Asthma Management in Primary Care: Pathway to Control

Learning Objectives

After completing this activity, participants should be better able to:

- Describe the prevalence and burden of asthma in adults and children
- Perform a differential diagnosis of asthma using history, physical examination, and pulmonary function testing
- Apply the recommended clinical process for achieving and maintaining control of asthma
- Select medical therapy for long-term control and acute relief of asthma
- Collaborate with patient and family to develop an asthma action plan

Introduction

From 1980 to 1996, the prevalence of asthma among children in the United States more than doubled to almost 15 million.[1] Recent updates from the Centers for Disease Control and Prevention (CDC) confirm that the prevalence of asthma is still increasing among America's children and adults. The CDC analysis, covering data from 2001 through 2009 in the National Health Interview Survey and Behavioral Risk Factor Surveillance System, showed that asthma prevalence increased by 12% among people of all ages—from 20.3 million (7.3%) to 24.6 million (8.2%). While this change represents a slower rate of increase in prevalence, it remains at historically high levels.[2,3] Worldwide, an estimated 300 million people have asthma, a number expected to increase by more than 100 million by 2025.[4]

It's not clear why more people are being diagnosed with asthma, especially given improvements in outdoor air quality and less overall exposure to tobacco smoke. Some clues can be found in looking at patient populations most at risk. Almost all subgroups in the CDC analysis—adults, children, men, women, blacks, whites, and Hispanics—saw a steady rise in prevalence over time (Figure 1). However, by 2009, the prevalence among adults was highest for women (9.7%) and adults living below the poverty level (10.6%). Prevalence

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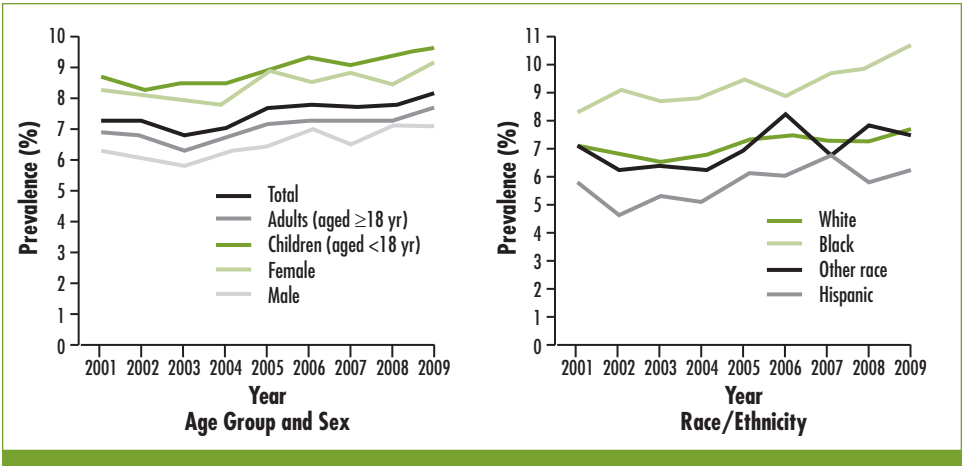

Figure 1. Current asthma prevalence[a] by age group,[b] sex, and race/ethnicity—National Health Interview Survey, United States, 2001-2009. [a]Includes persons who answered "yes" to the questions: "Have you ever been told by a doctor or other health professional that [you/your child] had asthma? and "Do you/your child still have asthma?" [b]Age-adjusted to the 2000 US population, except age group–specific estimates.[3]

among children—9.6% overall—was highest for boys (11.3%), poor children (13.5%), and non-Hispanic black children (17.0%).[2,3] Racial disparities in asthma management and outcomes also have been noted.[5] For example, in a study from the Asthma Care Quality Assessment Project, black and Hispanic children in the same Medicaid populations had worse asthma status and less use of preventive asthma medications than white children in the program.[6] Asthma is a common, chronic disorder of the airways involving a complex interaction of airflow obstruction, bronchial hyper-responsiveness, and underlying inflammation.[7] The interaction of these factors determines the clinical manifestations and severity of asthma and response to treatment.

Goals of Asthma Treatment

Asthma is a chronic respiratory disease characterized by episodes or attacks of impaired breathing. Symptoms are caused by inflammation and narrowing of small airways and may include shortness of breath, coughing, wheezing, and chest pain. Disease severity ranges from mild with occasional symptoms to severe with persistent symptoms that impact quality of life.

This definition is one of the few aspects of asthma that hasn't changed substantially in the last 25 years, a period of major scientific and clinical advances for asthma. The era brought discoveries in the pathophysiology of asthma, refinements in therapy, publication of scientifically sound clinical guidelines, and the clear sense that asthma is a controllable disease—so much so that the prevailing goal has become to apply the best practices for control to all people who have asthma, particularly those at high risk.[7] The charge to clinicians has been explicit: establish and maintain control of asthma for each patient to the point where symptoms are absent or minimal (including at night), activities (including exercise) can be done without limits, lung function is at or near normal, rescue medications are rarely necessary, and exacerbations are very infrequent (Table 1).[7,8]

Yet, these goals remain elusive. As the prevalence of asthma continues to increase, most of the patient population has not benefited from recent advances. Many children and adults have not had a proper diagnosis or are living with poorly controlled asthma. Only about a third of patients use long-term control therapies such as inhaled corticosteroids (ICS).[3] Hospitalizations still count heavily in the total burden of asthma, which is borne disproportionately by racial and ethnic minorities and the poor. In short, even with meaningful gains in knowledge and management of asthma, the goals of treatment are unmet.

Table 1.

Asthma Management Goals[8]

- Achieve and maintain control of symptoms
- Maintain normal activity levels, including exercise
- Maintain pulmonary function as close to normal levels as possible
- Prevent asthma exacerbations
- Avoid adverse effects from asthma medications
- Prevent asthma mortality

There are multiple obstacles to improving this situation (see *Barriers to Optimal Treatment of Asthma*), including knowledge deficits among clinicians that may cause a "disconnect"

Barriers to Optimal Treatment of Asthma[7,9,10]

The goal of asthma therapy is to achieve guideline-defined control of asthma. According to research evidence, this goal is not only possible, but sustainable,[11,12] which means asthma-related morbidity and mortality are preventable. Yet, many children and adults are living their lives with uncontrolled asthma. What are the barriers to optimal management for all patients?

The clinician may…

- Fail to make a prompt and accurate diagnosis of asthma
- Overlook or lack conviction about the use of asthma treatment guidelines
- Initiate inappropriate therapy
- Inadequately monitor the patient's response to treatment
- Fail to recognize serious exacerbations
- Inadequately educate the patient and family about preventing symptoms and having a plan for emergencies (ie, no asthma action plan)

The patient (or caregiver) may…

- Fail to avoid environmental triggers of asthma
- Take inappropriate medication or otherwise not adhere to prescribed regimen
- Use incorrect inhalation technique
- Not recognize early warnings of worsening asthma
- Fail to appreciate the severity of an exacerbation and wait too long to get medical help

Other factors…

- Insurers may fail to cover fundamental components of asthma management, particularly those involving patient education
- Costs of medications may be prohibitive, especially in the absence of insurance
- Funds to support clinical staff training and comprehensive asthma management may be limited

between evidence-based clinical recommendations and the conviction that they are of benefit in practice.[9] Asthma management requires the best of clinical skills and judgment, particularly in the primary care setting where mild and severe cases present. Knowledge of current practices will help clinicians exercise their skills and judgment optimally to achieve asthma control in all patients.

Estimates of the Burden of Asthma

Measures of the burden of asthma also show continuing increases. From 1989 to 2004 in the United States, the number of physician office visits for asthma increased from ~6 million to nearly 15 million per year.[7] These figures reflect appropriate disease management in a time of increasing asthma prevalence. Visits to emergency departments and hospitalizations cannot be so interpreted; they are adverse outcomes and, for the most part, avoidable. The CDC reports that from 2005 to 2007, there was an average of 1.75 million emergency visits due to asthma and 456,000 asthma-related hospitalizations each year. On both measures, children outnumbered adults by about 2 to 1. In 2007, deaths due to asthma totaled 3262 among adults and 185 among children.[2] These mortality numbers, although unacceptable, represent a decline in deaths since 2000.

Direct and indirect medical costs of asthma have been estimated at $20 billion annually.[13] Even considering emergency visits and hospitalizations, prescription drugs are the major component of asthma-related costs.[14] In its total weight, the burden of asthma falls disproportionately on black and Hispanic (largely Puerto Rican) populations, especially minority children.[5]

Pathophysiology of Asthma: The Inflammation Paradigm

Asthma is a complex disorder characterized by variable and recurring symptoms, airflow obstruction, bronchial hyper-responsiveness, and an underlying inflammation triggered by factors such as allergens and viral illnesses. The key concept here is inflammation: asthma research over the decades has reaffirmed the critical role of underlying inflammation and found that the interaction of inflammation with airflow obstruction and hyper-responsiveness (Figure 2) determines the symptoms and severity of asthma and the way patients respond to treatment. The clinical spectrum of asthma varies among and within patients over time, but airway inflammation is a consistent feature.[7,8]

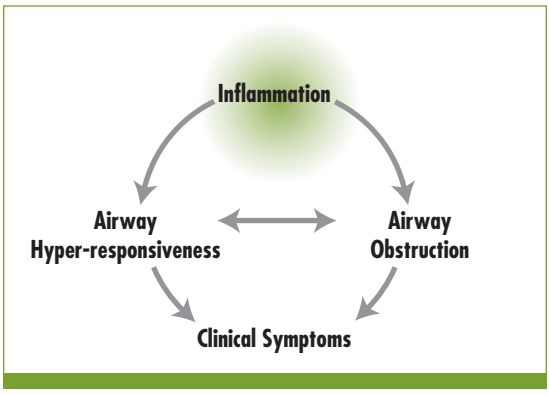

Figure 2. Interaction between airway inflammation and the clinical symptoms and pathophysiology of asthma.[7]

Most bronchoconstriction is an allergen-induced, immunoglobulin (Ig) E–mediated reaction that marshals neutrophils, lymphocytes, eosinophils, macrophages, mast cells, and other inflammatory cell infiltrates. Mast cells promote inflammation by release of cytokines such as histamine and interleukins (ILs) -4, -5, and -13,[15] which

directly contract smooth muscle in the airways. Exercise also may activate mast cells in causing exercise-induced asthma.[16] Atopy, or an inherited propensity for IgE response to environmental allergens, has emerged as the strongest predisposing factor in the development of asthma.[7]

Fortunately, acute inflammatory processes usually can be reversed with bronchodilator therapy. In some patients, however, chronic untreated inflammation may lead to airway remodeling—structural changes such as sub-basement fibrosis, mucus hypersecretion, and epithelial cell injuries—that increase the likelihood of only partial reversal of airway obstruction. The precise mechanisms by which inflammation leads to the functional and structural changes of asthma have yet to be discovered.[7] Structural changes may be monitored with baseline and then annual pulmonary function testing in adolescents and adults. This permits evaluation of current structural status and can identify patients who are developing structural changes over time.[7]

Diagnosing a patient as having asthma is only the first step in reducing the symptoms, functional limitations, impairment in quality of life, and risk of adverse events that are associated with the disease.

The Diagnostic Process

Early diagnosis of asthma and a prompt start on therapy significantly reduce the socioeconomic burden of asthma and improve patients' quality of life. The diagnostic process, carefully worked out in national guidelines, is based primarily on medical history and physical examination (Table 2). In its most recent update on the guidelines, the Expert Panel of the National Heart, Lung, and Blood Institute (NHLBI) stresses the importance of spirometry to evaluate lung function, especially in children. With information from these procedures, clinicians should (1) determine whether episodic symptoms of airflow obstruction or airway hyper-responsiveness are present; (2) confirm the reversibility of obstruction; and (3) exclude alternative diagnoses.[7]

Table 2.

Key Points in the Diagnosis of Asthma[7]

The clinician should establish that…

- Episodic symptoms of airflow obstruction or hyper-responsiveness are present
- Airflow obstruction is at least partially reversible
- Alternative diagnoses are excluded

…by using the following methods:

- Detailed medical history
- Physical examination focusing on the upper respiratory tract, chest, and skin
- Spirometry to demonstrate obstruction and assess reversibility, including in children 5 years of age or older
- Additional studies as necessary to exclude alternative diagnoses

Medical History

The clinician should take a detailed history focused on the key indicators of asthma, the most prominent being wheezing. Absence of wheezing, however, does not rule out asthma. Dyspnea, chest tightness, and cough are other important symptoms. The clinician should ask about precipitants or aggravants of symptoms; nighttime worsening; seasonal or other variability of symptoms; and family history of atopic diseases (see *Questions to Ask in the Diagnosis of Asthma*). No single indicator is diagnostic of asthma, but its presence should prompt spirometry.[16] Multiple indicators increase the probability of asthma. Accordingly, asthma is more likely if the patient's symptoms are variable, precipitated by irritants such as smoke or exercise, worse at night, and responsive to appropriate asthma therapy.[8] Children as young as 5 years of age have been found to provide reliable and valuable responses about their asthma characteristics[17] and may offer unique information about its impact in daily life.

Questions to Ask in the Diagnosis of Asthma[8]

- ☑ **Has** the patient had an attack or recurrent attacks of wheezing?
- ☑ **Does** the patient have a troublesome cough at night?
- ☑ **Does** the patient wheeze or cough after exercise?
- ☑ **Does** the patient experience wheezing, cough, or chest tightness after exposure to airborne allergens or pollutants?
- ☑ **Do** the patient's colds "go to the chest" or take more than 10 days to clear up?
- ☑ **Are** symptoms improved by appropriate asthma treatment?

Examination

The physical examination for asthma focuses on the upper respiratory tract, chest, and skin, with attention to:

- Hyperexpansion of the thorax, especially in children (hunched shoulders, chest deformity)
- Sounds of wheezing during normal breathing, or a prolonged phase of forced exhalation (typical of airflow obstruction). Wheezing heard only during forced exhalation is not considered a specific indication of limited airflow
- Increased nasal secretion, mucosal swelling, or nasal polyps
- Atopic dermatitis, eczema, or any other manifestation of an allergic skin condition (allergic shiners, pebbled conjunctiva)

Again, given the variable nature of asthma, the absence of any of these symptoms does not rule out asthma as these symptoms might only be present during acute attacks.[7]

Spirometry

Lung abnormalities pointing to asthma usually can be confirmed by history and physical examination. Spirometry is an objective way to confirm the diagnosis as well as the short-term reversibility of airway obstruction. The NHLBI Expert Panel recommends measurements of forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), and the ratio of FEV_1 to FVC for all patients 5 years of age or older if there is any clinical suspicion of asthma. A disproportionate reduction in FEV_1 compared with FVC is diagnostic of obstructive disease (asthma can still be suspected if spirometry is nondiagnostic). Reversibility, based on measurements obtained before and after inhalation of a short-acting beta agonist (SABA), is defined

by an increase in FEV_1 of >200 mL and ≥12% from baseline. Spirometry testing requires an effort-dependent, forced-expiratory maneuver, so patients have to be trained properly before taking the test.[7,16] Spirometry should be performed (1) at initial assessment; (2) after treatment is initiated and symptoms and peak expiratory flow have stabilized to document attainment of (near) "normal" airway function; (3) during a period of progressive or prolonged loss of asthma control; and (4) every 1 to 2 years to assess maintenance of airway function.[7]

Differential Diagnosis

In children and adults, episodic cough and wheezing are most often due to asthma. They also are common in patients without asthma. The clinician needs to consider other possible causes in the initial diagnosis of asthma and if initial therapy for asthma fails to control symptoms. The differential diagnostic possibilities in adults include[7]:

- Chronic obstructive pulmonary disease (COPD)
- Vocal cord dysfunction
- Congestive heart failure
- Pulmonary embolism
- Airway tumor
- Cough related to drug (such as an angiotensin-converting enzyme [ACE] inhibitor)

…and in children:

- Rhinitis or sinusitis
- Large-airway obstruction (foreign body, tumor, laryngotracheomalacia)
- Cystic fibrosis
- Bronchopulmonary dysplasia
- Aspiration (from swallowing dysfunction or reflux)

Initiate therapy based on asthma severity. Adjust therapy based on asthma control.

Framework for Asthma Treatment

Treatment of asthma proceeds according to assessment of the severity of symptoms and, above all, control of symptoms. Clinical judgment, aided by guidelines and monitoring tools, plays a large role in these assessments. Management guidelines suggest approaching severity and control through 2 domains: current impairment and future risk. Impairment reflects the frequency and intensity of the patient's symptoms and how they affect physical activity, school attendance, performance, sleep, and the need for quick-relief medication. The patient can describe these factors through standard tools such as the Asthma Control Test, Asthma Therapy Assessment Questionnaire, and Asthma Control Questionnaire. Status of lung function also figures in impairment and is best assessed by spirometry. Future risk relates to prevention of life-threatening exacerbations, hospitalizations, loss of lung function, and adverse effects of medications. Risk is more challenging for the clinician to assess than impairment. It requires a meticulous medical history, alert clinical observation, and documentation of warning signs of increased risk. Patients found to be at increased risk of morbidity will need closer monitoring and more frequent ongoing assessment.[7]

Assessing Severity

Asthma severity serves as a guide to selecting appropriate asthma therapy. It is most easily assessed in patients who are not receiving long-term control therapy for asthma, but who are

already controlled—severity can be assessed based on the lowest level of treatment required to maintain control. The main categories of severity are "intermittent" and "persistent"("intermittent" replaces "mild intermittent" of previous guidelines, to emphasize that intermittent asthma may involve severe exacerbations). Persistent asthma is subclassified as "mild," "moderate," or "severe." The category should be assigned according to the most severe feature of the patient's assessment. There are separate classification tables for patients 4 years of age or younger, 5 to 11 years of age, and 12 years of age and older.[7]

Assessing Control

Asthma control can be described as the degree to which current impairments and future risks are minimized and goals of therapy are met. Once therapy is initiated on the basis of asthma severity, clinical management shifts to assessment and monitoring of control, and the level of control becomes the basis of decisions to step-up or step-down therapy (Figure 3). The goal is prolonged control. A follow-up assessment every 2 to 6 weeks is recommended for patients who are starting therapy or stepping up to regain asthma control, and every 1 to 6 months once control is achieved. The clinician should review asthma control, medication technique, the written asthma action plan (see *Asthma Action Plan*), and patient adherence and concerns at every visit.[7]

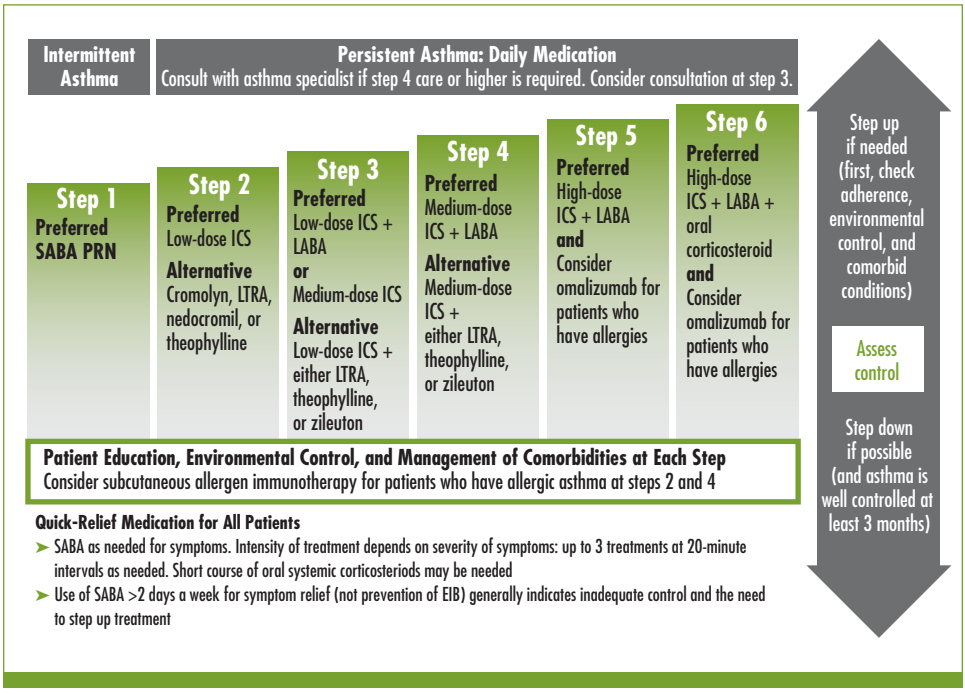

Figure 3. Stepwise treatment approach for managing asthma in patients ≥12 years of age.[7]
EIB = exercise-induced bronchospasm; ICS = inhaled corticosteroid; LABA = long-acting inhaled beta$_2$-agonist; LTRA = leukotriene receptor agonist.

Stepwise Therapy Plan

A stepwise approach to management (Figure 3) is recommended to gain and maintain control of asthma with appropriate treatment options. Treatment decisions should be guided by assessments of impairment and future risk (considered independently). Asthma severity is the guide for initial therapy, and asthma control the guide to adjusting ongoing therapy. Key features of stepwise therapy, as updated by the NHLBI Expert Panel, include[7]:

- Treatment recommendations are specified for 3 age groups (0-4 years, 5-11 years, and youths ≥12 years and adults), given that asthma characteristics change over time
- Daily long-term care is recommended for children classified as "persistent"
- ICS remains the preferred long-term control treatment across all age groups
- Combination LABA and ICS therapy is preferred for stepping up therapy in patients ≥12 years and may be used in younger age groups
- Therapy should be stepped up if necessary and stepped down if possible when asthma is controlled for 3 months

Asthma Action Plan[7,18]

The written asthma action plan is an integral part of monitoring, assessing, and reassessing a patient's asthma control. Asthma action plans have been credited with improving patients' self-perception of asthma control and their confidence in self-management during exacerbations. Action plans are also an excellent way for the clinician to involve the patient directly in self-management. Despite their importance, action plans are underused. Only about one-third of asthma patients report receiving an action plan in the course of their care.[2]

Action plans encompass patient instructions relevant to daily control and adjustments to treatment when symptoms or exacerbations occur. Whether designed for adults or children, the elements of the action plan are as follows:

Daily management	➤ Daily medications, including specific drug names, dosages (puffs, milligrams), and frequency ➤ Actions to control environment
Recognizing and handling worsening symptoms	➤ Symptoms/peak flow measures that warn of worsening asthma ➤ Rescue medication ➤ Symptoms/peak flow measures that indicate an emergency ➤ Emergency telephone numbers (doctor, transportation, emergency department)

Action plans are typically formatted to signify asthma status; doing well (green zone), not doing well (yellow zone), or feeling awful (red zone), with steps to take in each situation. An action is reproduced on pages 10 and 11 or may be downloaded from: www.nhlbi.nih.gov/health/public/lung/asthma/asthma_actplan.pdf

Asthma Action Plan

For: _____ Doctor: _____ Date: _____

Doctor's Phone Number: _____ Hospital/Emergency Department Phone Number: _____

GREEN ZONE

Doing Well

- No cough, wheeze, chest tightness, or shortness of breath during the day or night
- Can do usual activities

And, if a peak flow meter is used,

Peak flow: more than _____ (80 percent or more of my best peak flow)

My best peak flow is: _____

Take these long-term control medicines each day (include an anti-inflammatory).

Medicine	How much to take	When to take it

Before exercise ☐ _____ ☐ 2 or ☐ 4 puffs _____ 5 to 60 minutes before exercise

YELLOW ZONE

Asthma Is Getting Worse

- Cough, wheeze, chest tightness, or shortness of breath, or
- Waking at night due to asthma, or
- Can do some, but not all, usual activities **-Or-**

Peak flow: _____ to _____ (50 to 79 percent of my best peak flow)

First

Add: quick-relief medicine—and keep taking your GREEN ZONE medicine.

_____ (short-acting $beta_2$-agonist) ☐ 2 or ☐ 4 puffs, every 20 minutes for up to 1 hour

☐ Nebulizer, once

Second

If your symptoms (and peak flow, if used) return to GREEN ZONE after 1 hour of above treatment: ☐ Continue monitoring to be sure you stay in the green zone **-Or-**

If your symptoms (and peak flow, if used) do not return to GREEN ZONE after 1 hour of above treatment:

☐ Take: _____ (short-acting $beta_2$-agonist) ☐ 2 or ☐ 4 puffs or ☐ Nebulizer

☐ Add: _____ (oral steroid) mg per day For _____ (3-10) days

☐ Call the doctor ☐ before/ ☐ within _____ hours after taking the oral steroid.

RED ZONE

Medical Alert!

- Very short of breath, or
- Quick-relief medicines have not helped, or
- Cannot do usual activities, or
- Symptoms are same or get worse after 24 hours in Yellow Zone **-Or-**

Peak flow: less than _____ (50 percent of my best peak flow)

Take this medicine:

☐ _____ (short-acting $beta_2$-agonist) ☐ 4 or ☐ 6 puffs or ☐ Nebulizer

☐ _____ (oral steroid) mg

Then call your doctor NOW. Go to the hospital or call an ambulance if:

- You are still in the red zone after 15 minutes AND
- You have not reached your doctor.

DANGER SIGNS

- **Trouble walking and talking due to shortness of breath**
- **Lips or fingernails are blue**

→

- **Take ☐ 4 or ☐ 6 puffs of your quick-relief medicine AND**
- **Go to the hospital or call for an ambulance _____ (phone) NOW!**

How to Control Things That Make Your Asthma Worse

This guide suggests things you can do to avoid your asthma triggers. Put a check next to the triggers that you know make your asthma worse and ask your doctor to help you find out if you have other triggers as well. Then decide with your doctor what steps you will take.

Allergens

☐ **Animal Dander**

Some people are allergic to the flakes of skin or dried saliva from animals with fur or feathers.

The best thing to do:

- Keep furred or feathered pets out of your home.

If you can't keep the pet outdoors, then:

- Keep the pet out of your bedroom and other sleeping areas at all times, and keep the door closed.
- Remove carpets and furniture covered with cloth from your home. If that is not possible, keep the pet away from fabric-covered furniture and carpets.

☐ **Dust Mites**

Many people with asthma are allergic to dust mites. Dust mites are tiny bugs that are found in every home—in mattresses, pillows, carpets, upholstered furniture, bedcovers, clothes, stuffed toys, and fabric or other fabric-covered items.

Things that can help:

- Encase your mattress in a special dust-proof cover.
- Encase your pillow in a special dust-proof cover or wash the pillow each week in hot water. Water must be hotter than 130ºF to kill the mites. Cold or warm water used with detergent and bleach can also be effective.
- Wash the sheets and blankets on your bed each week in hot water.
- Reduce indoor humidity to below 60% (ideally between 30% and 50%). Dehumidifiers or central air conditioners can do this.
- Try not to sleep or lie on cloth-covered cushions.
- Remove carpets from your bedroom and those laid on concrete, if you can.
- Keep stuffed toys out of the bed or wash the toys weekly in hot water or cooler water with detergent and bleach.

☐ **Cockroaches**

Many people with asthma are allergic to the dried droppings and remains of cockroaches.

The best thing to do:

- Keep food and garbage in closed containers. Never leave food out.
- Use poison baits, powders, gels, or paste (for example, boric acid). You can also use traps.
- If a spray is used to kill roaches, stay out of the room until the odor goes away.

☐ **Indoor Mold**

- Fix leaky faucets, pipes, or other sources of water that have mold around them.
- Clean moldy surfaces with a cleaner that has bleach in it.

☐ **Pollen and Outdoor Mold**

What to do during your allergy season (when pollen or mold spore counts are high):

- Try to keep your windows closed.
- Stay indoors with windows closed from late morning to afternoon, if you can. Pollen and some mold spore counts are highest at that time.
- Ask your doctor whether you need to take or increase anti-inflammatory medicine before your allergy season starts.

Irritants

☐ **Tobacco Smoke**

- If you smoke, ask your doctor for ways to help you quit. Ask family members to quit smoking, too.
- Do not allow smoking in your home or car.

☐ **Smoke, Strong Odors, and Sprays**

- If possible, do not use a wood-burning stove, kerosene heater, or fireplace.
- Try to stay away from strong odors and sprays, such as perfume, talcum powder, hair spray, and paints.

Other things that bring on asthma symptoms in some people include:

☐ **Vacuum Cleaning**

- Try to get someone else to vacuum for you once or twice a week, if you can. Stay out of rooms while they are being vacuumed and for a short while afterward.
- If you vacuum, use a dust mask (from a hardware store), a double-layered or microfilter vacuum cleaner bag, or a vacuum cleaner with a HEPA filter.

☐ **Other Things That Can Make Asthma Worse**

- Sulfites in foods and beverages: Do not drink beer or wine or eat dried fruit, processed potatoes, or shrimp if they cause asthma symptoms.
- Cold air: Cover your nose and mouth with a scarf on cold or windy days.
- Other medicines: Tell your doctor about all the medicines you take. Include cold medicines, aspirin, vitamins and other supplements, and nonselective beta-blockers (including those in eye drops).

U.S. Department of Health and Human Services
National Institutes of Health

National Heart Lung and Blood Institute

For More Information, go to: www.nhlbi.nih.gov

NIH Publication No. 07-5251
April 2007

Asthma Medications

The medications used to prevent and control symptoms and reverse airflow obstruction are categorized as long-term control medications or quick-relief medications.

Long-Term Control Medications[7,16]

Long-term therapy is taken daily to control persistent asthma. The most effective agents for this purpose reduce underlying inflammation, which attenuates airway hyper-responsiveness. Long-term agents include the following:

Corticosteroids. Inhaled corticosteroids (ICS) (eg, fluticasone, budesonide, triamcinolone, beclomethasone) are the most consistently effective long-term control medications across all age groups and at all steps of care for persistent asthma. In the last 2 decades, clinical investigations have credited ICS therapy with reducing the severity of symptoms, improving asthma control and quality of life, enhancing peak flow and spirometry measures, reducing airway hyper-responsiveness, preventing exacerbations, and reducing the need for systemic corticosteroids. This therapy also has a major impact on morbidity—emergency department visits, hospitalizations, and deaths due to asthma all have been reduced and loss of lung function in adults has possibly been attenuated. At recommended doses, ICS are considered safe and well tolerated. Oral corticosteroids are often used in short courses to gain prompt control of asthma, and over the long-term for severe persistent asthma (step 6 care [Table 4]).[7,14]

Asthma medications are categorized as long-term control or quick-relief.

Long-acting beta$_2$-agonists (LABAs) (with duration of ≥12 hours) are inhaled bronchodilators (eg, salmeterol, formoterol) intended for daily use only in combination with an ICS, not as monotherapy. The combination is appropriate in step 3 care (moderate or severe persistent asthma) or higher in children 5 years of age or older and in adults; and in step 4 care (severe persistent asthma) or higher in children 4 years of age or younger. LABAs are the preferred drugs for combining with ICS in patients 12 years of age and older.

Leukotriene modifiers (eg, montelukast, zafirlukast, zileuton) are alternative medications (not preferred) for patients who require care for mild persistent asthma (step 2 care). They can be used as adjunctive therapy with ICS. For patients 12 years of age or older, however, they are not preferred over LABAs as adjunct.

Omalizumab, an immunomodulator (anti-IgE), is used as adjunctive therapy in patients 12 years of age and older who have allergies or severe asthma (step 5 or 6 care). Clinicians should be prepared to manage anaphylaxis that may occur.

Theophylline is a mild to moderate bronchodilator used as alternative (not preferred) therapy for mild persistent asthma (step 2 care) or as adjunctive therapy with ICS in patients 5 years of age or older.

Quick-Relief Medications

Quick-relief medications are used to promptly reverse airflow obstruction. They include:

Short-acting beta$_2$-agonists (SABAs) are the agents of choice for acute symptoms of bronchospasm and for preventing exercise-induced bronchospasm. Regularly scheduled use of SABAs (eg, albuterol, levalbuterol, pirbuterol) is not recommended, and use of SABAs more than twice per week generally indicates inadequate asthma control.[16]

Anticholinergics may provide additive benefit to SABA therapy in the emergency care setting or as an alternative when SABA is not well tolerated.

Systemic corticosteroids are used for moderate and severe exacerbations in addition to SABA to speed recovery and prevent progression. When used for children, care should be taken to minimize the dose. Choose other modes of therapy when possible. Chronic use of systemic corticosteroids should be reserved for the most severe cases, as side effects are serious and may include growth suppression, hypertension, and adrenal suppression.[16]

CASE: 12-Year-Old Boy With Poorly Controlled Asthma

Presentation

Jake attends middle school, where his teachers have become concerned about his absences due to asthma. Jake's mother has brought him to the pediatrician for the third time in as many months. She says that Jake is having symptoms of coughing, wheezing, and shortness of breath almost daily, but only occasionally at night. In the 10 years since Jake's initial diagnosis, he had exacerbations requiring oral steroids, but he never had to be hospitalized. Triggers of his asthma symptoms have included seasonal allergies and viral illnesses.

In the last few months, Jake has been averaging 2 daily rescue doses of albuterol. The pediatrician earlier prescribed Jake a daily combination of low-dose ICS and LABA therapy as a controller regimen. But at this visit, Jake's mother says he hasn't been using the controller medication regularly.

As in the past, Jake's growth appears normal at this visit. Although he does get colds most winters, they are usually mild, and they do not occur with undue frequency or involve ear infections. The family lives on a farm, and Jake has been unable to help with after-school chores because of his asthma.

Results of Spirometry

- FEV_1/(FVC): 68%
- FEV_1: 52% of predicted (1.77 L)
- FVC: 62% of predicted (2.61 L)
- 17% improvement in FEV_1 after bronchodilator administration

Environmental Exposures

- Jake's father is a smoker but "usually" smokes outside the home
- Two cats live inside and around the home
- Jake's symptoms seem to coincide with seasonal changes

Clinical Decision Point

How would you characterize Jake's asthma control?

- Intermittently controlled
- Moderately controlled
- Poorly controlled
- Very poorly controlled

Comment

According to criteria established in current management guidelines, his asthma is very poorly controlled based on the frequency of his symptoms, need for daily rescue medication, limitations on activities, and FEV_1 results. In close collaboration with Jake and his mother, the pediatrician belatedly decides to prepare an asthma action plan (see *Asthma Action Plan*) to bring Jake's asthma under control.

Medication Plan

- Daily control: ICS (fluticasone)
- Rescue: SABA (albuterol)
- Instruction in the use of inhalation device (approximately 80% of device users make mistakes in inhalation technique—an avoidable cause of uncontrolled disease, side effects, and expense)[19]

Clinical Decision Point

Jake's asthma action plan will include:

- Spirometry
- Plans for daily management
- Asthma triggers
- Emergency numbers
- All of the above

Comment: Clinical Action Plan

- *Track Jake's long-term asthma control*
  Administer the Asthma Control Test to measure how bothersome his symptoms have been in the prior month and monitor his use of the rescue inhaler
- *Teach Jake to recognize and treat acute attacks*
  Increase his awareness of warning signs such as coughing, wheezing, and shortness of breath, and the importance of treating them promptly
- *Take action based on peak flow or FEV_1 readings*
  Teach Jake and his family to use a peak flow meter. Low peak flow readings may be the first sign of a flare-up and the need for medication adjustment
- *Help Jake avoid asthma trigger*
  Second-hand smoke should be completely avoided; pets should be kept out of the bedroom; Jake should act fast to move away from known triggers

Case Conclusion

Jake gets new prescriptions for rescue and controller medications. A nurse practitioner trains him in inhaler technique, and he demonstrates his proficiency before leaving the office. He's given a sample Asthma Control Test and agrees to complete it and bring it with him to his next appointment, scheduled for 1 month later. Jake and his parents receive instruction and an educational DVD on how to use a peak flow meter.

Jake is instructed on how to avoid triggers and recognize warning signs of an asthma exacerbation. He says he will be encouraging his father to stop smoking "once and for all." He will no longer let his cats sleep in his room. He agrees to keep his inhaler on hand if he is going to be exercising. Jake's therapy will be adjusted at his 1-month appointment; therapy will be stepped down only after his asthma is well controlled for at least 3 months.

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