit. Recommendations for modifying treatment according to the level of control appear in the final row.

Measures 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
Impairment	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	All through the day		
	Awakenings at night	≤1x/month		≤2x/month	>1x/month	≥2x/month	1–3x/week	>1x/week	≥2x/week	≥4x/week
	Limitations in normal activity	None			Some limitation			Extremely limited		
	SABA* taken for symptom relief (not to prevent EIB*)	≤2 days/week			>2 days/week			Several times per day		
	Lung function ➡ FEV_1* (% *predicted*) or peak flow (% *personal best*) ➡ FEV_1/FVC*	Not applicable Not applicable	>80% >80%	>80% Not applicable	Not applicable Not applicable	60–80% 75–80%	60–80% Not applicable	Not applicable Not applicable	<60% <75%	<60% Not applicable
	Validated questionnaires† ➡ ATAQ* ➡ ACQ* ➡ ACT*	Not applicable 	Not applicable 	0 ≤0.75‡ ≥20	Not applicable 	Not applicable 	1–2 ≥1.5 16–19	Not applicable 	Not applicable 	3–4 Not applicable ≤15
Risk	Asthma exacerbations needing oral systemic corticosteroids§	0–1/year			2–3/year	≥2/year		>3/year	≥2/year	
		Weigh severity and time since the last asthma exacerbation.								
	Reduced lung growth/Progressive loss in lung function	Not applicable	Assessment needs long-term follow-up care.		Not applicable	Assessment needs long-term follow-up care.		Not applicable	Assessment needs long-term follow-up care.	
	Therapy-related adverse effects	*Medication side effects may range from absent to highly troublesome and concerning. Their intensity does not correlate with specific control levels but should be included in the overall assessment of risk.*								
Recommended Action for Therapy *(See "Stepwise Approach for Managing Asthma Long Term," page 7)* *The stepwise approach supports but does not replace the clinical judgment required to address each patient's needs.*		*Keep the current step.* *Arrange follow-up every 1–6 months.* *Consider stepping down if well controlled for at least 3 months.*			Step up 1 step *Reassess in 2–6 weeks to establish control.* *For children 0–4 years, if no clear benefit appears within 4–6 weeks, consider treatment changes or alternative diagnoses.*	Step up at least 1 step	Step up 1 step	*Consider a brief course of oral systemic corticosteroids.* *Step up 1–2 steps.* *Reassess in 2 weeks to establish control.*		
					Before increasing treatment: *Check medication adherence, inhaler technique, and environmental control. If an alternative treatment was used, stop it and use the preferred treatment for that step. If side effects occur, consider other treatment options.*					

* **Abbreviations:** ACQ, Asthma Control Questionnaire©; ACT, Asthma Control Test™; ATAQ, Asthma Therapy Assessment Questionnaire©; EIB, exercise-induced bronchospasm; FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 second; SABA, short-acting $beta_2$-agonist.

† Minimal important difference: 1.0 for the ATAQ; 0.5 for the ACQ; not established for the ACT.

‡ ACQ scores of 0.76–1.4 are inconclusive for well-controlled asthma.

§ Evidence is insufficient to associate exacerbation frequencies with distinct asthma control levels. In general, more frequent and severe exacerbations (e.g., needing urgent care, hospital or intensive care admission, and/or oral corticosteroids) indicate worse asthma control.

STEPWISE APPROACH FOR MANAGING ASTHMA LONG TERM

This stepwise approach matches medication choice to asthma severity (see page 5) or the degree of asthma control (see page 6). Use the stepwise approach to support, rather than replace, the clinical judgment needed to address each patient's needs.

ASSESS CONTROL:

STEP UP WHEN NEEDED (first assess medication adherence, inhaler technique, environmental control, and comorbidities)

STEP DOWN WHEN POSSIBLE (if asthma has been well controlled for at least 3 months)

At every step: Patient education, environmental control, and management of comorbidities

0–4 years of age

	Intermittent Asthma	Persistent Asthma: Daily Medication Consult an asthma specialist when step 3 or higher is needed. Consider consultation at step 2.				
	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
Preferred Therapy†	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 Therapy†,‡		cromolyn or montelukast				
If no clear benefit appears in 4–6 weeks and medication technique and adherence are satisfactory, consider therapy changes or alternative diagnoses.						
Quick-Relief Medication	▪ SABA* as needed for symptoms; tailor treatment intensity to symptom severity. ▪ With viral respiratory symptoms: use SABA every 4–6 hours for up to 24 hours (longer with physician consultation). Consider a short course of oral systemic corticosteroids if the exacerbation is severe or there is a history of severe exacerbations. ▪ Caution: Frequent SABA use may signal a need to step up treatment.					

5–11 years of age

	Intermittent Asthma	Persistent Asthma: Daily Medication Consult an asthma specialist when step 4 or higher is needed. Consider consultation at step 3.				
	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
Preferred Therapy†	SABA* as needed	low-dose ICS*	low-dose ICS* + either LABA,* LTRA,* or theophylline(b) OR medium-dose ICS	medium-dose ICS* + LABA*	high-dose ICS* + LABA*	high-dose ICS* + LABA* + oral corticosteroids
Alternative Therapy†,‡		cromolyn, LTRA,* or theophylline§		medium-dose ICS* + either LTRA* or theophylline§	high-dose ICS* + either LTRA* or theophylline§	high-dose ICS* + either LTRA* or theophylline§ + oral corticosteroids
		Consider subcutaneous allergen immunotherapy in patients with persistent, allergic asthma.**				
Quick-Relief Medication	▪ SABA* as needed for symptoms. Match treatment intensity to symptom severity: up to 3 treatments every 20 minutes as needed. A short course of oral systemic corticosteroids may be necessary. ▪ Caution: Increasing SABA use or use >2 days/week for symptom relief (not to prevent EIB*) usually signals inadequate control and a need to step up treatment.					

≥12 years of age

	Intermittent Asthma	Persistent Asthma: Daily Medication Consult an asthma specialist when step 4 or higher is needed. Consider consultation at step 3.				
	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6
Preferred Therapy†	SABA* as needed	low-dose ICS*	low-dose ICS* + LABA* OR medium-dose ICS*	medium-dose ICS* + LABA*	high-dose ICS* + LABA* AND consider omalizumab for patients with allergies††	high-dose ICS* + LABA* + oral corticosteroid§§ AND consider omalizumab for patients with allergies††
Alternative Therapy†,‡		cromolyn, LTRA,* or theophylline§	low-dose ICS* + either LTRA,* theophylline,§ or zileuton‡‡	medium-dose ICS* + either LTRA,* theophylline,§ or zileuton‡‡		
		Consider subcutaneous allergen immunotherapy for patients with persistent, allergic asthma.**				
Quick-Relief Medication	▪ SABA* as needed for symptoms. Match treatment intensity to symptom severity: up to 3 treatments every 20 minutes as needed. A short course of oral systemic corticosteroids may be necessary. ▪ Caution: SABA use >2 days/week for symptom relief (not to prevent EIB*) usually indicates inadequate control and a need to step up treatment.					

* **Abbreviations:** EIB, exercise-induced bronchospasm; ICS, inhaled corticosteroid; LABA, inhaled long-acting beta$_2$-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta$_2$-agonist.
† Multiple treatment options are ordered alphabetically.
‡ If response to alternative treatment is inadequate, stop it and use preferred treatment before stepping up.
§ Theophylline is a less preferred alternative because serum concentrations require monitoring.
** Based on evidence for dust mites, animal dander, and pollen; evidence for molds and cockroaches is weak or absent. Evidence is strongest for immunotherapy using single allergens. Allergy plays a greater role in children's asthma than in adults'.
†† Clinicians giving immunotherapy or omalizumab should be ready to treat any anaphylaxis that may occur.
‡‡ Zileuton is less preferred because studies as adjunctive therapy are limited and liver function monitoring is needed.
§§ Before introducing oral corticosteroids, a trial of high-dose ICS + LABA + either LTRA, theophylline, or zileuton may be considered, although it has not been tested in clinical trials.

ESTIMATED DAILY DOSAGE COMPARISONS: INHALED CORTICOSTEROIDS FOR LONG-TERM ASTHMA CONTROL

	0–4 years of age			5–11 years of age			≥12 years of age		
Dose per Day	**Low**	**Medium***	**High***	**Low**	**Medium***	**High***	**Low**	**Medium***	**High***
MEDICATION									
Beclomethasone MDI†	N/A	N/A	N/A	80–160 mcg	>160–320 mcg	>320 mcg	80–240 mcg	>240–480 mcg	>480 mcg
40 mcg/puff				1–2 puffs 2x/day	3–4 puffs 2x/day		1–3 puffs 2x/day	4–6 puffs 2x/day	
80 mcg/puff				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
Budesonide DPI†	N/A	N/A	N/A	180–360 mcg	>360–720 mcg	>720 mcg	180–540 mcg	>540–1,080 mcg	>1,080 mcg
90 mcg/inhalation				1–2 inhs† 2x/day	3–4 inhs† 2x/day		1–3 inhs† 2x/day		
180 mcg/inhalation					2 inhs† 2x/day	≥3 inhs† 2x/day	1 inh† am, 2 inhs† pm	2–3 inhs† 2x/day	≥4 inhs† 2x/day
Budesonide Nebules	0.25–0.5 mg	>0.5–1.0 mg	>1.0 mg	0.5 mg	1.0 mg	2.0 mg	N/A	N/A	N/A
0.25 mg	1–2 nebs†/day			1 neb† 2x/day					
0.5 mg	1 neb†/day	2 nebs†/day	3 nebs†/day	1 neb†/day	1 neb† 2x/day				
1.0 mg		1 neb†/day	2 nebs†/day		1 neb†/day	1 neb† 2x/day			
Ciclesonide MDI†	N/A	N/A	N/A	80–160 mcg	>160–320 mcg	>320 mcg	160–320 mcg	>320–640 mcg	>640 mcg
80 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	
160 mcg/puff				1 puff/day	1 puff 2x/day	≥2 puffs 2x/day		2 puffs 2x/day	≥3 puffs 2x/day
Flunisolide MDI†	N/A	N/A	N/A	160 mcg	320–480 mcg	≥480 mcg	320 mcg	>320–640 mcg	>640 mcg
80 mcg/puff				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

* A higher mcg/puff or mcg/inhalation formulation is preferred to keep puffs or inhalations to a minimum.

† **Abbreviations:** DPI, dry powder inhaler (requires deep, fast inhalation); inh, inhalation; MDI, metered dose inhaler (releases a puff of medication); neb, nebule.

ESTIMATED DAILY DOSAGE COMPARISONS: INHALED CORTICOSTEROIDS FOR LONG-TERM ASTHMA CONTROL *(continued)*

	0–4 years of age			5–11 years of age			≥12 years of age		
Dose per Day	**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		1–2 puffs 2x/day	3–4 puffs 2x/day		1–3 puffs 2x/day		
110 mcg/puff		1 puff 2x/day	≥2 puffs 2x/day		1 puff 2x/day	≥2 puffs 2x/day		2 puffs 2x/day	3 puffs 2x/day
220 mcg/puff								1 puff 2x/day	≥2 puffs 2x/day
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/inhalation				1–2 inhs† 2x/day	3–4 inhs† 2x/day		1–3 inhs† 2x/day		
100 mcg/inhalation				1 inh† 2x/day	2 inhs† 2x/day	>2 inhs† 2x/day		2 inhs† 2x/day	≥3 inhs† 2x/day
250 mcg/inhalation						1 inh† 2x/day		1 inh† 2x/day	≥2 inhs† 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/inhalation				1 inh†/day	1–2 inhs† 2x/day	≥3 inhs† 2x/day	1–2 inhs† pm	3–4 inhs† pm or 2 inhs† 2x/day	≥3 inhs† 2x/day
220 mcg/inhalation					1–2 inhs†/day	≥3 inhs† divided in 2 doses	1 inh† pm	1 inh† 2x/day or 2 inhs† pm	≥3 inhs† divided in 2 doses

* A higher mcg/puff or mcg/inhalation formulation is preferred to keep puffs or inhalations to a minimum.
† **Abbreviations:** DPI, dry powder inhaler (requires deep, fast inhalation); inh, inhalation; MDI, metered dose inhaler (releases a puff of medication); neb, nebule.

Treatment Considerations: Inhaled Corticosteroids (ICSs) for Long-Term Asthma Control

- **The clinician's assessment of the patient's response to treatment is the main basis for choosing an appropriate dose.** Monitor the patient's response using several clinical measures (e.g., symptoms; activity level; measures of lung function), and adjust the dose accordingly. Once asthma control is achieved and maintained for at least 3 months, carefully reduce the dose to the minimum needed to maintain control.
- Certain doses may fall outside package labeling, especially in the high-dose range. Budesonide nebulizer suspension is the only inhaled corticosteroid (ICS) with FDA-approved labeling for children <4 years of age.
- Metered-dose inhaler (MDI) doses specify the actuator dose: the amount that exits the actuator and reaches the patient. This labeling is required in the United States. This differs from the valve dose: the amount of drug leaving the valve, of which only part is available to the patient. Valve doses are used in many European countries and some scientific literature. Dry powder inhaler (DPI) doses reflect the amount of medication in the inhaler after activation.
- For children <4 years of age: ICS safety and efficacy have not been established in children <1 year of age. Children <4 years of age generally need ICS (budesonide and fluticasone MDI) delivered through a face mask fitted closely over the nose and mouth to keep nebulized medicine out of the eyes. Wash the face after treatment to prevent local corticosteroid side effects. Budesonide may be given 1–3 times daily. Budesonide suspension can be used with albuterol, ipratropium, and levalbuterol nebulizer solutions in the same nebulizer. Use only jet nebulizers; ultrasonic nebulizers do not work for suspensions. Divide the fluticasone MDI dose 2 times daily; children <4 years of age need a higher low dose than children 5–11 years of age because a face mask delivers less medication and because of efficacy findings in young children.

TYPICAL DOSAGES FOR OTHER LONG-TERM CONTROL MEDICATIONS*

Medication	0–4 years of age	5–11 years of age	≥12 years of age
Combination Medication (inhaled corticosteroid + long-acting beta$_2$-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 based on the level of severity or control	1 inhalation 2x/day; dose based 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 based on the level of severity or control	2 puffs 2x/day; dose is based on severity or control level
Mometasone/Formoterol — MDI† 100 mcg/5 mcg	N/A†	N/A†	2 inhalations 2x/day; dose based on asthma severity
Leukotriene Modifiers			
Leukotriene Receptor Antagonists (LTRAs) Montelukast — 4 mg or 5 mg chewable tablet, 4 mg granule packets, 10 mg tablet	4 mg each night at bedtime (1–5 years of age)	5 mg each night at bedtime (6–14 years of age)	10 mg each night at bedtime
Zafirlukast — 10 mg or 20 mg tablet *Take at least 1 hour before a meal or 2 hours after. Monitor liver function.*	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 *Monitor liver function.*	N/A†	N/A†	2,400 mg daily (give 1 tablet 4x/day)
Immunomodulators			
Omalizumab (Anti IgE†) — Subcutaneous injection: 150 mg/1.2 mL after reconstitution using 1.4 mL sterile water for injection *Observe patients after injections; be ready to treat anaphylaxis if it occurs.*	N/A†	N/A†	150–375 mg subcutaneous every 2–4 weeks, based 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 *Monitor serum concentrations.*	Initial 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	Initial dose 10 mg/kg/day; usual maximum: 16 mg/kg/day	Initial dose 10 mg/kg/day up to a 300 mg maximum; usual maximum: 800 mg/day
Inhaled Long-Acting Beta$_2$-Agonists (LABAs) – use with ICS† for long-term control; LABA must NOT 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 **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	▪ 0.25–2 mg/kg daily as a single a.m. dose or every other day, as required for control ▪ Brief "burst" course: 1–2 mg/kg/day, max 60 mg/d for 3–10 days	▪ 0.25–2 mg/kg daily as a single a.m. dose or every other day, as required for control ▪ Brief "burst" course: 1–2 mg/kg/day, max 60 mg/d for 3–10 days	▪ 7.5–60 mg daily as one a.m. dose or every other day as required for control ▪ Brief "burst" course: to gain control, 40–60 mg/day as single or 2 divided doses for 3–10 days

* Dosages are listed for products approved by the U.S. Food and Drug Administration or supported by sufficient clinical trial safety and efficacy data in the relevant age groups to justify 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 clinician's assessment of the patient's response to treatment is the main basis for choosing an appropriate dose. The clinician must monitor response using several clinical measures (e.g., symptoms; activity level; measures of lung function), and adjust the dose accordingly. Once asthma control is achieved and maintained for at least 3 months, carefully reduce the dose to the minimum needed to maintain control.

ANSWERING PATIENT QUESTIONS ABOUT INHALED CORTICOSTEROIDS

Questions and differing views about inhaled corticosteroids (ICSs) are common and can affect treatment adherence. The following key points can be shared with patients and families.

- ICSs are the most effective drugs for the long-term control of persistent asthma. As inhaled medicines, ICSs reach the lungs directly to reduce ongoing airway inflammation. Generally, ICSs should be used daily to prevent asthma symptoms and attacks.
- ICSs offer benefits that balance their potential risks. To limit side effects, patients should work with their doctor to find the lowest dose that keeps asthma controlled, and make sure they use the medication correctly.
  - Mouth irritation and thrush (a yeast infection), which can occur with higher ICS doses, can be prevented by rinsing the mouth and spitting after using ICSs and, when suitable for the inhaler device, using a valved holding chamber or spacer.
  - ICS use can slightly slow a child's growth rate. This effect on growth in height is unpredictable, generally small (about 1 cm), and seems to occur in the first several months of treatment. It does not progress. The clinical importance of this potential effect remains undetermined. Children's growth rates vary greatly, and poorly controlled asthma can also slow a child's growth.
- ICSs are usually safe for women who are pregnant. Asthma control is important during pregnancy to ensure that the fetus receives sufficient oxygen.
- ICSs do not cause addiction.
- ICSs differ from the anabolic steroids some athletes use illegally to improve their sports performance.

ANSWERING PATIENT QUESTIONS ABOUT LONG-ACTING BETA$_2$-AGONISTS

Use the following key points when teaching patients and families about long-acting beta$_2$-agonists (LABAs).

- Adding LABA (salmeterol or formoterol) to treatment for patients who need more than low-dose inhaled corticosteroid (ICS) alone for asthma control improves lung function, lessens symptoms, and reduces exacerbations and the use of short-acting beta$_2$-agonists (SABA) for quick relief in most patients more than doubling the ICS dose does.
- In a large clinical trial, slightly more deaths occurred among patients taking salmeterol daily through a single inhaler in addition to usual asthma therapy* (13 out of about 13,000), compared with patients taking placebo in addition to usual asthma therapy (3 out of about 13,000). Trials of formoterol used daily in a single inhaler alongside usual therapy* found more severe asthma exacerbations among patients taking formoterol, especially at higher doses, compared with patients receiving placebo plus usual therapy. As a result, the Food and Drug Administration placed a Black Box warning on every drug containing a LABA.
- The benefits established for LABAs added to ICS in the great majority who need more than low-dose ICS alone to control asthma should be weighed against the risk of severe exacerbations linked to daily LABA use, although these events are uncommon.
- LABAs should not serve as monotherapy for long-term control. Even if symptoms improve greatly, it is important to continue ICS treatment while using LABA.
- In general, daily doses should not exceed 100 mcg salmeterol or 24 mcg formoterol.
- LABAs are not currently recommended for treating acute symptoms or exacerbations.

* Usual therapy covered many regimens, ranging from no other daily treatment to different doses of other medications taken each day.

RESOURCES FOR EDUCATION

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

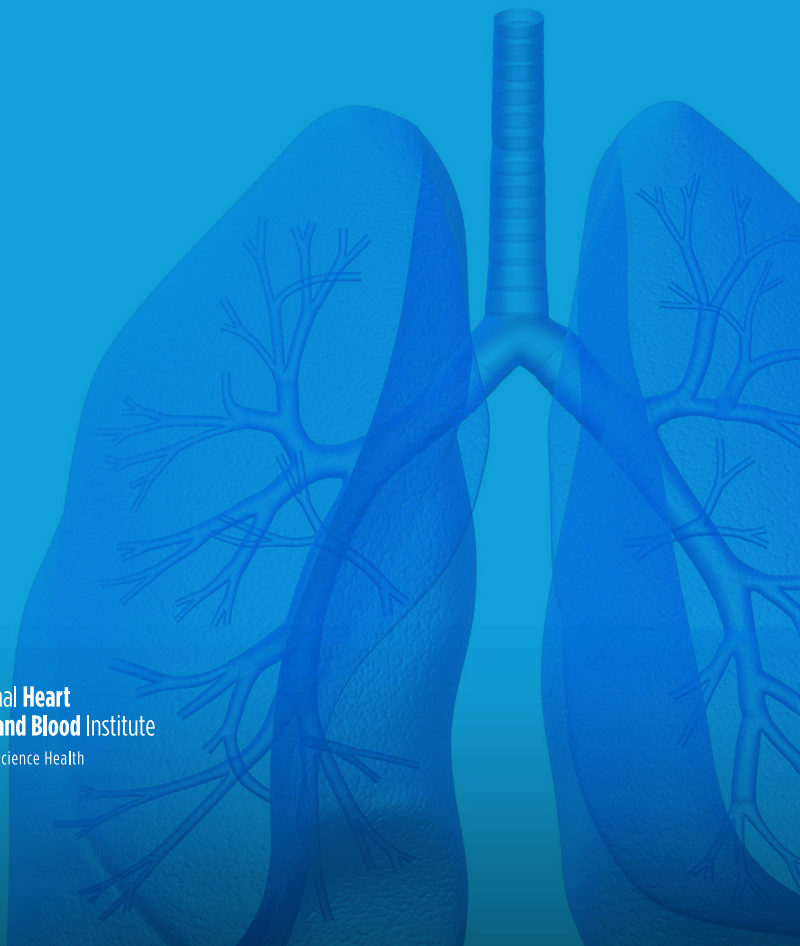
Centers for Disease Control and Prevention
800–CDC–INFO (800–232–4636)
www.cdc.gov/asthma

Environmental Protection Agency/ Asthma Community Network
www.asthmacommunitynetwork.org
800–490–9198 (for EPA publication orders)
www.epa.gov/asthma/publications.html

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

For further information, contact:

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