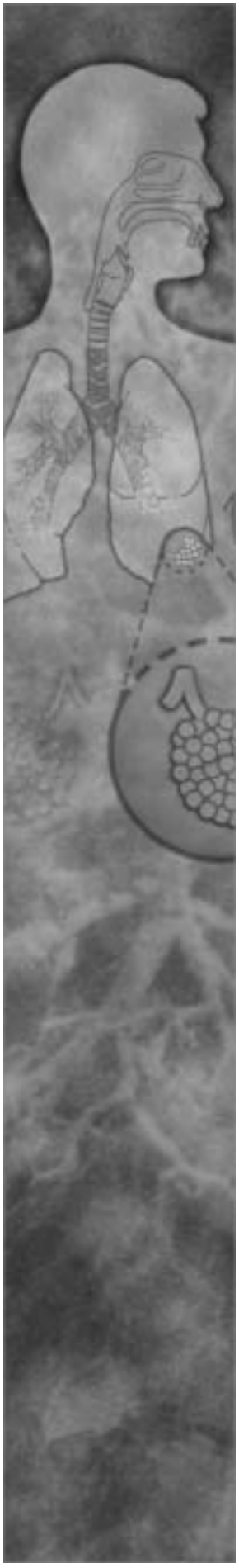

Understanding Asthma:
The Asthma Center Education and Research Fund Manual

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6th Edition

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PART THREE

Frequently Asked Questions

Introduction

Read this introduction before using the manual. It will help you understand the basis for your treatment.

The sixth edition of *The Asthma Center Education and Research Fund Manual (The Asthma Manual)* was written by **The Asthma Center** allergists *(see The Authors, page 129)* to provide you with a clear understanding of the causes of asthma and a complete outline of current treatment strategies. This is a comprehensive manual filled with basic information, tips and in-depth explanations of medications and many other topics that may be important in your specific asthma management. All medications have been updated, and a number of new sections have been added, including sections devoted to coughing, vocal cord dysfunction, allergic rhinitis, allergic conjunctivitis, osteoporosis, chronic obstructive pulmonary disease (COPD), Asthma COPD Syndrome (ACOS) smoking cessation, e-cigarettes and unique immunological treatments.

Asthma is a common problem affecting millions of American adults and children. If you are one of these people, you may often complain of chest symptoms, including coughing, chest tightness, wheezing and/or shortness of breath. Symptoms may vary from mild to severe. You may suffer only occasional symptoms or perhaps feel some form of discomfort on a daily basis. You may find that your symptoms are only associated with "colds," or follow exposure to irritants such as cigarette smoke, strong odors and/or chemicals. At times, asthmatic symptoms can be triggered by some sort of stress. In contrast, you may be able to identify a specific allergic factor, such as animal dander or pollen, causing your symptoms. In summary, there are many causes of asthma, and the severity of asthmatic symptoms may vary considerably from person to person.

Although symptoms can vary greatly, all individuals with asthma appear to have a common underlying mechanism that is responsible for their illness. Asthmatic symptoms result from constriction of the breathing tubes or bronchi (tightening of the muscles around the airways), which is referred to as bronchospasm. Inflammation causes an increase in bronchial mucus production as well as edema (swelling) of the membranes lining the inside of the bronchi. Both of these events contribute to narrowing of the passageways, which results in part from the release of inflammatory mediators, which attract invading cells (eosinophils, neutrophils, etc.). The release of mast cell mediators and resultant inflammation may be triggered by exposure to allergens, irritants and infection. Inflammation of the bronchi increases airway hyper-reactivity (hyper-responsiveness) and is the main cause of chronic asthmatic symptoms, which may lead to permanent airway damage. In summary, the inflammatory reaction of the asthmatic bronchi leads to local airway irritation, bronchospasm, mucus production, edema and airway hyper-responsiveness. These effects cause a narrowing or obstruction of the airway, which in turn results in symptoms of asthma.

Well, that is the bad news. The good news is that asthma is a very manageable medical problem! Those of you receiving optimum management will suffer only occasional symptoms while minimizing the risk of significant long term damage to your lungs. Such an asthma treatment program is based on a detailed and detective-like evaluation in which all possible causes of asthma are examined, including common allergic

triggers. Successful treatment involves defining the type of asthma, learning to avoid triggering factors (environmental controls), using reliever and controller medications and, in some instances, immunotherapy (e.g. allergy injection treatment). All of these concepts are reviewed in this manual.

The good news is that asthma is a **very** *manageable medical problem!*

The Asthma Center encourages you to co-manage your disease with specialists who have the knowledge and time to educate you. You should have a clear understanding of your medications and the issues involved in your disease. The treating physician(s) should regularly evaluate your progress while adjusting your treatment program. Further, due to the episodic nature of asthma, you must have immediate access to your physician and have a clear treatment plan prepared in advance. In this way, an emerging attack of asthma can be contained and a catastrophe avoided.

Although some children can truly "outgrow" their asthma, for most affected adults and many children, asthma is a lifelong disease that can be well controlled.

Unfortunately, if you do not receive optimum medical attention, you will continue to have significant problems that just seem to get worse with the passage of time. One of the main reasons for treatment failure is the fact that treatment is often only given to relieve current symptoms and not consistently directed at managing the underlying chronic nature of this disease. Underlying problems may include environmental allergy, pollution exposure (e.g. exposure to cigarette smoke), related medical problems (gastroesophageal reflux disease, chronic sinusitis, etc.), stress, insufficient medical management of chronic inflammation of the airways, inconsistent physician follow-up and/or poor patient compliance with physician recommendations.

Asthma is a complex disease, which requires a thoughtful and carefully tailored individual treatment program. **The Asthma Center** allergists' goal is to manage your asthma so that you may breathe comfortably and minimize interferences with work, school, or other activities. In fact, you can lead a relatively normal life if you have a comprehensive treatment program. When your asthma is not well controlled, **The Asthma Center** allergists feel it is essential to reexamine all the possible factors that may worsen symptoms ("things change"), and then reformulate your treatment plan in an attempt to maximize your comfort and ability to function normally. **The Asthma Center** allergists "optimize" (best match between medications, disease process and potential side effects) treatment so that the minimum amount of medication is used to provide good control of asthmatic symptoms and prevent long term consequences. Just as a suit needs to be skillfully tailored if it is to fit properly, so does a medical treatment program need to be adapted expertly to you.

The Asthma Center allergists have found that patient education and the development of a partnership with patients in treatment lead to the best outcome in managing asthma. Specifically, you need to be well informed about your disease, know how your medications work, monitor your own progress and have quick access to expert advice and guidance when your asthma flares. *The Asthma Center Education and Research Fund Manual* has been written for anyone with asthma, including **The Asthma Center's** patients, based on over 30 years of knowledge and experience gained at **The Asthma Center**. This manual will provide you with a high degree of information regarding your treatment and other important issues in asthma control, based on **The Asthma Center's** approach to asthma management.

How Can You Get Top-Notch Medical Care in Treating Your Asthma?

Asthma is a complex disease that has the potential to become increasingly severe with the passage of time or even escalate into a life-threatening emergency. Successful management strategies include patient education, good communication between physician and patient, preventive medicine and the availability of an emergency back-up treatment program. Few, if any, of the key factors that lead to the successful management of asthma will be available to you unless you have access to:

1. Motivated and skilled physicians who recognize asthma as chronic in nature, requiring individualized treatment and regular follow-up. Your physicians should be oriented toward educating you and maintaining your asthma under excellent control by adjusting medication on a frequent basis based on your pulmonary functions, physical examination and current symptoms. In addition, your physicians should respond promptly to asthmatic emergencies and guide you through a flare of asthmatic symptoms with considerable skill, thus avoiding unnecessary E.R. visits and hospitalization.

2. A health care system that is flexible and allows access to a specialist when your primary care physician cannot adequately control your asthma.

3. Regular office visits for asthma evaluation with pulmonary function testing.

4. An understanding of your treatments and a good working relationship with your physicians *(see Physician/Patient Relations, page 102).*

Be Your Own Advocate When It Comes to Your Medical Care

Although this may sound like heresy, when it comes to medical treatment these days, simply trusting a medical system may not be the best approach. To receive outstanding care, you should play an active role in your own medical delivery system rather than passively assume that a hospital, medical insurance program, medical specialist, or family doctor is doing everything possible to provide you top-notch treatment. Dramatic changes in health care delivery have challenged traditional values. This has, at times, resulted in pitting your own interest against that of the system. Mostly it has to do with attempting to limit the use of expensive resources and placing a maze of obstacles and inefficiencies between you and your physicians. As a result, you may not receive adequate attention and/or optimum treatment. You are more likely to receive excellent treatment if you become knowledgeable about your disease process and treatment options, fully understand the limitations and benefits of your insurance plan before needing to use it and find an excellent physician with whom you have good communication and a cooperative working relationship *(see Physician/Patient Relations, page 102).*

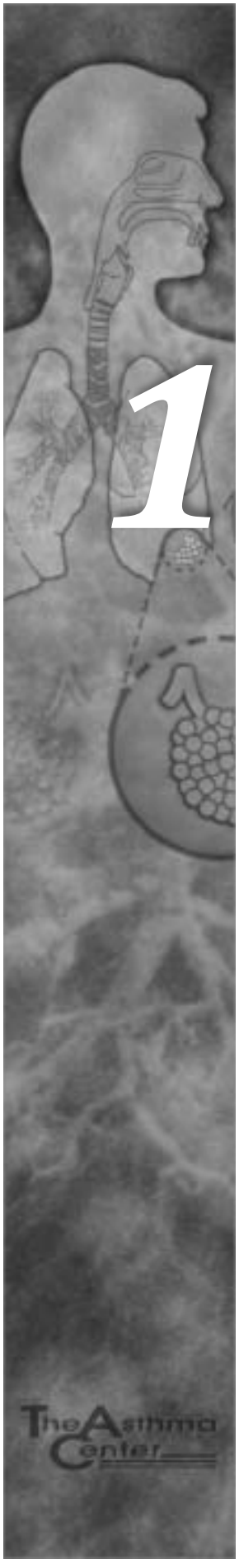
When you are not feeling well, you should contact your primary care physician. If your physician cannot resolve the problem, you should request a consultation with a specialist and make every effort to find a superior specialist in your community.

If your insurance company or primary care physician is not cooperating in resolving a problem, you should consider making appropriate changes, such as speaking to the insurance company or physician about your concerns and asking for help. This simple act may resolve the problem.

Since it has often been observed that the economic costs for treatment by the top specialists are usually the same as that of the least skilled specialists, you should actively seek outstanding physicians.

Choosing the right primary care physician and specialist is an extremely important decision since those physicians' treatment will often have long lasting effects on your quality of life and perhaps prevent permanent lung damage.

Therefore, you should do your homework and critically evaluate physician performance to receive the best medical care. It can take considerable time and effort to identify an excellent physician, but this effort is a valuable investment. You can begin this search by reviewing insurance directories of specialists, asking your primary care physician, friends, neighbors and other doctors you know, and reviewing the doctor's educational background, achievements (usually available online), professional website, and social media presence. Certain physicians with reputations of excellence will stand out. You should look for a clean, well organized office, cooperative staff and a doctor or doctors interested in your particular problem. You should also look for a group practice. This group approach ensures continuity of care regardless of which physician is available and provides continuous and consistent on-call emergency service. You also benefit from the cumulative knowledge of the group, which will always be greater than any single physician. In addition, you should learn as much as possible about your disease process and the medications used in its treatment. You should also ask your doctor(s) to explain his/her recommendations and plans. This careful approach, although taking time and effort, will guarantee finding the best group of physicians.



PART ONE

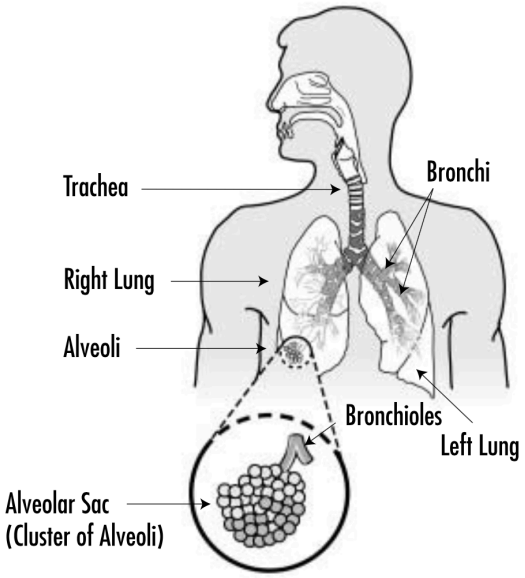
Asthma:
A General Definition

1 What Is Bronchial Asthma?

Bronchial asthma is a chronic (long term) disease affecting the bronchial tubes (bronchi, breathing tubes, or airways) of the lungs. Normally when you breathe in (inhale), air is drawn through your mouth and nose into the trachea (windpipe) *(see Figure 1)*. The trachea divides into two large breathing tubes called bronchi. These bronchi divide and divide again into ever smaller bronchi. Eventually, they divide into thousands of tiny bronchi called bronchioles. The bronchioles are connected to, or end in, tiny breathing sacs called alveoli. When you inhale, air passes down to the bronchioles and fills the air sacs (alveoli), permitting fresh oxygen to enter the body and allowing the waste gas, carbon dioxide, to leave the body when you breathe out (exhale).

Asthma is a common chronic lung disorder. In recent decades, asthma prevalence has increased from 7.3% in 2001 to 7.8%, 24.6 million people, in 2017. Currently, 8.4% of children aged 0-17 and 7.6% of adults aged 18 and over have asthma. It is estimated that in 2025 there will be over 100 million asthmatic patients. As many as 89.5% of asthmatic patients have allergic rhinitis as a concurrent condition. In terms of the socioeconomic costs of asthma care, a recent estimate stated that total annual asthma costs grew quickly from $12 billion in 1994 to over $56 billion today. It is estimated that the average cost per year for the care of one asthmatic patient is $5000, being much higher in severe asthmatic patients. Asthma mortality rates show that there are over 3600 deaths per year due to asthma, majority of those being in adults. This has dropped over the past decades when asthma death rates were over 5000 deaths per year.

FIGURE 1 Anatomy of the Lower Respiratory Tract



The walls of the bronchial tubes are made up of different layers *(see Figures 2A and 2B)*. The outer layer is composed of muscle and cartilage. The muscular tone of this layer determines how wide or narrow the bronchial tube passageway will be. The inner layer of the bronchial tubes is lined with mucous membranes that secrete mucus, which coats the inside of these breathing tubes. Mucus functions to protect and clean the bronchial passageways.

FIGURE 2A Normal Airways

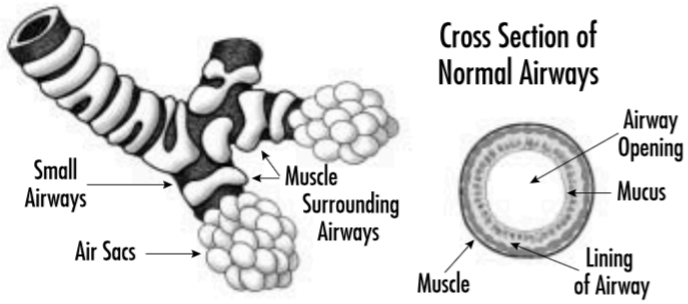
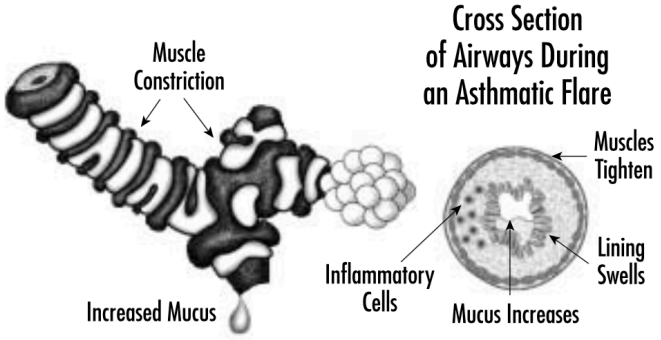


FIGURE 2B Airways During an Asthmatic Flare



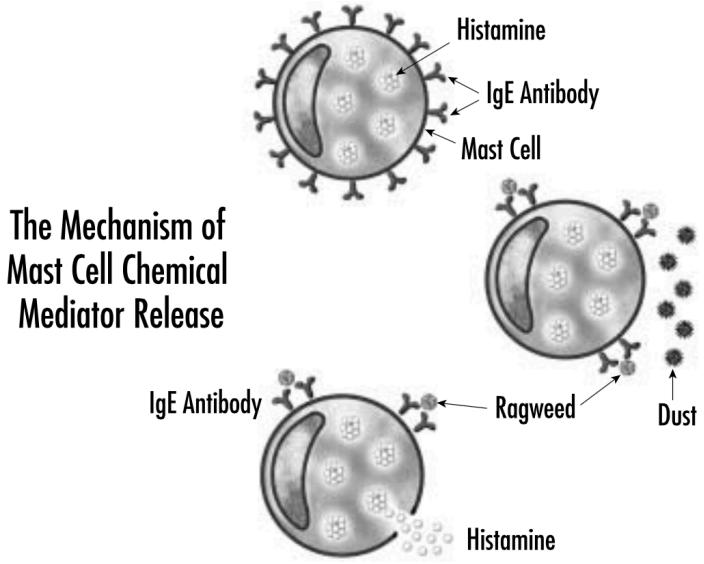
Asthmatic symptoms are the result of constriction or narrowing of irritable bronchial tubes. This constriction is caused by bronchial tube muscle spasms and airway narrowing due to inflammation, which leads to swelling of the lining and increased mucous secretion. Narrowing of the airway causes resistance to the movement of air during breathing and often results in the symptoms of shortness of breath, chest tightness, wheezing and/or coughing.

Characteristically if you are asthmatic, your bronchial tubes are very sensitive and easily irritated. These sensitive airways can be thrown into spasm at times by a relatively minor stimulus (e.g. breathing in cold air, exposure to allergens, exercise, cigarette smoke, etc.). When you exhale, the lungs are compressed by the upward movement of the diaphragm and the obstructed bronchial tubes further narrow. This causes greater resistance to the outflow of air. A musical sound or wheeze is often heard as turbulent air passes out of the narrowed and partially obstructed bronchi.

Because it takes a longer amount of time to exhale through obstructed bronchi, some air remains trapped inside the airways and alveoli as you take your next breath. Over time, the remaining (residual) trapped air accumulates so that you feel difficulty breathing. In addition, the chest "tightness" you feel is due to increased resistance to air movement in the bronchial tubes. The decreased movement of your diaphragm muscle that has been pushed down by all the trapped air in your lungs also contributes to a feeling of shortness of breath. If the airway obstruction worsens, as in a severe asthmatic attack, poor air passage can result in reduced amounts of oxygen reaching the alveoli. Under these circumstances, your lungs can also begin to accumulate carbon dioxide waste, which can, in the most extreme case, contribute to irregular heart beats, coma and death due to respiratory failure.

One of the major underlying causes of bronchial asthma is related to the mechanism of mast cell chemical mediator release *(see Figure 3)*.

FIGURE 3 How Allergies Cause Asthma



The unique, chemically-rich mast cells that line the mucous membranes of the bronchi may be triggered to release histamine and other chemical mediators (leukotrienes, tryptase, etc.), which can cause bronchospasm and inflammation of the bronchial tubes. In allergic asthma, the allergy antibody, IgE, can cause the mast cells to release chemicals when exposed to appropriate allergen(s). In other circumstances, mast cells release their chemicals without an allergic trigger (e.g. following a cold or with exercise). If you are asthmatic, the effects of the mast cell mediator release are spasm (constriction) of the smooth muscle surrounding the airway, inflammation due to accumulation of various cells (eosinophils, neutrophils, lymphocytes, macrophages, etc.), edema (swelling) and increased mucus production within the bronchi. This process not only culminates in clinical asthmatic symptoms but also increases the hyper-responsiveness of the bronchial tubes to other irritant and/or allergen exposure(s).

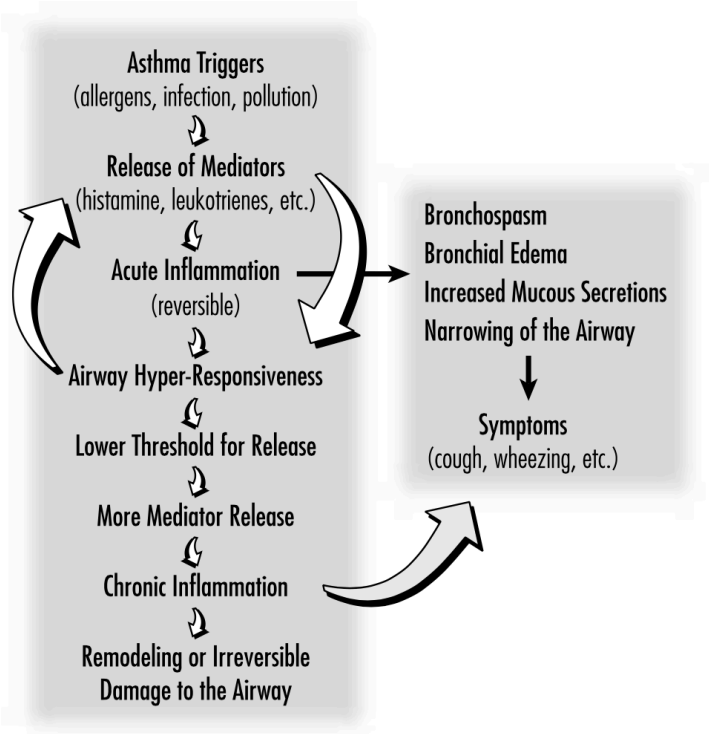
Mast cell mediator release results in smooth muscle spasm, airway inflammation, edema, and increased mucus production.

Asthmatic symptoms that follow exposure to an allergen may occur immediately, within minutes of exposure (immediate response), and may subside within an hour. In addition, you may have a delayed response (late phase reaction) that occurs 3 - 4 hours following the immediate response. This dual reaction is most often seen in more sensitive asthmatic individuals. The late phase reaction may last many hours or days and is thought to result from an inflammatory reaction. The late phase reaction may be associated with increased bronchial hyper-responsiveness or irritability of the airway, rendering you even more sensitive to a variety of inhaled irritants. As a result of increased hyper-responsiveness of the bronchi, the threshold for provoking asthmatic symptoms by various stimuli is lowered and may result in even more mediator release, inflammation and airway hyper-responsiveness. This can lead to a vicious cycle causing chronic symptoms, ultimately culminating in an acute attack of asthma unless the disease process is effectively treated *(see Figure 4)*.

FIGURE 4

Mediator Release-Inflammation-Airway Hyper-Responsiveness Cycle

Inflammation results in airway hyper-responsiveness which causes asthmatic patients to be more sensitive to allergens and irritants.



Partial or total reversibility of bronchial tube spasm is a primary characteristic of bronchial asthma early in the disease.

Finally, obstruction of the inner passageway of the bronchial tube may result from the thick, sticky mucus and mucous plugs that are characteristically produced during an asthmatic attack. If you are asthmatic, you may frequently complain of feeling "congested" from mucus accumulation, or you may often say that if the mucus could only be coughed up, your symptoms would be relieved. In a flare of asthmatic symptoms, however, as quickly as mucus is coughed up, new mucus is produced. Symptom relief is best achieved by treating the underlying bronchial inflammation and obstruction. In general, the earlier you treat asthmatic symptoms in an evolving attack, the less medication you need to bring it under control.

In summary, if you have asthma, you suffer from symptoms due to very sensitive bronchial tubes *(see Table 1*). Irritation of the bronchial tubes may trigger spasm or obstruction of the airways *(see Table 2)*. Usually with the passage of time and/or the use of asthma medication, airway obstruction can ease up, and there is partial or total reversal of the bronchial tube obstruction. However, this is not true in all cases.

Partial or total reversibility of bronchial tube spasm is a primary characteristic of bronchial asthma early in the course of the disease.

TABLE 1

Asthmatic Symptoms Result from:
• **Mast cell release of mediators**
• **Inflammatory cell infiltration of airway tissue**
• **Bronchospasm**
• **Edema (swelling) of the airway tissues**
• **Increased thick mucus and mucous plugs**
• **Bronchial obstruction causing symptoms**
• **Hyper-responsiveness of the airway**
• **Possible remodeling of the airway (permanent damage – *see below*)**

TABLE 2

Triggers of Asthmatic Symptoms:

• **Upper respiratory infections ("colds" or "sinus infections")**
• **Allergens – pollen, house dust, house dust mites, animal dander, molds, foods, insects**
• **Strong odors**
• **Exercise**
• **Cold air**
• **Pollution – indoor and outdoor**
• **Emotional stress**
• **Drugs – aspirin, aspirin-like drugs, beta-blockers, ACE inhibitors**
• **Hyperventilation, laughing, crying**

Remodeling of the Airway

Permanent narrowing of the airways resulting from inflammation and fibrosis is called *remodeling.*

Asthma is a chronic disease that can lead to permanent lung damage. Although this may appear to be a shocking statement, there is increasing evidence supporting this concept. In recent years, **The Asthma Center** allergists have come to understand that you may in fact not "outgrow" your symptoms. The chronic (long term) nature of the disease and chronic inflammation can lead to permanent changes of the airway, which may be associated with daily non-reversible symptoms. Permanent changes in the airways appear to result from repeated asthmatic events causing recurrent bouts of inflammation of the bronchi, which in turn can ultimately lead to airway fibrosis (scarring) and permanent narrowing of the airways (remodeling). Once fibrosis occurs, it cannot be reversed with treatment. This is not an "all or nothing" process. Over years of poorly controlled asthma, you may suffer ever increasing lung damage and obstruction. Permanent damage to the airways usually occurs very slowly over a very long time. Effectively treating asthma during acute episodes, while undertreating the disease when your symptoms are less severe, nevertheless may lead to serious long term non-reversible lung disease. Unfortunately, it is not possible to know in advance whether you have the potential to develop permanent damage.

The concept of permanent narrowing of the airways resulting from inflammation and fibrosis is called remodeling. Poorly controlled asthma is thought to be a dynamic (changing) disease that can evolve from fully reversible bronchospasm to permanent narrowing of the airways. In some ways, remodeling of the bronchi, which results in fixed airway obstruction, may appear to be similar clinically to the fixed airway obstruction seen if you have chronic obstructive pulmonary disease (COPD) *(see COPD, page 95)*. In fact, poorly managed asthma can take on some of the features of COPD. The term for this is ACOS or Asthma COPD Syndrome (see ACOS section). This is a new concept and points to the truly insidious nature of asthma and the inherent danger of not optimally managing this chronic disease.

In the past, some pediatricians have told children and their parents that the children would outgrow their asthma. Although many pediatric asthmatic patients do, in fact, appear to be cured of asthma, millions of

other childhood asthmatic patients continue to experience asthmatic symptoms as adults. In children with asthma, early and aggressive treatment of the inflammatory process of asthma may be the most important factor in preventing airway remodeling and permanent damage.

One of the main reasons that asthmatic symptoms are often underestimated is the fact that there is an enormous excess capacity in the lungs to breathe. In fact, you can increase your breathing from 6 liters (6.3 quarts) a minute at rest to more than 90 liters (95 quarts) a minute during vigorous exercise, representing a 1500% increase. Although this phenomenal reserve capacity of the lungs is used primarily during exertion, you can understand that you only use a very small percentage of your lung capacity to breathe at rest or when performing most daily tasks. Unless you really exert yourself physically and begin to tap your reserve of breathing capacity, you may never even be aware that asthma has damaged or limited your ability to breathe. In fact, you may have already lost 30 - 40% of your breathing capacity and over time feel "just fine."

In summary, ongoing inflammation of the bronchi causes increasing sensitivity of the airways (hyper-responsiveness), which results in asthmatic symptoms being provoked by even mild irritant or allergen exposure. This can lead to a vicious cycle of ever increasing symptoms.

As your airway hyper-responsiveness increases and the threshold to stimuli that cause symptoms decreases, acute life-threatening asthmatic symptoms can occur.

2 Types of Bronchial Asthma

Phenotypes

Like many other disorders, asthma is a disorder that can be divided into phenotypes. A phenotype is defined as the observable physical characteristics. Asthma phenotypes result from interactions between a person's environment and genes.

There are 5 major asthma phenotypes. Allergic, extrinsic-type, asthma is when the patient experiences asthmatic symptoms following exposure to an allergen. Non-allergic, intrinsic-type, asthma is when the patient suffers from asthmatic symptoms following strong odors, weather changes, exercise, etc. These patients usually have negative allergy skin tests. Next, infection-related asthma is when the patient suffers from asthmatic symptoms following a chest or respiratory infection. Aspirin Exacerbated Respiratory Disease (AERD), also known as Aspirin Sensitive Asthma, is an asthmatic phenotype where the patient has asthmatic symptoms that can be made worse by aspirin or certain other nonsteroidal anti-inflammatory drugs. Finally, childhood pre-asthma phenotype is when a child presents with symptoms indicative of developing asthma.

Other asthma phenotypes can be divided into phenotypes based on biomarkers, symptoms, and triggers. A biomarker is a measurable substance in a person's tissues, cells, or fluids that can tell information about disease, infection, or environmental exposure. Based on biomarkers, asthma can be divided into eosinophilic, neutrophilic, and paucigranulocytic asthma, based on the levels of eosinophils and neutrophils,

two cell types, in the lung tissue. Eosinophilic asthmatic patients have higher levels of eosinophils in the lung, neutrophilic asthmatic patients have higher levels of neutrophils in the lung, and paucigranulocytic asthmatic patients have minimal levels of both eosinophils and neutrophils in the lung. It is estimated that 40% of adults have eosinophilic asthma, whereas 25% of adults have neutrophilic asthma.

Asthma can also be divided into 5 phenotypes based on symptoms. Exacerbation-prone asthma is an asthma phenotype where the patient experiences exacerbations, or worsening, of asthma symptoms, unless they are given proper medications, such as corticosteroids. Asthma with persistent airflow limitation is the second symptom-based phenotype where the patient's airflow is limited unless high doses corticosteroids are given. Cough-variant asthma is the third symptom-based phenotype. Patients with this type of asthma have a chronic cough that is partially caused by the presence of certain cells, mast cells, in the airway muscle, which makes the airway overactive. Adult-onset asthma is the fourth symptom-based phenotype. This phenotype occurs when a patient develops asthma over the age of 20 years. The final symptom-based phenotype is the obese asthma phenotype. There is an increased prevalence of asthma in patients who are obese (have a body mass index [BMI] greater than 30 kg/m2 [normal BMI is 18.5-24.9]).

Asthma can be divided into 4 phenotypes based on different triggers. Occupational asthma is a trigger-based phenotype where asthmatic symptoms are triggered by a variety of exposures in the workplace. Cigarette smoke-induced asthma is the second trigger-based phenotype, in which asthmatic patients who smoke tend to have even more cough and phlegm and an even more rapid decline in lung function. Air pollution-induced asthma is the third trigger-based phenotype where asthmatic patients have worsening of symptoms when exposed to pollution, like that caused by air and road traffic. Finally, exercise-induced asthma is a trigger-based phenotype that is characterized by a worsening of asthma symptoms when a person exercises. It is predicted that there will be dozens more of distinct asthma phenotypes to define in future years. In the future, treatment may be tailored specifically to each phenotype. In many cases, a given individual may have several characteristic phenotypes (i.e. AERD and exercise-induced).

TABLE 3

Asthma Phenotypes

Classic Phenotypes	Allergic (Extrinsic-Type)
	Non-Allergic (Intrinsic-Type)
	Infection-Related
	Aspirin Exacerbated Respiratory Disease (AERD)
	Childhood Pre-Asthma
Biomarker-Based Phenotypes	Eosinophilic
	Neutrophilic
	Paucigranulocytic
Symptom-Based Phenotypes	Exacerbation-Prone
	Asthma with Persistent Airflow Limitation
	Cough-Variant
	Adult-Onset
	Obese
Trigger-Based Phenotypes	Occupational
	Cigarette Smoke-Induced
	Air Pollution-Induced
	Exercise-Induced

The classic asthma phenotypes are based on allergic and/or non-allergic triggers.

Allergic or Extrinsic-Type Asthma

If you have allergic or extrinsic-type asthma, it is likely you have a history of sneezing, itchy eyes and itchy nose as well as asthmatic symptoms following exposure to allergens *(see Common Allergic Symptoms, page 75)*. You may suffer allergy symptoms during a particular season due to pollen exposure, or you may suffer symptoms year-round that are worse during the winter, especially when indoors. You also may suffer from exposure to a perennial allergen such as house dust, house dust mite, animal dander (from a dog, cat, etc.) and/or mold.

The Asthma Center allergists can best identify allergic sensitivity through a detailed history followed by allergy skin testing. If you are specifically sensitive to one or more allergens, you may benefit from avoidance of the allergens that trigger your symptoms. If an allergic trigger is found in your home (e.g. house dust mite, animal dander), removal of these triggers can result in a decreased need for medications and can permit better clinical control of symptoms. In addition, there are many environmental measures you and your family can implement in your home and work environments to decrease allergen exposure *(see Environmental Avoidance of Allergens and Irritants, page 64)*.

Allergy injections (subcutaneous immunotherapy [SCIT] or sublingual immunotherapy [SLIT]) are other effective treatments for extrinsic asthma. Allergy immunotherapy works by lowering your sensitivity to a specific allergen and may allow you to tolerate out- door and/or indoor allergen exposure to a greater extent. Furthermore, allergy immunotherapy may reduce your overall airway hyper-responsiveness, making you less sensitive to nonspecific, asthma-provoking factors such as infections and air pollutants. Immunotherapy also may prevent the onset of asthma in some susceptible individuals, especially children *(see Immunotherapy, page 65)*.

Non-allergic triggers of asthma:
cold air, respiratory infections (colds), air pollution, cigarette smoke, aerosols, cleaning agents, bleach, strong odors (e.g. perfumes) and cooking odors.

Non-Allergic or Intrinsic-Type Asthma

If you have non-allergic or intrinsic-type asthma, it is likely you suffer from asthmatic symptoms following an infection that settles in your chest. Since these infections are usually viral, antibiotics do not help since they are ineffective against viruses. Less frequently asthma may be provoked by bacterial infections often associated with sinusitis, ear infections, or bronchitis. Antibiotics are often essential in these situations.

Symptoms also may be provoked by other non-allergic factors such as weather changes, cold air, exercise, indoor pollutants (formaldehyde, household cleansing products and chemicals, cigarette smoke), outdoor pollutants (ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide) and strong odors (perfumes, scented sprays, fresh paint, moth balls). Allergies are not causing your symptoms if you have intrinsic-type asthma. Therefore, you typically will have negative allergy skin tests and you would not benefit from allergy immunotherapy.

Mixed-Type Asthma

If you have mixed-type asthma, you have both allergic and non-allergic factors that provoke your symptoms. You have some symptoms triggered by nonspecific inhalants while typical allergic factors may also play a role in your asthma. For instance, you may have wheezing episodes with each cold and also have similar symptoms during ragweed season. This type of asthma is seen by **The Asthma Center** allergists most often.

Exercise-Induced Asthma (Sports Asthma)

Exercise-induced asthma (sports asthma, exercise-induced bronchospasm) is a unique form of asthma that may accompany other forms of asthma. If you have pure exercise-induced asthma, then you are free of symptoms at rest. However, when you run or physically exert yourself, you usually become short of breath, feel chest tightness, begin coughing and/or start wheezing. Symptoms of coughing and wheezing frequently begin within minutes after exercising. Resting for a period of time may resolve mild symptoms completely. Exercise-induced asthma is thought to result from cooling and drying of the airways (bronchial tubes) due to increased ventilation (movement of air) and evaporation of moisture from the bronchial tubes. You also may exhibit asthmatic symptoms when laughing or crying. If your exercise-induced asthma is well-managed, you can still lead a physically active life, exercise routinely and usually participate in sports. For example, many Olympic athletes have won medals despite having exercise-induced asthma *(see Should You Exercise?, page 113)*.

Occupational Asthma

Occupational asthma is a special case of asthma triggered by an irritant or allergen found in the workplace. The incidence of occupational asthma in the workplace is estimated to be about 2% *(see Does Work Make Your Asthma Worse?, page 108)*

Cough-Variant Asthma

Cough-variant asthma refers to asthma in which the major symptoms are repetitive bursts of coughing. Shortness of breath and chest tightness also may be experienced, but wheezing usually is not present. Symptoms do not respond to cough suppressant medication. In contrast, symptoms of coughing respond well to some combination of asthma medications. If you have cough-variant asthma, it is likely you have normal or near normal pulmonary function tests, so the best way to make an accurate diagnosis is with a methacholine challenge (a special breathing challenge test). It is important to have an objective support for this diagnosis since there are so many causes of chronic coughing other than asthma *(see Chronic Cough, page 92)*.

Nocturnal Asthma

Although asthma symptoms do occur at night, nocturnal asthma refers to a condition of suffering frequent nighttime asthmatic attacks *(see Why Do You Wheeze at Night (Nocturnal Asthma)?, page 109).*

Aspirin-Induced Asthma

About 3 or 4% of asthmatic individuals have significant asthmatic symptoms following aspirin ingestion. Therefore, most individuals with asthma rarely note a significant flare of asthmatic symptoms following the ingestion of any form of aspirin or nonsteroidal anti- inflammatory medication such as ibuprofen (Motrin®/Advil®, etc.) *(see Table 4*).

TABLE 4

Aspirin-Like Medications

Drugs to be avoided	Permissible drugs*
antipyrine (Aurodex®, Dolotic®)	acetaminophen (Tylenol®)
diflunisal (Dolobid®)	choline magnesium trisalicylate (Trilisate®)
fenoprofen (Nalfon®)	choline salicylate
ibuprofen (Motrin®, Advil®, Midol®)	chloroquine (Aralen® Phosphate)
indomethacin (Indocin®, Tivorbex®)	narcotics (e.g. codeine, meperidine)
ketoprofen (Oruvail®, Orudis®)	salicylamide (BC® Allergy Cold Sinus Powder)
meclofenamate (Meclomen®)	salsalate (Disalcid®, Amigesic®)
mefenamic acid (Ponstel®)	celecoxib (Celebrex®)
naproxen (Aleve®)	meloxicam (Mobic®)
piroxicam (Feldene®)	
sulindac (Clinoril®)	
tartrazine – (FD&C yellow dye no. 5) containing drugs	
tolmetin sodium (Tolectin®)	
Rarely cause symptoms in aspirin-sensitive patients	

If you are aspirin-sensitive, it is likely you have very difficult-to-manage asthma in conjunction with chronic sinusitis and nasal polyps. This combination of symptoms is often referred to as Triad Asthma. If it is suspected that your episodes of asthma are provoked by aspirin ingestion, you may require testing to determine whether you are aspirin-sensitive. If you are in fact aspirin-sensitive, you may benefit from a special aspirin desensitization program. **The Asthma Center** has over 30 years of experience in successfully performing outpatient aspirin desensitization.

Potentially Fatal Asthma

If your asthma is properly treated, you can generally do well and live a normal life. However, some individuals are at a greater risk of dying from their asthma. You may be at a higher risk if you have a history of any of the following:

- Respiratory failure from asthma
- Airway intubation and mechanical ventilation for asthma
- Two or more recent episodes of severe asthma despite oral corticosteroid use
- Two or more recent complications of severe asthma
- Not accurately sensing your degree of respiratory difficulty
- Overuse or underuse of medications

The majority of individuals with potentially fatal asthma put themselves at risk by not complying with physician directions and follow-up visits, by overusing their rescue inhaler medication and/or by delaying access to specialty care.

Coexistent Asthma and COPD

If you have chronic obstructive pulmonary disease *(see COPD, page 95)*, it is likely you also have a significant component of reversible airway obstruction due to asthma. This is called ACOS. Diligently defining and treating the asthmatic component involved with COPD could lead to significant improvement in your symptoms.

Cardiac Asthma

If you have heart disease such as coronary artery disease, valvular heart disease and/or congestive heart failure, you may develop congestion in your lungs related to your heart disease. Treatment of "cardiac asthma" includes medications directed at improving heart function and relieving acute lung symptoms. Long term asthma treatment, unlike most cases of asthma, will not be required unless you also suffer from bronchial asthma.

Factitious Asthma (False Asthma)

Factitious asthma is a disorder that mimics asthma but is not asthma at all. Symptoms similar to asthma may be present, but the origin of these symptoms is ***not*** due to bronchospasm as it is in asthma. Problems often occur in the upper airway, especially at the level of the vocal cords *(see Vocal Cord Dysfunction, page 94)*. Rarely a lung tumor or blood vessel pressing on the bronchi can cause wheezing *(see Other Medical Problems, page 17)*. Specialized tests will identify factitious asthma.

Stress-Related Asthma

Although asthma is not a psychological illness, anxiety, stress reactions and other psychological problems may lead to flaring of your asthmatic symptoms. In these cases, you may benefit from stress reduction techniques or psychological or psychiatric counseling as well as asthma medications *(see Is Asthma an "Emotional Disease"?, page 110)*.

Other Medical Problems That Cause Symptoms Similar to Asthma:

In Children:

- Inhaled foreign body (e.g. peanut)
- Narrow or floppy trachea/larynx

- Cystic fibrosis
- Immunodeficiency
- Tumors, lymph nodes in chest pressing on airway
- Blood vessels pressing on airway
- Vocal cord dysfunction *(see page 94)*
- Pneumonia, bronchiolitis, congenital defects
- Congenital heart disease
- Subglottic stenosis

In Adults:

- Chronic obstructive pulmonary disease (COPD) *(see page 95)*
- Vocal cord dysfunction *(see page 94)*
- Subglottic stenosis
- Congestive heart failure/irregular heart rhythm
- Tumors of the lung
- Immunodeficiency
- Pulmonary emboli
- Medication induced cough (e.g. ACE inhibitors)
- Other diseases of lung tissues

How is Asthma Diagnosed?

- Detailed allergy and asthma history
- Physical examination
- Pulmonary Function Testing (peak flow, spirometry, complete lung volumes, methacholine challenge)
- Chest X-ray
- Rule out other diseases that cause similar symptoms
- Your positive response to asthma medication; worsening of symptoms when off of asthma medications

How is the Doctor Sure You Have Asthma if Your Breathing Test is Normal?

When your pulmonary function testing reveals an obstructive pattern with significant reversibility of the obstruction with a bronchodilator (albuterol), you are likely dealing with asthma. When you have symptoms typical of asthma and normal pulmonary function tests, a methacholine challenge test is the best way to objectively confirm the presence of airway hyper-reactivity, the hallmark of currently active asthma. Asthmatic individuals are highly sensitive to tiny amounts of inhaled methacholine whereas non-asthmatic individuals are generally unaffected. Therefore, if you are asthmatic and inhale methacholine, you will experience a significant decrease in pulmonary functions. This also can be accompanied by mild asthmatic symptoms. A methacholine challenge test is the standard most specialists use to confirm the diagnosis of

asthma if you have otherwise normal pulmonary function tests.

Tests the Doctor Often Orders to Evaluate Asthma and the Factors Contributing to Asthma:

- Allergy skin testing
- Chest X-ray
- Sinus X-rays or sinus C.T. scans
- Studies for gastroesophageal reflux *(see page 88)*
- Blood work
- Sweat test or blood test in young children to rule out cystic fibrosis
- Pulmonary function testing/methacholine challenge test
- Peak flow monitoring at home
- Quantitative immunoglobulins (for immunodeficiencies)
- Rhinolaryngoscopy (endoscopic examination of the upper airway)

Poorly Controlled Asthma may be the Result of Other Underlying Medical Problems including:

- Sinusitis *(see Asthma and Sinusitis, page 86)*
- Gastroesophageal Reflux Disease (GERD) *(see page 88)*
- Cigarette Smoking or Passive Cigarette Smoke Exposure *(see page 98)*
- Allergic Rhinitis (hayfever) *(see Common Allergic Symptoms, page 75)*
- Congestive Heart Failure
- Stress or Psychological Problems *(see Is Asthma an "Emotional Disease"?, page 110)*
- Poor Air Quality or Exposure to Irritants/Allergens
- Poor Patient Compliance with Medications or Environmental Controls
- Medications (e.g. Beta-Blockers) for Other Medical Problems *(see What Medications Do You Need To Avoid?, page 111)*

Classification of Asthma Severity

A representative group of physicians, nurses and researchers from virtually all medical organizations involved in asthma management has developed a method of classifying asthma into categories of severity in order to help you and your physicians better understand the nature of the disease and choose your appropriate treatment. This classification was meant to act as a guide to asthma therapy using a stepwise approach, linking classification to pre- determined treatment regimens. Although this approach has its benefits as a general guide, it is no replacement for an individualized treatment program since you may not do well with the general recommendations of a committee. The severity of asthma reflects the intrinsic intensity of asthma and is most easily assessed in an individual not on long term therapy. Severity assessment is important to guide clinical decisions on medication use and other interventions. The charts below are from the *National Heart, Lung, and Blood Institute (NHLBI) and National Asthma Education and Prevention Program (NAEPP) Asthma Guidelines* classifying asthma severity.

TABLE 5 Classification of Asthma Severity Before Treatment

Components of Severity	Classification of Asthma Severity (Patients 0-4 years old)			
	Intermittent	Persistent		
		Mild	Moderate	Severe
Symptoms	≤2 days a week	>2 days/week but not daily	Daily	Throughout the day
Nighttime awakenings	0	1-2x/month	3-4x/month	>1x/week
SABA* use for symptom control	≤2 days a week	>2 days/week but not daily	Daily	Several times per day
Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2 exacerbations in 6 months requiring oral systemic corticosteroids, or ≥4 wheezing episodes/1 year lasting >1 day AND risk factors for persistent asthma		

*Short-acting inhaled beta$_2$ agonist

Components of Severity	Classification of Asthma Severity (Patients 5-11 years old)			
	Intermittent	Persistent		
		Mild	Moderate	Severe
Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
Nighttime awakenings	≤2x/month	3-4x/month	>1x/week but not nightly	Often 7x/week
SABA* use for symptom control	≤2 days a week	>2 days/week but not daily	Daily	Several times per day
Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
Lung function	• Normal FEV_1** between exacerbations • FEV_1>80% predicted • FEV_1/FVC***>85%	• FEV_1>80% predicted • FEV_1/FVC>80%	• FEV_1= 60-80% predicted • FEV_1/FVC=75-80%	• FEV_1<60% predicted • FEV_1/FVC<75-80%
Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year		

*Short-acting inhaled beta$_2$ agonist, **Forced expiratory volume in 1 second, ***Forced vital capacity

Components of Severity	Classification of Asthma Severity (Patients ≥12 years old)			
	Intermittent	Persistent		
		Mild	Moderate	Severe
Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
Nighttime awakenings	≤2x/month	3-4x/month	>1x/week but not nightly	Often 7x/week
SABA* use for symptom control	≤2 days a week	>2 days/week but not daily and not more than 1x on any day	Daily	Several times per day
Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
Lung function	• Normal FEV_1** between exacerbations • FEV_1>80% predicted • FEV_1/FVC*** normal	• FEV_1>80% predicted • FEV_1/FVC normal	• FEV_1>600% but less than 80% predicted • FEV_1/FVC reduced 5%	• FEV_1<60% predicted • FEV_1/FVC reduced >5%
Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year		

*Short-acting inhaled $beta_2$ agonist, **Forced expiratory volume in 1 second, ***Forced vital capacity

Asthma control refers to the extent that the symptoms of asthma are minimized by different therapies and the goals of these therapies are met.

After the severity of asthma has been determined, the focus of asthma care turns to asthma control. Asthma control refers to the extent that the symptoms of asthma are minimized by different therapies and the goals of these therapies are met. Asthma control is divided into well controlled asthma, not well controlled asthma, and very poorly controlled asthma (See Table 6). Control is divided into looking at two different domains – impairment and risk. Impairment refers to how frequently and how intense the symptoms of the patient are and what types of functional limitations the patient is experiencing currently. Risk refers to how likely in the future it is that the asthma symptoms worsen, lung function declines (or, for children, lung growth reduces), or adverse effects from medication are experienced. The goal for asthma control is to reduce both impairment and risk. Once you begin treatment, both symptoms and pulmonary function improve quickly, and you can move into a category of lesser severity. As improvement occurs and/or continues, medications need to be adjusted slowly and carefully to the lowest effective dose. Although symptoms may improve with treatment, you may continue to have a persistent disease, which can be documented by decreased pulmonary functions when medications are tapered or discontinued. Unfortunately, it is possible you are receiving less medication than necessary because you are not complaining of all symptoms, and yet you have ongoing inflammation of the airways. At times, chronic inflammation is silent (little or no

symptoms), and yet it may lead to permanent damage to the bronchi when untreated or undertreated for long periods of time.

Although classification of asthma is helpful as a guide, it does not replace individualized treatment. Regular follow-up office visits in which the physician reviews medication use, symptoms, quality of life issues, physical examination findings and pulmonary function tests are the best way to keep asthma under good control while preventing unnecessary flares of asthma and permanent lung damage.

The Asthma Control Test (ACT) (see Figure 5) is a very helpful home and office tool that can quickly help assess the level of current asthma control for individuals 4 years or older. Based on responses to 5 questions, the ACT can assess whether the patient's asthma is well controlled (score of 20 or greater), not well controlled (score of 16-19), or very poorly controlled (score of 15 or less).

FIGURE 5

Asthma Control Test

1. In the past **4 weeks**, how much of the time did your **asthma** keep you from getting as much done at work, school or at home?

All of the time	1	Most of the time	2	Some of the time	3	A little of the time	4	None of the time	5

2. During the past **4 weeks**, how often have you had shortness of breath?

More than once a day	1	Once a day	2	3 to 6 times a week	3	Once or twice a week	4	Not at all	5

3. During the past **4 weeks**, how often did your **asthma** symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

4 or more nights a week	1	2 or 3 nights a week	2	Once a week	3	Once or twice	4	Not at all	5

4. During the past **4 weeks**, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

3 or more times per day	1	1 or 2 times per day	2	2 or 3 times per week	3	Once a week or less	4	Not at all	5

5. How would you rate your **asthma** control during the **past 4 weeks**?

Not controlled at all	1	Poorly controlled	2	Somewhat controlled	3	Well controlled	4	Completely controlled	5

TABLE 6

Classification of Asthma Control

Components of Control	Classification of Asthma Control (Patients 0-4 years old)		
	Well Controlled	Not Well Controlled	Very Poorly Controlled
Symptoms	≤2 days/week	>2 days/week	Throughout the day
Nighttime awakenings	≤1x/month	>1x/month	>1x/week
Interference with normal activity	None	Some limitation	Extremely limited
SABA use for symptom control	≤2 days/week	>2 days/week	Several times per day
Exacerbations requiring oral systemic corticosteroids	0-1/year	2-3/year	>3/year
Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		
Components of Control	**Classification of Asthma Control (Patients 5-11 years old)**		
	Well Controlled	Not Well Controlled	Very Poorly Controlled
Symptoms	≤2 days/week but not more than once on each day	>2 days/week	Throughout the day
Nighttime awakenings	≤1x/month	>1x/month	>1x/week
Interference with normal activity	None	Some limitation	Extremely limited
SABA use for symptom control	≤2 days/week	>2 days/week	Several times per day
Lung function: FEV_1 or peak flow FEV_1/FVC	>80% predicted/personal best >80%	60-80% predicted/personal best 75-80%	<60% predicted/personal best <75%
Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year	
	Consider severity and interval since last exacerbation		
Reduction in lung growth	Evaluation requires long-term follow-up		
Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		

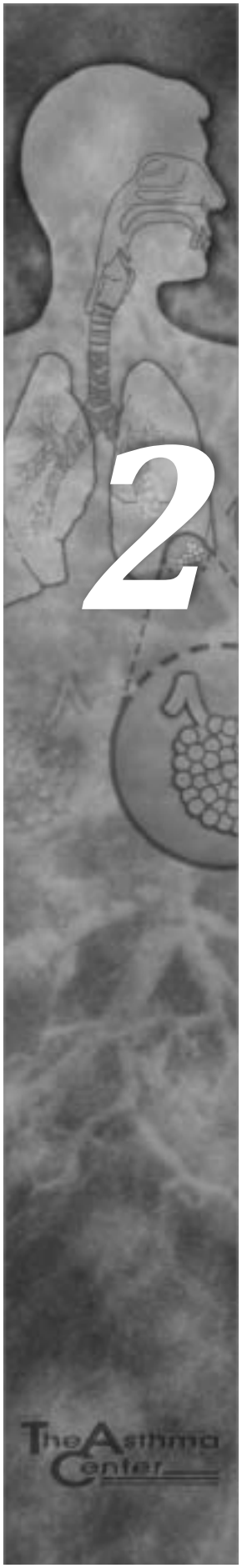
Components of Control	Classification of Asthma Control (Patients ≥12 years old)		
	Well Controlled	Not Well Controlled	Very Poorly Controlled
Symptoms	≤2 days/week	>2 days/week	Throughout the day
Nighttime awakenings	≤2x/month	1-3x/month	≥4x/week
Interference with normal activity	None	Some limitation	Extremely limited
SABA use for symptom control	≤2 days/week	>2 days/week	Several times per day
FEV_1 or peak flow	>80% predicted/personal best	60-80% predicted/personal best	<60% predicted/personal best
Validated questionnaire: ACT*	ACT: ≥20	ACT: 16-19	ACT: ≤15
Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year	
	Consider severity and interval since last exacerbation		
Progressive loss of lung function	Evaluation requires long-term follow-up care		
Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		
*Asthma Control Test			

When to Consult an Asthma Specialist

- Frequent breathing difficulty or coughing that interferes with daily activities
- Breathing problems are interfering with your quality of life (exercise, sleep, ability to be comfortable, missing school or work)
- You or your child exhibits the warning signs of asthma (e.g. chest tightness, shortness of breath, coughing and/or wheezing, especially after exercise, with colds, in the cold air, or during the night)
- History of frequent episodes of bronchitis, "croup," wheezing, chest congestion, pneumonia or pneumonitis, frequent hospitalizations, and/or ER or urgent care visits for cough, shortness of breath, wheezing, bronchitis, etc.

Why See an Asthma Specialist?

- Allergists and Pulmonologists are asthma specialists.
- Allergists are environmental specialists who are specifically trained to know how allergens and pollutants play a role in asthmatic symptoms.
- Asthma is the primary pulmonary disease treated by an allergist while pulmonologists treat many different pulmonary diseases, including asthma.
- Asthma specialists have an in-depth knowledge of all aspects of asthma.
- Asthma specialists are well versed in asthma education.
- Asthma specialists provide regular, thorough follow-up visits and are experts in asthma medications.
- Allergists can provide allergy immunotherapy to reduce sensitivity to allergens in the environment, which can contribute to ongoing asthma, or to prevent asthma from developing in individuals at risk.



PART TWO

2 Asthma Management

1 Introduction to the Management of Asthma

The management of asthma, much like the management of any chronic illness, is most successful when you are knowledgeable and actively participate in your own care and treatment. **The Asthma Center** allergists utilize an indepth diagnosis and treatment approach in order to develop strategies for asthma management that meet your individualized needs. **The Asthma Center** allergists recommend that you become familiar with the common types of asthma treatment and management. Part Two of this manual provides a comprehensive discussion of common approaches to asthma treatment including the office visit; environmental avoidance of allergens and irritants; pharmacological treatment; immunological treatments; and the use of special devices such as inhalers, spacers, nebulizers and peak flow monitors. Other issues related to asthma management discussed in this section include common allergic symptoms, sinusitis, GERD, laryngopharyngeal reflux, chronic cough, vocal cord dysfunction, chronic obstructive pulmonary disease (COPD), cigarette smoking and physician/patient relationships.

TABLE 7 Goals of Asthma Therapy

REDUCE IMPAIRMENT
• Prevent chronic and troublesome symptoms
• Infrequently use of inhaled short-acting beta agonists (SABA) for quick relief of symptoms (≤2 days/week)
• Maintain (near) "normal" pulmonary function
• Maintain normal activity levels (including exercise and other physical activity and attendance at work or school)
REDUCE RISK
• Prevent recurrent exacerbations and minimize the need for emergency department (ED) visits/hospitalizations
• Prevent progressive loss of lung function; for children, prevent reduced lung growth
• Provide optimal pharmacotherapy with minimal or no adverse effects

Best Manage Your Asthma:

1. Find an outstanding asthma specialist.
2. Education: learn everything about asthma.
3. Participate in your asthma care in partnership with your physician.
4. Follow up on all your doctor's recommendations.
5. Use a peak flow meter if recommended.
6. Take medications as prescribed even though you may feel well.
7. Be prepared for an asthmatic emergency. Have a plan and emergency back- up medications.
8. Keep all follow-up visits for assessment and adjustment of treatment. The National Heart, Lung, and Blood Institute (NHLBI) recommends a visit once every 1-6 months in the office.
9. Never run out of medication(s).
10. Avoid known triggers of your asthma. Plan ahead.
11. Follow through with environmental allergen avoidance recommendations and/or allergy injection treatment when recommended. Get appropriate vaccinations to prevent infections and asthma flares.
12. Maintain good communication with your specialist. Discuss your concerns and ask questions if issues are not clear to you.

2 The Office Visit

The most important part of any treatment program occurs during the office visit. Unfortunately the significance of these visits may not always be clear to you.

There is nothing routine about the office visit when it comes to asthma management.

The office visit offers the physician the opportunity to assess your quality of life (level of asthmatic symptoms and their impact on your daily activities and comfort) and objectively assess the current status of your asthma by combining this information with information from your physical examination and breathing tests (pulmonary function tests). The effectiveness and potential side effects of your medications are reviewed, and appropriate adjustments are made in order to maximize asthma control with the minimum amount of medication.

Associated issues are reviewed including possible environmental factors contributing to your asthma, proper use of medications (i.e. techniques and compliance), related medical problems and an overall review of the course of your asthma.

As a result of this complex analysis, the physician can recommend increases or decreases in medication doses, changes in medications or techniques, further diagnostic studies, or consultation with other specialists. If your asthma appears to be under excellent control, the asthma specialist may make no changes at all or may reduce or stop your medications. In addition, **The Asthma Center** allergists try to gauge your understanding and participation in your asthma treatment, which is a critical building block in the foundation of optimum management. The physician is aware that undertreatment of this chronic inflammatory disorder can lead to permanent lung damage *(see Remodeling of the Airway, page 11)* and that active asthma can cause lung damage with or without significant

asthmatic symptoms being present.

At times, asthma and its resulting airway obstruction can be likened to an iceberg, with significant disease lying just beneath the surface. Fortunately, pulmonary function testing usually can detect this "silent" airway obstruction. As the airway obstruction worsens, you eventually will develop breathing problems. However, by this time, damage may have occurred already, and you may be at risk for an acute attack and/or may need to take powerful medications with possible side effects (e.g. oral corticosteroids) to bring the neglected condition under control. Therefore, part of the evaluation of your asthma control will be dependent on your physician's analysis of your pulmonary function tests and evaluation of how these results fit with all the other information gathered during your office visit.

In **The Asthma Center** allergists' opinion, which is consistent with national guidelines, maintenance or follow-up office visits need to occur regularly, usually every few months, because control of chronic asthma can easily change, even if you feel fine. When you are taking daily medication, infrequent evaluation (every 6 - 12 months) is simply inadequate for optimum treatment and places you at increased risk for a poor outcome. **The Asthma Center** allergists recommend that you be evaluated every 3 - 4 months if you are taking daily medications for asthma control. If you have recurrent acute symptoms, or sudden worsening of symptoms, contact your allergist frequently and have an in-office review following each major episode of asthma or whenever your asthmatic symptoms are not resolving with phone consultation.

In general, the cost of office visits represents a small fraction of the overall cost of asthma treatment, while the benefit of controlling asthma optimally has an immeasurable intrinsic value. Optimum control of asthma ultimately saves you money because of decreased emergency room visits, hospitalizations and unnecessary costs of managing flares of asthma on an outpatient basis and less loss of time from work or school. Of course, optimum care for you cannot be evaluated primarily as a matter of dollars and cents with so much of your future well-being hanging in the balance.

Having a prescription refilled without a timely physician review of your asthmatic condition as outlined above puts your treatment on "auto-pilot" and does not represent a competent way to manage a potentially dangerous and disabling chronic disease.

A skilled primary care physician who is knowledgeable about asthma can perform a quality office visit for asthma management if he/she spends the time reviewing all aspects of your asthma as outlined above and then bases recommendations on careful analysis of your symptoms, examination and pulmonary function results. The physician also needs to participate in your ongoing asthma education.

The Asthma Center allergists find that many primary care physicians simply do not have the time or "set up" to carry out this comprehensive evaluation and asthma education.

Finally, your busy life may lead you to overlook your medical needs, particularly when you feel well. It takes a certain amount of discipline to ensure that a chronic medical condition such as asthma receives optimum treatment to achieve excellent outcomes in quality of life while preventing long term permanent lung damage and/or unnecessary side effects from medication. It is important not to just focus on the issues related to optimum treatment only after you suffer an adverse event or asthma exacerbation.

3 Environmental Avoidance of Allergens and Irritants

If you suffer from asthmatic symptoms following exposure to a specific factor or substance, removal of the allergen or irritant from your environment is the ideal preventive treatment. The allergist, more than any other physician, is skilled in identifying specific allergic triggers. These triggers include: animal dander (dog, cat and other animals), house dust and house dust mites, molds, pollens, foods, medications and other home or workplace allergens.

Avoidance of allergic triggers, however, is only of benefit if a specific allergen(s) can be identified as a causative agent. For instance, removing a pet from your home will be of value only if it has been established through allergy testing that you are definitely allergic to the pet's animal dander. In addition, you may be sensitive to environmental irritants including cigarette smoke, air pollutants, cold air, humidity, infections, stress and exercise. Once a specific factor (allergic or non-allergic) is identified as a causative agent, your allergist can make recommendations to help you avoid the aggravating factor or, if this is not possible, at least minimize your exposure to a known trigger.

Environmental Triggers of Asthma

Knowing your asthma triggers and avoiding them is key to optimal asthma management.

- Animal dander
- Dust mites
- Molds
- Tobacco smoke
- Irritants (e.g. air pollution, perfume, smog, paint fumes, aerosol sprays)
- Exercise in cold air
- Infections ("colds," influenza, etc.)
- Pollens
- Air pollution in the work environment

Specific Measures

Animal Dander

There are no "safe" furry pets if you have strong animal dander allergy.

Animal dander is a well known trigger of extrinsic (allergic) asthma. Furry pets are much- loved members of many households. Over one half of the homes in the United States have a cat and/or a dog, accounting for over 100 million pets. Unfortunately, about five to ten percent of Americans are allergic to pets. Family members and others who enter your home may suffer from animal dander allergy. Symptoms may include itchy, teary, swollen, red eyes and eyelids and/or a runny, itchy, congested nose. You might develop symptoms of coughing, wheezing and/or shortness of breath.

Occasionally you may develop hives at the site of contact with your pet or your pet's saliva. If you are allergic to your own pets, you may have no immediate worsening of symptoms in your home. Instead you may suffer from constant low-grade symptoms that only clear up after days or weeks away from your house. The more sensitive you are, the more difficult controlling your symptoms may be, even with medication. Complications of pet dander allergy can include chronic sinus headaches and infections, nasal polyps, asthma and even hives. Most people think pet fur or hair is the problem. Pet allergy symptoms actually result from exposure to animal proteins found in the pet's skin, saliva and urine. While the fur may be coated with proteins deposited from dried saliva, it is the dander that is the major source of pet allergen. Dander is the layer of dead skin, rich in animal protein, that is continuously shed. Sebaceous (oil producing) glands in the skin also produce these protein allergens. Male cats have, on average, greater amounts of sebaceous secretions and therefore are more allergenic than female or neutered male cats. This is a result of testosterone hormone effects on sebaceous glands. Pet dander can cause allergy symptoms through direct contact or by transfer of the dander to the eye, nose, or skin. However, most symptoms are caused by airborne dander that comes into contact with the mucous membranes of the eyes and nose. Animal dander also can be inhaled into the bronchial tubes. Allergenic proteins are found in homes for up to 6 months or more after a pet has been removed. Low levels of animal dander have even been found in homes without pets. These low levels may be caused by a pet owned by a previous occupant or by someone who inadvertently transports animal dander into the home on his/her clothes and hair. Common heating or air conditioning systems in apartment buildings also may spread pet allergens if some of the residents have pets. These low levels of pet dander exposure can cause chronic symptoms for you. You also can have symptoms in school classrooms, office settings and other places where pets are not directly present. Unfortunately, there are no "non-allergenic" or "hypoallergenic" breeds of cats or dogs. It is a myth that short haired animals are not allergenic. Dark haired cats, however, tend to produce more symptoms than light haired cats. Although certain breeds may be more or less allergenic, there are no "safe" furry pets if you are allergic to animal dander.

Did you know that people are twice as likely to be allergic to cats as they are to dogs? There are severalpossible explanations for this:

1. Cats often lick themselves as part of a constant grooming process, depositing additional saliva-based allergen on their pelts.
2. The allergenic protein from cats may be more "sticky" than other animal dander. This explains why it is found for longer periods of time on carpets, floors, walls, ceilings, bedding and furniture.
3. Cat dander protein simply may be more allergenic than other animal proteins.
4. Cats often live in extremely close contact with their owners.

It is possible to be so allergic to cat dander that as soon as you enter a home with cats, you immediately experience severe symptoms. This explosive response can occur, less commonly, with dog dander exposure.

Animals other than dogs and cats can cause allergy symptoms. Guinea pigs, rabbits and gerbils have strong allergens in their dander and urine. Laboratory workers, zoo personnel, and veterinarians may encounter severe difficulty with allergy to other animals including horses, rodents and less commonly the large cats (lions and tigers) and primates such as monkeys. Bird feathers and droppings can also cause allergy symptoms. People with mold allergy can have symptoms due to bird droppings and accumulation of mold in the cage (dust can also be a problem). Fish tanks can cause symptoms because of mold growth.

The best way to control pet dander allergy is to remove the pet from your home environment. However, removing your family pet can be difficult and emotionally painful. When it is impossible to remove your pet,

The Asthma Center allergists recommend several measures that may reduce your exposure to animal dander and allow you to live with your pet:

1. **Eliminate Animal Allergen Hideouts**

Aside from the pet, carpets, bedding, upholstered furniture and air ducts are the biggest reservoirs in the home for cat and dog allergen. The more carpeted surface you have, the more allergen there will be in the air. Animal dander may also survive in mattresses for years; therefore, buying new bedding and encasing pillows, mattresses and box springs are advised. Upholstered furniture is also a problem, and all attempts should be made to keep pets off of stuffed furniture. Walls and ceilings can also be coated with allergen and should be washed periodically or wiped with a synthetic electrostatic cloth like the Swiffer™ or Grab-It™ products. Avoid purchasing used items from homes with pets since these items may be a rich source of animal dander. Be aware that any significant source of animal allergen can be a problem if it is near the intake of a forced air heating system or within the system itself. Periodic duct cleaning therefore may be helpful. Avoid putting litter boxes near the air intake vents. Wash pet blankets frequently but not with other clothing or bedding material.

2. **Remove Allergen From Your House**

Frequent vacuuming will help. HEPA filter-containing vacuum cleaners, such as the Nilfisk and Miele (canister types) or Fantom, Kenmore, and Hoover (upright type) machines, are superior to conventional non-HEPA filter vacuums. Conventional vacuum cleaners allow microscopic dust mite antigens to escape back into the room being cleaned. Vacuum carpets and upholstery 2 times per week. If you are sensitive, wear a dust mask while vacuuming. Bedrooms, in particular, should be aired out after vacuuming except during significant pollen seasons. Placing a HEPA filter air cleaner or Molekule air purifier using Photo Electrochemical Oxidation (PECO) as an air purification method in your home is an important way to control animal dander and pollen exposure. Since animal dander is carried on clothing, ask visitors who own pets not to wear clothing that has been in contact with their pets.

3**. Remove Allergen From Your Pet**

There are several scientific studies that show that washing your pet weekly will reduce the allergen load that it carries. In one study, airborne allergen was reduced by 85%. This is a difficult task, though it may be easier if you start washing the pet as a puppy or a kitten. Products like Allerpet™ (available at local pet stores) claim to decrease allergen if used regularly and may be easier to do than bathing your pet. It is not yet clear how effective these products are. Of course, washing your pet is best left to a family member who is not sensitive to animals. In general, if you are pet allergic, you should not groom the pet or clean the litter.

4. **Keep the Pet Out of Your Bedroom**

This can be best accomplished by keeping the door to your bedroom closed at all times. Wireless fence systems can be installed indoors to keep the animal out of certain areas of the house, including the bedroom. It is best to restrict pets to non-carpeted/non-bedroom areas of the home.

5. **Medical Treatment and/or Allergy Injections**

Despite these measures, symptoms often persist. If this is the case, both allergy medications and/or allergy injection treatments may help. Newer anti-allergy medications have fewer side effects and work very well. They include non-sedating anti histamines and nasal sprays (containing cromolyn, corticosteroids, or antihistamines). For symptoms involving the eyes, drops containing similar medications are also very helpful. For allergic asthma, you can use inhalers containing cromolyn, bronchodilators, or inhaled corticosteroids. Asthma medications called leukotriene modifiers (Singulair®, Accolate®, and Zyflo®) can also help.

Another form of treatment involves allergy shots, also known as allergen immunotherapy. A series of injections containing allergy-causing protein (cat and/or dog) is given regularly. This form of treatment is highly recommended if a pet is in your home and causing frequent symptoms. Allergy shots are given as long as you are still exposed to the animal(s). Scientific studies have shown this to be a very effective form of therapy in treating cat and dog dander allergy. Results may be permanent (*see Immunotherapy, page 64*).

Dust Mites

House dust can contain dust mites, fabric fiber, skin scales, animal dander, bacteria, insect parts, mold spores, food particles, and other synthetic and organic material.

Dust mite is one of the most common and important allergens known to trigger asthma in allergic asthma. House dust contains a variety of materials including dust mites, fabric fiber, human skin scales, animal dander, bacteria, insect parts, mold spores, food particles and other synthetic and organic material. Of all the components of house dust, the house dust mite is the most important since it causes the most problems for allergy sufferers. These creatures are not true insects but are arachnids closely related to spiders, chiggers and ticks. Dust mites cannot be seen without the aid of a microscope. They feed off of skin scales and dander shed by humans and indoor animals. Studies in the United States have shown that 30 - 40% of all asthmatics and the majority of individuals with hayfever are allergic to dust mite. Atopic dermatitis is also commonly triggered by mite sensitivity.

Because human skin scales are the major food source for dust mites, they tend to live in bedding, carpeting, curtains, upholstered furniture, heating and air-conditioning ducts, clothing, closets and car seats. They thrive when the temperature is warm (70 - 90°F) and when the relative humidity is 75 - 80%. Dust mites cannot survive when the relative humidity falls below 40% or at very high altitudes (greater than 9,000 feet elevation) or when it is too cold. They can, however, survive vacuum cleaning because they are able to burrow deep into carpets. Mites do not bite or transmit disease. The only human illnesses dust mites cause are allergy, asthma and perhaps atopic dermatitis.

Approximately 100 to 400 dust mites have been counted in one gram of house dust (approximate weight of a paperclip), and populations in the millions can be found in mattresses, pillows and boxsprings. Mite populations peak in home environments in July and August and remain high through December. Mites and mite particles can be found anywhere dust accumulates although they are not common components of surface dust. Mite allergens are carried on relatively large particles that remain in the air only a few minutes after being disturbed. Therefore, the vast majority of dust mites are not in the air. Allergies to dust mites are caused by the proteins in mite body parts and mite feces. These fecal pellets are as tiny as some pollen grains and can float easily into the air and get carried into the nose and lungs. Mites become airborne when dust is stirred

up by vacuum cleaning, during pillow beating and with curtain shaking. Forced-air heating systems can also exacerbate dust mite allergy by sending these allergens into the air. If you are sensitive to dust mites and come in contact with them, hayfever, asthma and/or eczema can result.

Since dust mites cannot be seen by the naked eye, usually you are unaware of the connection between dust mite allergy and your symptoms. Mite allergy can be diagnosed best by allergy skin testing. This is the easiest, most sensitive and least expensive way of making the diagnosis. Avoidance, medications, and allergy immunotherapy are the main treatment modalities for dust mite allergy.

Since dust mites cannot be seen by the naked eye, usually you are unaware of the connection between dust mite allergy and your symptoms.

The following measures can help reduce dust mite levels in the home environment and have been shown in clinical studies to successfully reduce dust mite populations and improve symptoms:

1. Reduce dust content of the home, especially in the bedroom.

2. Eliminate carpets and upholstered furniture where possible since they are breeding grounds for mites. This is particularly important where carpeting is laid over concrete like in basement areas. If carpeting is essential, low pile synthetic carpets and washable scatter rugs are preferred. Optimal flooring is a smooth non-porous surface such as a polished hard wood, seamless linoleum or vinyl flooring. HEPA filter-containing vacuum cleaners, such as the Nilfisk and Miele (canister types) or Fantom (upright type) machines, are superior to conventional vacuums. Conventional vacuum cleaners allow microscopic dust mite antigens to escape back into the room being cleaned. Vacuum carpets and upholstery 2 times per week. If you are sensitive, wear a dust mask while vacuuming. Bedrooms, in particular, should be aired out after vacuuming except during significant pollen seasons. Since tight energy efficient homes have less fresh air, such homes tend to have higher indoor humidity and elevated mite levels. Increased ventilation from the outside may have a positive effect on reducing indoor mite levels.

3. Keep humidity at 45% or lower to retard mite growth (using a hygrometer may be helpful to measure indoor humidity). Run a dehumidifier or air conditioner when humidity is high, particularly from spring through fall. Be careful when using bedroom humidifiers and cool mist vaporizers since excessive moisture will increase mite and mold levels in the bedroom.

4. Replace used bedding material – mattress, boxspring, pillow, blankets. This is one of the most highly effective measures in reducing dust mite allergen exposure. In addition, new or used bedding material should be enclosed separately in hypoallergenic plastic or dust-mite proof impenetrable encasings to reduce mite populations and limit exposure during sleep. Place tape over the zipper of these encasings and cover the mattress encasings with a washable mattress pad. These products vary in quality, and you should choose covers based on both comfort and durability. These covers should be wiped at least once a week. Waterbeds are not a "hypoallergenic" alternative to box springs or mattresses since mite levels are just as high on waterbeds as on regular bedding material. Electric blankets may be helpful in killing off dust mites. However, the small but real risk of starting a fire may outweigh the benefits.

5. Stuffed animals should be minimized in the bedroom environment, and washable products are preferable. GUND® brand stuffed animals are washable. Minimize other fabrics in the bedroom like upholstered furniture and fabric curtains.

6. Avoid feather pillows, down comforters and woolen blankets since they may harbor dust mites. Washable blankets and quilts of synthetic materials are preferable. Use dacron or other synthetic polyester pillows and replace yearly. Regularly wash pillows in very hot water.

7. Washing all bedding linens and blankets in hot (greater than130°F) water every 7 - 10 days will kill dust mites. Hot drying is not as lethal as hot water washing, and cold water washing allows 10% of mites to survive. Dry cleaning blankets can also reduce mite contact. Personal clothing may also be an important source of dust mite exposure. Regular washing, preferably in hot water or dry cleaning, may remove and/or kill dust mites in clothing**.** In addition, clothing should be stored under dry conditions or be laundered/dry cleaned after prolonged storage.
8. Shower and shampoo before bedtime to wash off shedded skin and dandruff that could otherwise serve as a food source for mites in bedding material.

Acaricides

Several commercially available preparations kill or break down dust mites. The general term for these products is acaricides. Keep in mind, however, that dead dust mite parts can stay in carpeting and bedding materials for several months and can continue to cause allergy symptoms long after the mites have died. Therefore, acaricides should be used as adjuvants to the other environmental control measures discussed above.

1. Paragerm is a nontoxic acaricide that has been used extensively in Europe, acts promptly and is easy to use. A two minute spray is usually effective and lasts for about 2 months. Unfortunately it has an offensive odor.
2. Tannic acid breaks down protein, and a 4 hour treatment of carpet with tannic acid significantly reduces dust mite allergen levels. Tannic acid, however, does not kill dust mites. The ability of tannic acid to denature proteins also makes it effective in reducing animal allergen levels, particularly cat allergens. High levels of cat allergen, however, will block the effective use of tannic acid on dust mite protein. Tannic acid is not recommended for white carpets since discoloration may occur. Because it does not kill dust mites, the application must be repeated every 6 - 8 weeks.
3. Sunlight-Studies from Australia have shown that a 3 hour exposure of mite infested carpet to sunlight results in complete killing of all dust mites. This technique, however, has limited application in the U.S. except in selected warm areas.
4. Benzyl benzoate powder (Acarosan®) is a repellent acaricide that is commercially available as a moist powder. It has a long safety record in humans since it is also used as a preservative for foods. The powder should be applied at night, brushed into the carpet, left overnight for 12 hours and brushed into the carpet again before vacuuming. Its effect may last from 6 weeks to 3 months. This is not effective on wood floors. Unfortunately it is not always as potent after storage, and it is recommended that an opened bag be used immediately and then discarded. Pets and infants should be kept off the treated carpet until it has been vacuumed. Contamination of food and water should be avoided.

All commercially available acaricides are somewhat expensive and treatment must be repeated several times per year. In addition, these products may be unpleasant to use because of odor or discoloration of carpets. They do, however, offer an effective adjuvant to dust mite allergy control if you refuse to part with carpeting.

Medications may also be prescribed to help your symptoms. If these measures are unsuccessful, allergy injections may be recommended since they are very effective for dust mite allergy.

For more information on HEPA-containing vacuum cleaners, humidistats, hygrometers, dust masks, encasings and acaricides, the following mail order companies are recommended:

Allergy Asthma Technology, LLC: 1-800-621-5545, *www.allergyasthmatech.com*

National Allergy Supply, Inc: 1-800-522-1448, *www.natlallergy.com*

Allergy Control Products: 1-800-255-3749, *www.allergycontrol.com*

3M / Racal Health and Safety, Inc. (dustmasks): 1-888-364-3577, *www.3m.com*

Molekule Air Purifier: 1-855-999-9069, *www.molekule.com*

Molds

1. Prevent indoor moisture accumulation.
2. Use a dehumidifier to keep humidity below 45%.
3. Dry and ventilate your basement.
4. Fix leaks in roofs, faucets, pipes, etc.
5. Use bleach to clean mold covered surfaces.

Tobacco Smoke *(see Cigarette Smoking, page 98)*

1. Do not smoke under any circumstances.
2. Do not permit anyone to smoke in your home or around you at work.
3. Specifically request that family members, co-workers and guests smoke outside of the house or office.
4. Do not allow anyone to smoke in your car.
5. Do not allow anyone to smoke around your children.

Non-Specific Air Pollutants

1. Avoid exposure to fireplaces, wood burning stoves and kerosene heaters.
2. Stay away from strong odors, sprays, perfumes, powders, fresh paint, potpourri, and anything else that irritates your asthma

4 Pharmacological Treatment (Medications)

Even if you are the most conscientious person who strictly avoids all known triggers (both allergic and non-allergic), you can still experience a flare of asthma. When symptoms of coughing, wheezing and shortness of breath occur, treatment with medications is the most effective method to bring asthmatic symptoms under control. If you experience mild, intermittent and/or occasional asthmatic symptoms, you may need medications infrequently. If you are severely affected, you may need medications on a daily basis to remain functional. Some people avoid asthma medications for fear of potential side effects. However, untreated asthma often becomes chronic, can be disabling and may evolve into a severe acute episode requiring hospitalization. On rare occasions, poorly managed asthma results in death. Such extreme consequences are avoidable in the vast majority of cases. The following discussion of asthma medications clearly indicates that the benefits of asthma control far outweigh the potential risks of side effects of medications. Currently there are a variety of medications available for the treatment of asthma. The most common of these medications are discussed in this section. To help you become more familiar with treatment alternatives, each section provides the following information:

- Description of the medication (how the medication works and examples)
- Use of the medication (when and how the medication is to be used)
- Risks and Precautions associated with the medication (what precautions are necessary when taking this medication and what are the potential risks and/or side effects)

All of the medications covered in the following sections must be prescribed by a physician. Learning about these medications will enable you to intelligently and prudently participate in your own care while under medical supervision.

Medical treatment described in this manual is only recommended as an educational aid and is not intended as a substitute for receiving care from a physician. Speak to your physician before making any changes in your treatment.

Asthma Medications and Side Effects

While taking medication, you may develop new symptoms, which may or may not be related to one of your medications. In general, reactions to medications fit within one of the following categories.

A. **Pharmacological side effect**: Most medications have more than one effect on the body. Although the main effect of the medication is used for treatment, other minor effects can lead to specific reactions. For example, antihistamines can cause a dry mouth or tiredness. Although the main action of antihistamines is to counteract allergy symptoms by blocking histamine, side effects are direct results of the medications' other pharmacological activity.

Medical treatment described in this manual is only recommended as an educational aid and is not intended as a substitute for receiving care from a physician. Speak to your physician before making any changes in your treatment.

Most pharmacological side effects cause symptoms in only a few percent of individuals. Learn about the common side effects of each of your medications before you begin taking them.

B. **Increased sensitivity**: You could be exquisitely sensitive to certain classes of medication. How you metabolize and handle certain drugs may be genetically determined. A new field, pharmacogenetics, is tailored to looking at genetic susceptibility to certain drug effects. Slow metabolism requires a lower dosage of a drug to avoid ill effects. For example, you can become very agitated when you take decongestants. You may find that even small doses of a decongestant can cause your heart to race or may keep you up at night. If this is the case, your receptor for these medications is highly sensitive, and you are having a heightened response to the normal pharmacological action of these medications. You need to sharply reduce your dose or use another class of medication.

C. **Allergic reaction**: You may develop an immune response (allergic reaction) to medications. For example, you may develop allergy antibodies to penicillin. When this drug is administered, you may develop hives, swelling, or even anaphylaxis. This reaction has nothing to do with the pharmacology (action) of the drug, but rather symptoms result from your unique immunological response to the medication. Usually you need to avoid all medications that are structurally similar. In rare instances, where no alternative is available, you may be desensitized.

D. **Metabolism**: You may have an underlying medical problem or unique metabolism, which contributes to adverse reactions to certain medications. For example, if you have a gastric ulcer, you may have major problems taking an oral corticosteroid since this medication may worsen your underlying ulcer disease. Antihistamines and decongestants may inhibit urination if you have an enlarged prostate. If you have congestive heart failure, you may accumulate toxic levels of theophylline because of a decreased metabolism of this drug. Also, you may develop anemia with aspirin if you have G6PD deficiency. In each of these instances, your underlying medical problem or unique metabolism is related to the drug reaction.

E. **Drug interaction**: You may have a side effect from a medication when two medications are taken at the same time and one of these medications affects the action or metabolism of the other. For example, when the antibiotic erythromycin is started and you are already taking theophylline, the erythromycin will slow down your ability to metabolize and remove theophylline, leading to higher and higher levels of theophylline. If the doctor does not lower your theophylline dose, the theophylline level will eventually rise high enough to cause a toxic reaction even though the original dose was correct.

A Balancing Act

If you have chronic asthma, it is likely that you will need to take medication for a long time. Balancing the potential negative effects of the disease versus the potential side effects of the medication will require repeated evaluation of your condition, understanding of the disease process and in-depth knowledge of the actions and potential side effects of the medication prescribed. **The Asthma Center** allergists understand that it is the physician's task to recommend the least risky medication, which will be effective in controlling and/or preventing asthma symptoms. Because you are unique, it is not possible to accurately know in

advance your precise benefits or exact risk of side effects of a medication. Further, the short and long-term risks of asthma are often underestimated if you are undertreated. Therefore, your allergist needs to weigh the pros and cons regarding medications every time you are evaluated and make thoughtful adjustments in treatment to achieve your optimum treatment.

If you start a new medication and then experience any unexpected symptoms, it would be a good idea to call the prescribing doctor to discuss the possibility of a side effect.

Controller vs Reliever Medication: A Basic Concept in Asthma Treatment

Asthma educators have divided asthma medications into two broad categories based on how they work.

Quick reliever or rescue medications are usually bronchodilators and are used to **quickly relieve bronchospasm**, which is usually a temporary and reversible state of airway obstruction. These medications generally do not treat the underlying inflammatory process of asthma.

Quick reliever or rescue medications include:

Quick reliever or rescue medications provide quick bronchodilation while controller medications are usually slow to work but provide long term control in asthma management.

1. **1. Short Acting Sympathomimetic ß$_2$-agonist Bronchodilators (SABA)**: albuterol (Proventil®, Ventolin®, ProAir®), levalbuterol (Xopenex®), epinephrine (Adrenalin®) and others. These medications are quick acting and usually give immediate relief of asthmatic symptoms due to bronchospasm.
2. **2. Anticholinergic Bronchodilators**: ipratropium bromide (Atrovent®, Combivent®) and other similar acting medications. When inhaled, these medications are quick acting bronchodilators, though are generally less potent than ß$_2$-agonists.

Although quick reliever or rescue medications can give quick and dramatic relief from bronchospasm related asthmatic symptoms, they are also helpful in preventing exercise-induced asthma symptoms when taken prophylactically. Under certain circumstances, high dose IV corticosteroids and oral corticosteroids may also relieve acute asthma symptoms, but may take longer to work than typical rescue inhalers. However, in general, corticosteroids are used as controller medications in asthma management.

Long term controller medications act by providing long acting bronchodilation and/or have anti-inflammatory action to prevent or diminish the inflammatory process and its consequent increase in airway hyper-reactivity. Some of these medications (e.g. corticosteroids) are primarily directed at the underlying inflammatory mechanism of asthma that leads to chronic symptoms and possibly permanent lung damage *(see Remodeling of the Airway, page 11)*.

Controller medications include:

1. **Corticosteroids**: Today, corticosteroid asthma medications are probably the most effective controller treatments available because they are effective in almost all individuals since they block or suppress most aspects of inflammation. These medications are available in the following forms:
    a. *Inhaled corticosteroids:* budesonide (Pulmicort Turbuhaler®, Symbicort®, triamcinolone (Azmacort®), beclomethasone (QVAR®), flunisolide (Aerospan®), fluticasone (Flovent®, Arnuity® Ellipta®, Advair Diskus®, Breo®), mometasone (Asmanex®, Dulera®), ciclesonide (Alvesco®), and others. These medications are available alone (monotherapy) or in combination with a long acting bronchodilator.
    b. *Oral corticosteroids*: prednisone (Deltasone®), methylprednisolone (Medrol®) and prednisolone. Oral corticosteroids have the same effect as inhaled corticosteroids but also have a higher incidence of side effects.
2. **Mast cell stabilizers**:
    a. *Cromolyn sodium* is strictly a preventive treatment medication and needs to be inhaled two to four times daily. Cromolyn sodium is remarkable in that it is rarely associated with any side effects. This is a great medication when it is effective. However, it may be effective in fewer individuals than corticosteroids.
3. **Leukotriene modifiers**: Leukotriene modifiers, such as zafirlukast (Accolate®), montelukast (Singulair®), and zileuton (Zyflo®) affect only one portion of the inflammatory process (i.e. the leukotriene pathway) and appear to be an effective controller medication for some, not all, individuals. Unlike corticosteroids, the ability of leukotriene modifiers to prevent remodeling and permanent lung damage is still under investigation but does not appear, at this point, to be as effective as corticosteroids.
4. **Long Acting Sympathomimetic ß$_2$-agonist Bronchodilators (LABA)**: These medications are used together with anti-inflammatory medications for better control of chronic asthma. In particular, individuals with nocturnal asthma (nighttime asthma) and some forms of exercise-induced asthma often benefit from this treatment. Examples of long acting ß$_2$-agonists are salmeterol (Serevent®), formoterol (Foradil®), and vilanterol (in Breo Ellipta®). These drugs are never used alone for asthma and are, instead, always combined with inhaled steroids.
5. **Anticholinergic Bronchodilators (LAMA)**: Tiotropium (Spiriva®) is a long acting asthma-approved bronchodilator (24 hours), although it is generally less potent than ß$_2$-agonists. It works well for those with COPD or asthma and COPD. Other long acting muscarinic antagonists that are available and approved for COPD but not asthma include glycopyrronium (Seebri®), umeclidinium (Incruse®), and aclidinium (Tudorza®).
6. **Methylxanthines**: Methylxanthines are theophyllines often used in conjunction with anti-inflammatory medications (e.g. corticosteroids) to provide continuous relief from asthmatic symptoms. These medications are rarely used due to safer and more effective inhaled agents.

Combination asthma medication treatments containing both bronchodilator (LABA) and anti-inflammatory medications (inhaled steroids) currently are available (Advair®, Symbicort®, Dulera®, Breo®, Air Duo®). These medications contain an inhaled corticosteroid (e.g. budesonide, fluticasone, mometasone) and a long acting reliever medication (e.g. salmeterol, formoterol, vilanterol).

Controller medications are used on a daily basis for long term control of chronic asthma even when you have no symptoms. These medications are not particularly effective in the treatment of acute symptoms with the exception of oral or intravenous corticosteroids. Although oral corticosteroids are not quick acting, they are the most powerful treatments and over time can relieve the inflammatory component of a severe, acute asthmatic attack when nothing else will work.

Methylxanthines (Theophyllines)

Description:

Methylxanthines (theophyllines) are medications with some pharmacological effects similar to caffeine (as found in coffee or tea). Preparations of this type of medication relax and open constricted bronchi. Because they help you "open up" and breathe easier, these medications are considered bronchodilators.

Use:

Theophylline preparations can be taken by mouth as a pill, capsule, or liquid or can be sprinkled onto food. Because of the side effect profile (see below), these drugs are rarely used for asthma or COPD. Your physician must determine the correct dosage of theophylline for you. This correct dosage is based primarily on your weight, age and ultimately on your theophylline blood level. Other factors may affect theophylline levels including: additional medical problems (such as congestive heart failure and liver disease), concurrent medications - specifically quinolone (e.g. Cipro®) and erythromycin or macrolide-like antibiotics (e.g. erythromycin, Biaxin®), cimetidine (Tagamet®), certain seizure medications, high fevers, certain viral infections and cigarette smoking. The administration of theophylline is undertaken with great care since theophylline can produce many side effects.

Risks and Precautions:

Theophylline best controls asthmatic symptoms when a steady blood level of theophylline is maintained. Time-release preparations have been developed which release medication steadily into the bloodstream over 6, 8, 12 or more hours. These longer acting preparations allow you to take a pill or capsule 1 or 2 times a day and maintain the proper amount of theophylline in the body over a 24 hour period. Longer acting theophyllines have been particularly effective in controlling nighttime asthma.

Although physicians can estimate the proper theophylline dosage, there are many factors that influence the way the body metabolizes (breaks down and eliminates) this medication. Currently, theophylline blood levels are the only method of determining whether the "right or effective level" has been achieved. The "right or effective level" of theophylline should be within the therapeutic range (10 to 20 micrograms (μg) per mL of plasma). Theophylline blood levels should be checked periodically when you are on daily theophylline medications.

Other medications (e.g. erythromycin, Biaxin®, Cipro® and Tagamet®) can change the way your body metabolizes theophylline. Some drug interactions can lead to elevated or "toxic levels" of theophylline (greater than 20 μg/mL). Elevated theophylline levels can cause extreme headaches, stomach aches, diarrhea, seizures, heart rhythm irregularities, irritability and tremors.

At times, you may have a high serum level of theophylline and no adverse symptoms. However, it is possible that you can experience the following adverse effects even at "normal" serum levels:

- Gastrointestinal symptoms: stomach ache, nausea, vomiting, diarrhea
- Nervous system symptoms: headache, irritability, difficulties concentrating at work or in school, insomnia, tremors, convulsions

- Cardiac symptoms: fast heart rate, palpitations, irregular heart rate

Sympathomimetic Stimulant Medications

Sympathomimetic medications include epinephrine-like medications (Adrenalin®, $ß_2$-agonists), which stimulate biochemical changes (i.e. increased cellular cyclic-AMP) in the airway, which leads to bronchodilation and quick relief of asthmatic symptoms.

SYNTHETIC EPINEPHRINE MEDICATIONS

Introduction:

Epinephrine is a hormone produced by the adrenal glands (located above the kidneys within the abdomen). The adrenal glands naturally release a very small amount of this substance that may bind to specialized $ß_2$ receptors in the lungs. These receptors, in turn, are responsible for bronchodilation (relaxing of bronchial tube constriction). In addition to its function as a powerful bronchodilator, epinephrine also can stimulate the heart to beat faster and elevate the blood pressure through binding to $ß_1$ receptors located in heart tissue and alpha receptors in blood vessels. If you are asthmatic, you may have a deficiency (defect) in the biochemistry of your $ß_2$ receptors (sites on cells which need to be stimulated to cause bronchodilation). Therefore, the amount of natural epinephrine that you produce may be insufficient to promote adequate stimulation and bronchodilation. Sympathomimetic medications (i.e. inhaled or injected epinephrine-like medications) can provide quick relief and allow you to overcome your defective or insensitive receptor mechanism. These medications result in bronchodilation and relieve symptoms. Quick acting sympathomimetics are "reliever" medications. Sympathomimetic medications include Adrenalin® and the more specific $ß_2$ stimulants (agonists) discussed below.

Description:

Synthetic versions of epinephrine are considered among the most valuable medications for emergency treatment of severe, life-threatening asthmatic attacks. They may be injected or inhaled and work quickly, often reversing bronchospasm within minutes. Epinephrine medications have many uses including the following: 1) treatment of severe allergic reactions (including anaphylactic shock); 2) prolongation of the effects of local anesthetics like those used for dental procedures; and 3) stimulation of the heart. Examples of epinephrine medications include:

- Most over-the-counter "asthma inhalers" (Primatene mist®)
- Epinephrine injections administered in emergency rooms, hospitals and doctors' offices for acute asthmatic attacks
- Self administered epinephrine injections (EpiPen®, Auvi-Q®, SYMJEPI®) for treatment of acute outpatient allergic reactions such as anaphylactic reactions due to bee stings, food allergens, drug reactions, etc.

Use:

Since these medications work so quickly, they are commonly used as injections as described above. While epinephrine medications are available in inhaler form in non-prescription preparations (Primatene mist®), **The Asthma Center** allergists do not recommend these inhalers *(see precautions noted below).*

Frequent use of over-the-counter epinephrine inhalers or prescribed epinephrine-like inhalers (e.g. albuterol, ProAir® Ventolin®, Proventil®) or need for frequent epinephrine injections are usually clear signs of poor asthma control.

Risks and Precautions:

Although epinephrine is a good bronchodilator with rapid onset of action, significant side effects may occur. Epinephrine medications may cause tremor, palpitations, irritability, restlessness and possibly nausea. These preparations should be used with caution in the elderly. You should also be cautious if you have hyperthyroidism, heart disease and/or high blood pressure. These medications absolutely *should be avoided* if you are receiving monoamine oxidase inhibitors (MAOs) in psychiatric treatment.

The Asthma Center allergists do not recommend over-the-counter epinephrine inhalers because they are short acting and are more likely to cause heart stimulation. Overuse of those medications is very dangerous.

Epinephrine Auto Injections (Self Administration)

Epinephrine medications are dispensed if you are at particularly high risk for a severe asthmatic attack that might not respond to inhaler or nebulizer treatment. In this form of administration, the medication is injected intramuscularly and will definitely get into you no matter how badly your lungs are obstructed. Injected epinephrine in any form can be a lifesaver since it can buy you enough time to be safely transported to the emergency room.

EpiPen®, Auvi-Q®, and generic epinephrine are auto-injector devices preloaded with epinephrine and can be used as emergency medications during a severe acute episode of asthma that is not responding to treatment with an inhaler or nebulizer. Epinephrine can be administered in a preloaded, premeasured dose syringe in which you manually inject epinephrine. Epinephrine also can be drawn up from a medication vial, and you can inject a specified dose. Any of these methods will be equally effective. The choice of which product will be recommended depends on your needs. Side effects of epinephrine injections usually last less than an hour or two and are similar in nature, but more intense, than those described below with the use of inhaled β_2-agonists (sympathomimetics). Recent studies showed that outdated EpiPen® devices can still be used as long as no discoloration or precipitates are apparent.

Frequent use of over-the-counter epinephrine inhalers or prescribed epinephrine-like inhalers (e.g.albuterol, Ventolin®, Proventil®) or need for frequent epinephrine injections are usually a clear sign of poor asthma control.

ß$_2$-AGONISTS (BETA-2 RECEPTOR STIMULATORS)

Description:

B_2-agonists are very similar to epinephrine medications. By selectively stimulating B_2 receptors, these preparations dilate or relax spastic or constricted airways. The major advantage of these medications over synthetic epinephrine is that they primarily stimulate the bronchial tubes (via B_2 receptors). These medications also cause much less stimulation to the heart (via B_1 receptors) and to the blood vessels, which can result in rapid heartbeat and/or elevated blood pressure (stimulation of alpha receptors).

ß$_2$-agonists (beta-2 stimulators) include:

- **metaproterenol**
- **albuterol** (AccuNeb®, Proventil®,Ventolin®, ProAir®, Xopenex®)
- **indacaterol** (Arcapta Neohaler®), **olodaterol** (Striverdi Respimat®), **vilanterol** (Breo Ellipta®, Anoro Ellipta®)
- **salmeterol** (Serevent®) and **formoterol** (Foradil®) are long acting; Formoterol (Foradil®) has the fastest onset of action

The above two groups are selective bronchodilators and have less effect on the heart. Tremors may still occur with these medications, but they may subside with time. These preparations are available in liquid and tablet forms, metered-dose inhalers (Proventil®, Ventolin®, Serevent®, Foradil®, Aerolizer®), inhaled powders (Serevent Diskus®), nebulizer solutions (AccuNeb®, Proventil®, Ventolin®, Xopenex®), or combined with other medications like inhaled steroids or long acting anticholinergic agents. Tables 9, 10 and 11 below show the different types of these medications.

TABLE 9

Short Acting ß$_2$-Agonists (Sympathomimetics)

Brand Name	Concentration	Active Ingredient	Dose
ALBUTEROL MDI (Proventil® HFA, Ventolin®, ProAir® HFA, ProAir Respiclick®)	90mcg/puff	albuterol sulfate	Up to: 2 puffs 4 x/day
syrup	2mg/5mL	albuterol sulfate	1 tsp 2 – 4 x/day
tablets	2mg, 4mg	albuterol sulfate	1 tab 2 – 4x/day
nebulized solutions* (AccuNeb®, Proventil®, Ventolin®)	0.63mg/3mL** 1.25mg/3mL** 2.5mg/3mL**	albuterol sulfate	3 – 4 x/day
XOPENEX® nebulized solutions*	0.31mg/3mL** 0.63mg/3mL** 1.25mg/3mL**	levalbuterol	3 – 4 x/day

**See page 39 more for information about nebulized solutions.*
***Concentration depends on age and size of individual.*
Note: MDI = metered-dose inhaler; mcg = microgram; mg = milligram; mL = milliliter

TABLE 10

Long Acting β_2-Agonists (Sympathomimetics)

Brand Name	Concentration	Active Ingredient	Dose
Foradil® Aerolizer®*	12mcg/capsule	formoterol fumarate	1 puff 2 x/day
Serevent® Diskus®*	42mcg/dose	salmeterol xinofoate	1 puff 2 x/day
Arcapta® Neohaler®	75mcg/capsule	indacterol	1 puff 1 x/day
Striverdi® Respimat®	1.25mcg/dose, 2.5mcg/dose	olodaterol hydrochloride	2 puffs 1 x/day
Perforomist®	20mcg/dose	formoterol fumarate	1 puff 2 x/day
Brovana®	15mcg/dose	arformoterol tartrate	1 puff 2 x/day

Note: mcg = microgram
**Dry Powder Inhaler*

TABLE 11

Nebulizers (β_2 and Other Type Solutions)

Brand Name	Concentration	Active Ingredient	Dose
Accuneb®	0.31mg/3mL, 0.63mg/3mL, 1.25mg/3mL	albuterol sulfate	4 x/day
Albuterol	1.25mg/3mL, 2.5mg/3mL	albuterol sulfate	4 x/day
Atrovent® HFA	17mcg	ipratropium bromide	4 x/day
Brovana®	15mcg/2mL	arformoterol tartrate	1 puff 2 x/day
Intal®	20mg/2mL	cromolyn sodium	4 x/day
Perforomist	20mcg/2mL	formoterol fumarate	1 puff 2 x/day
Pulmicort Respules®	0.25mg/2mL, 0.5mg/2mL, 1mg/2mL	budesonide	1-2 x/day
Xopenex®	0.31mg/3mL, 0.63mg/3mL, 1.25mg/3mL	levalbuterol	3-4 x/day
Mucomyst®	10%, 20%	acetylcysteine	3-4 x/day
Hypertonic Saline	3%, 7%	sodium chloride	3-4 x/day

For Adults: 1-2 unit doses (1.25mg/3mL) nebulized solution up to 4x/day
Note: mg = milligram; mL = milliliter

Overuse of these bronchodilator medications (inhaler abuse) is extremely dangerous and a sign of poor asthma management.

Use:

Although some of these medications are available as injections (epinephrine), **The Asthma Center** allergists usually recommend administration of ß$_2$-agonist medications by inhalation (MDI or DPI). Occasionally the liquid or tablet forms of these medications are recommended when an inhaler or nebulizer cannot be used effectively. A spacer device or holding chamber is often used with a metered-dose inhaler for better delivery *(see How to Use Spacers and Nebulizers, page 71).*

Serevent® and Foradil® are available as dry powder inhalers and are never used alone without inhaled steroids for asthma.

Risks and Precautions:

Side effects from these medications include:

- Palpitations (racing or pounding heartbeat)
- Headache
- Nausea
- Irritability
- Tremors

Overuse of these medications (inhaler abuse) is extremely dangerous and a sign of poor asthma management.

The Asthma Center allergists have seen individuals with a history of using a complete ß$_2$-agonist inhaler in a single day. Most ß$_2$-agonist metered-dose inhalers contain 200 inhalations, and in order to empty one in a single day, these individuals must have used their inhalers nearly every few minutes. Extreme overuse may lead to a situation of false confidence due to a limited short term relief while, in fact, there is a gradual worsening of the asthmatic state and risk of heart toxicity from the medication. If you use your ß$_2$-agonist inhaler this way, you may no longer respond to the inhaler and may suddenly develop severe respiratory distress. Such a situation can result in death in spite of emergency treatment. Overuse of ß$_2$-agonist metered-dose inhalers usually means that you have put off appropriate treatment for too long. If you use this type of inhaler more than 5 - 6 times per day or on average more than one inhaler per month, you should discuss your asthma management with your physician. These bronchodilators have little or no anti-inflammatory activity. Therefore, they offer only temporary relief from symptoms and do not correct the underlying problem of inflammation. Use of a ß$_2$-agonist more than 2 times a week indicates the need for an anti-inflammatory controller medication.

Cromolyn Sodium

Description:

Cromolyn sodium is a unique preventive medication for asthma. It is unique in that it prevents the mast cells in the bronchi (airways) from releasing their chemical mediators, which cause asthmatic symptoms and inflammation.

Cromolyn is not a bronchodilator. It will not provide quick relief if you are actively wheezing.

Cromolyn can prevent asthma caused by inhaled allergens. Cromolyn has also been shown to lower the overall irritability of the airways, and thus you may become less sensitive to several stimuli that ordinarily provoke your asthmatic symptoms.

Use:

Cromolyn is best used as a continuous treatment. Cromolyn is truly a preventive medication. This medication often takes weeks or even months to demonstrate its benefits. Cromolyn comes as a solution for nebulization. Nebulization of cromolyn solution through a mask or mouthpiece has been very effective in young children with chronic or frequent episodes of asthma. Cromolyn also has been very effective in controlling the chronic cough of asthma.

Cromolyn is not a bronchodilator. It will not provide quick relief if you are actively wheezing.

Cromolyn can be inhaled 15 - 30 minutes prior to exposure to an environment containing a known allergen. For example, if you are cat-sensitive and visit a friend who has a cat at home, prior use of cromolyn may allow you to tolerate such exposure. Of course, it would always be wiser to avoid exposure to allergic factors that cause wheezing, but cromolyn gives you some control when exposure cannot be avoided.

If you are exposed to allergens in your occupational environment (e.g. lab workers, carpenters, veterinarians), you may receive great benefit from cromolyn. In addition, cromolyn has been found to be effective in blocking exercise-induced asthma when taken prior to participating in sports. In this situation, it may be an alternative or supplement to inhaled $ß_2$ stimulants (e.g. albuterol) or theophylline preparations.

Cromolyn sodium is not always effective. However, when it works, it is one of the best medications since it can completely block inflammation at the highest possible level while also having the lowest incidence of side effects of any asthma medications.

Risks and Precautions:

Unlike many other asthma medications, cromolyn sodium rarely causes side effects.

Occasionally you may complain of coughing, sore throat, itchy rash, flushing, gastrointestinal upset and/or headache.

Leukotriene Modifiers

Description:

Leukotrienes are very powerful chemical mediators synthesized and released by mast cells in the

respiratory tract that result in bronchospasm, tissue edema (swelling) and attraction of inflammatory cells such as eosinophils. Leukotrienes have long been identified as an important cause in asthma. Studies have shown that leukotrienes are formed from fatty acids through a specific series of chemical reactions referred to as the leukotriene pathway or more specifically where leukotriene modifiers are concerned, the 5-lipoxygenase path- way. As more leukotrienes accumulate at the end of this pathway, symptoms of asthma develop. Leukotriene modifiers either interfere with the sequence of chemical reactions in the 5-lipoxygenase pathway, or interfere with the binding of leukotrienes with their corresponding receptors in the airways and thus limit their ability to cause asthmatic symptoms *(see common Leukotriene Modifiers in Table 12).*

TABLE 12

Leukotriene Modifiers

Brand Name	Generic Name	Dose	Other Instructions
Accolate®	zafirlukast	20mg tablet twice a day 10mg tablet twice a day (5-11 years)	use 1 hour before, or 2 hours after meals
Singulair®	montelukast	10mg tablet once a day, (ages 15 years and older) 5mg tablet once a day, (6-14 years) 4mg chewable tablet once a day (2-5 years) 4 mg granules once a day (12-24 months)	not affected by meals
Zyflo CR®	zileuton	2 600mg tablets twice a day	follow liver functions

Use:

Treatment of asthma with leukotriene modifiers can improve lung function, decrease the need for sympathomimetic inhalers (e.g. albuterol) and reduce symptoms. Although these medications are effective, they do not appear to be quite as effective as oral or inhaled corticosteroids in controlling asthma. Further, there is no clear evidence that leukotriene modifiers prevent remodeling of the airways as does treatment with corticosteroids (*see Remodeling of the Airway, page 11).*

Additionally, leukotriene modifiers may be very effective in treating some invidiuals with asthma, while having little or no effect in others. In contrast, corticosteroids are effective in controlling asthmatic symptoms in the vast majority of individuals. That being said, **The Asthma Center** allergists have found the combination of corticosteroids and leukotriene modifiers to be beneficial. Use of both leukotriene modifiers and corticosteroids can result in better control of asthmatic symptoms than with either medication

alone in some individuals, while also allowing reduction of the dose of corticosteroids needed to achieve good clinical control of asthmatic symptoms.

Leukotriene modifiers include the leukotriene-receptor antagonists montelukast (Singulair®, zafirlukast (Accolate®), and zileuton (Zyflo®).

Risks and Precautions:

Side effects are uncommon but include: headache, nausea, stomach upset, pain, fever, muscle ache, fatigue, sore throat, laryngitis and liver enzyme elevation. These medications are usually well tolerated. Churg Strauss syndrome, a form of vascular inflammation, rarely is noted with Singulair® and can include vague symptoms of fever, fatigue, weight loss, vasculitis leading to kidney disease, hypotension, abdominal pain, bowel damage, heart disease, muscle aches and wasting, nervous system damage and arthritis. Liver function abnormalities have been reported with all of these agents and should be periodically monitored.

Corticosteroids

Like epinephrine, cortisol (corticosteroid or glucocorticosteroid) is a natural hormone produced by the adrenal glands. Early each morning, a burst of cortisol is usually released into your bloodstream.

Corticosteroids are one of several types of "steroids." The type of steroid used in the treatment of asthma is called a glucocorticosteroid (corticosteroid). It is important to remember that corticosteroids are different from anabolic steroids that are sometimes abused by athletes to promote the development of muscle mass. Corticosteroid use in the treatment of asthma may raise serious concerns regarding its appropriateness because of the fear of potential side effects associated with "steroids." Potential side effects associated specifically with the use of corticosteroids are discussed in the following Risks and Precautions section as well as in the Steroid Phobia section.

Description:

Corticosteroids are **not** bronchodilators and are generally considered controller medications. **Corticosteroids work by suppressing the inflammatory reaction that causes swelling and narrowing of the bronchi.** The powerful anti-inflammatory properties of corticosteroids make them unique among asthma medications. Oral and inhaled corticosteroids are used when your asthma cannot be controlled adequately with avoidance of asthma-provoking environmental factors and use of bronchodilators and other medications.

Corticosteroids are very effective in controlling asthma. Inhaled corticosteroids are often used in mild-to-moderate or severe asthma, while oral preparations are usually reserved for the more difficult-to-manage asthma symptoms or for acute exacerbations. Before beginning a course of corticosteroids, **The Asthma Center** allergists carefully consider the benefits versus the potential risks of side effects. The most significant side effects tend to occur if you have taken high daily oral doses of this medication over a period of months to years. **The Asthma Center** allergists rarely recommend the use of corticosteroids in a way that can cause long term side effects. The benefits and risks of corticosteroids must be balanced against the risks associated with poorly controlled asthma.

The benefits and risks of corticosteroid use must be balanced against the risks associated with poorly controlled asthma.

Corticosteroids include:

- **beclomethasone** (QVAR®)
- **budesonide** (Pulmicort Turbuhaler® /Respules®)
- **cortisone**
- **dexamethasone** (Decadron®, Dexacort®)
- **flunisolide** (Aerospan®)
- **fluticasone** (Flovent®, Arnuity®, Breo®)
- **methylprednisolone** (Medrol®)
- **mometasone** (Asmanex® Twisthaler)
- **prednisone**
- **prednisolone** (Pediapred®)
- **triamcinolone**
- **ciclesonide** (Alvesco®)

Use:

Corticosteroid preparations can be taken as a pill, liquid, inhaled, or injected.

In general, corticosteroids are used in one of the following ways:

- Inhaled treatment courses (metered dose inhaler [MDI], dry powder inhaler [DPI], Nebulizer)
- Short term oral treatment courses
- Alternate-day oral treatment courses
- Long term oral treatment courses

In the following sections, each of the above methods will be discussed in detail as well as the phenomenon of "steroid-dependence."

Inhaled Corticosteroid Treatment

Inhaled corticosteroids are controller medications with powerful anti-inflammatory effects.

If you have chronic persistent asthma, you may benefit from long term use of inhaled corticosteroids such as Pulmicort Turbuhaler®, Advair®, Arnuity®, QVAR®, Flovent®, Aerospan® and others *(see Table 13)*. The National Heart, Lung, and Blood Institute recommended the long term use of inhaled corticosteroids for asthma because of their potent anti-inflammatory effects and ability to reduce airway hyper-responsiveness. There is also increasing evidence that corticosteroids may be able to prevent or slow down remodeling of the airway that can lead to permanent damage to the bronchi *(see Remodeling of the Airway, page 11)*. This may be particularly true in young children with asthma. Because inhaled corticosteroids are directly applied to the areas of inflammation in the bronchial tubes (topical or surface acting), only small amounts are usually needed to achieve the desired anti-

asthmatic effect. In addition, inhaled corticosteroids are rapidly metabolized into inactive substances and therefore are usually safer than oral corticosteroids. However, if these inhaled corticosteroids are used at doses greater than recommended, you could experience significant side effects. Inhaled corticosteroids work slowly and therefore are not an appropriate form of treatment for acute asthma when there is immediate need to relieve airway obstruction. Many individuals with chronic persistent asthma may be controlled on inhaled corticosteroids without the need to use oral corticosteroids. Inhaled treatment, if used properly, offers the anti-inflammatory benefit of corticosteroids with minimal risks of significant systemic side effects. Use the same inhalation technique with both the corticosteroid and bronchodilator MDIs, namely by slow deep inhalation. In contrast, DPIs (Dry Powder Inhalers) are inhaled quickly. If your inhaler technique is poorly coordinated, your corticosteroid MDI may still be used effectively by means of a spacer device (Vortex®, Aerochamber®) *(see How To Use Spacers and Nebulizers, page 71).* DPIs do not require a spacer. **The Asthma Center** allergists recommend rinsing your throat (gargling with water) after using inhaled corticosteroids to avoid sore throats, yeast infections and hoarseness. One of the most annoying side effects of inhaled corticosteroids is the development of a yeast infection in the back of the throat or on the tonsils, referred to as "thrush"(monilia or candida - a fungal infection). Yeast often looks like a white creamy or cheesy coating on the back of the throat or tonsils. Using a spacer device or just rinsing your throat with water after using corticosteroid inhalers may be effective in preventing this problem. However, once thrush has been diagnosed, treatment with anti-fungal agents is usually effective in controlling this side effect *(see "Steroid Phobia," page 56).*

TABLE 13

Inhaled Corticosteroids

You should rinse your throat (gargle with water) following use of inhaled corticosteroids to avoid sore throats, yeast infections, and hoarseness.

Brand Name	Active Ingredient
Advair Diskus® *	fluticasone/ salmeterol 100mcg/50mcg, 250mcg/50mcg, 500mcg/50mcg
Advair® HFA *	fluticasone/ salmeterol 45mcg/21mcg, 115mcg/21mcg, 230mcg/21mcg
Aerospan™	flunisolide 80mcg
AirDuo™ RespiClick®	fluticasone/ salmeterol 55mcg/14mcg, 113mcg/14mcg, 232mcg/14mcg
Alvesco®	ciclesonide 80mcg, 160mcg
Arnuity® Ellipta®	fluticasone 100mcg, 200mcg
Asmanex® HFA	mometasone 100mcg, 200mcg
Asmanex® Twisthaler	mometasone 110mcg, 220mcg
Breo® Ellipta® *	fluticasone/ vilanterol 100mcg/25mcg, 200mcg/25mcg
Dulera® *	mometasone/ formoterol 100mcg/5mcg, 200mcg/5mcg
Flovent® Inhalation Aerosol	fluticasone 44mcg, 110mcg, 220mcg
Flovent® Diskus	fluticasone 50mcg, 100mcg, 250mcg
Flovent® Rotadisk®	fluticasone 50mcg, 100mcg, 250mcg
Pulmicort Flexhaler®	budesonide 90mcg, 180mcg
Pulmicort Respules® Nebulizer Solution	budesonide 0.25mg/2mL, 0.5mg/2mL
Symbicort® Turbuhaler® *	budesonide/ formoterol 80mcg/4.5mcg, 160mcg/4.5mcg
QVAR®	beclomethasone 40mcg, 80mcg

**Combination medication – includes corticosteroid plus long acting sympathomimetic bronchodilator*

Short Term Oral Corticosteroid Treatment

A short burst of oral corticosteroids is most effective when taken early in an asthmatic attack.

Occasional, short term use of oral corticosteroids may control your acute asthmatic episodes when bronchodilators and other anti-inflammatory agents fail to control symptoms *(see Table 14 for examples of these medications)*. This method is an important technique in resolving acute flares of asthma and preventing more severe episodes. **The Asthma Center** allergists have found that this treatment program decreases the need for emergency room visits or hospitalizations. It may take many hours to notice relief with the use of oral corticosteroids. Therefore, it is essential to start their use early on in an asthmatic attack. You can begin corticosteroid use according to a protocol provided by your treating physician, but you should inform your treating physician that you have started this medication within 24 hours of its use.

You should not use this medication whenever you feel your chest is tight or when you are just mildly short of breath. Indiscriminate use of oral corticosteroids in an unsupervised manner may lead to "steroid-dependence" *(see "Steroid-Dependence," page 54)* as well as increased risk of side effects. Even small doses of oral corticosteroids can produce serious side effects when used on a long term daily basis *(see Risks and Precautions, page 55*).

TABLE 14

Oral Corticosteroids

Brand Name	Active Ingredient	Concentration
Decadron®	dexamethasone	Tablets: 0.75mg – 9mg
Medrol®, Medrol® Dosepak	methylprednisolone	Tablets: 4mg – 48mg
Pediapred®	prednisolone	Oral Solution, dye free: 5mg/5mL
Prednisone	prednisone	Tablets: 1, 2, 2.5, 5, 10, 20, 50mg
Prelone®	prednisolone	Syrup: 5mg/5mL, 15mg/5mL

Note: mg = milligram; mL = milliliter

Steroid Withdrawal

If you require short bursts of oral corticosteroids, you can be taken off of them by quickly tapering (decreasing the dose) or at times even abruptly stopping the medications. You may experience unpleasant side effects upon discontinuing short or long term oral corticosteroid administration. This is known as "steroid withdrawal." These adverse effects may include muscle aches, joint pains, fatigue, poor appetite and even fever. When coming off corticosteroids, you may even be at risk for symptoms that were suppressed while on corticosteroids such as skin problems (eczema, hives), hayfever, sinus symptoms and arthritis- like symptoms. If you are at risk for "steroid withdrawal" symptoms, a slow taper over a long period of time may be necessary in addition to supplemental aspirin-like medication to relieve musculoskeletal discomfort.

Alternate-Day Oral Corticosteroid Treatment

When inhaled corticosteroids and other medications fail to control severe asthmatic symptoms, alternate-day corticosteroid therapy may be considered as a treatment option.

In order to minimize the potential for side effects, many specialists may recommend treating you with a low dose oral corticosteroid with a shorter half-life such as prednisone or methylprednisolone (Medrol®) every other morning. If these short acting corticosteroids are taken as soon as you wake up in the morning, the medication will have a limited suppressive effect on the adrenal glands for only one day. On the following morning, your adrenal glands may resume their normal production of corticosteroids (cortisol). The day of corticosteroid treatment is usually referred to as the "on" day and the day that the corticosteroid is not given is called the "off" day.

Since the adrenal suppressive effect can last 12 - 24 hours, it is very important to take oral corticosteroid medications early in the morning as soon as you awaken. Taking the medication later in the day to catch up because you forgot the morning dose defeats the goals of this maintenance program. Administration of corticosteroids on an every-other-morning treatment plan is called alternate-day therapy. Since the anti-inflammatory or anti-asthma effects of corticosteroids appear to last longer than their suppressive effects on the adrenal glands, this approach gives you the benefits of oral corticosteroid therapy with little or no side effects when used in low doses.

Alternate-day oral corticosteroid treatment is a sophisticated type of therapy, and you must be under close supervision by a knowledgeable physician if involved in such a program.

Long Term Oral Corticosteroid Treatment

If you are unresponsive to commonly used controller and quick reliever or rescue asthma treatments, you may require long term use of daily or alternate-day corticosteroids. This treatment is used for the most difficult to manage asthma and requires frequent evaluation to assess medication effectiveness and side effects. Steroid-sparing treatments can be used often with some degree of success.

In general, it is always best to administer the smallest effective dose of a shorter acting oral corticosteroid (e.g. prednisone or methylprednisolone) to reduce the potential risks of side effects. This is best managed through a program of regular office visits where your current symptoms, physical examination and pulmonary functions all can be analyzed for appropriate decision making. If you require an acute burst of oral corticosteroids, **The Asthma Center** allergists recommend that you be seen in follow-up visits within

48 to 72 hours of corticosteroid treatment. This acute follow-up visit is important in evaluating effectiveness of treatment, assessing potential side effects and planning a dose taper program.

Long acting corticosteroids such as dexamethasone (Decadron®) or any type of depot (slow release) corticosteroid injection should be avoided except under extraordinary circumstances. Once this latter type of corticosteroid is injected, it cannot be removed from the body and will slowly be released over weeks or months. Although an injection of depot corticosteroid may seem convenient, **The Asthma Center** allergists do not consider its use as a wise approach to the management of asthma when more flexible and safer programs are available.

"Steroid-Dependence"

If you are steroid-dependent, you must be given supplemental corticosteroids during asthma attacks or during any major physical stress.

When corticosteroids are taken as a medication, they can suppress the normal secretion of corticosteroids from the adrenal gland. If the corticosteroid medication is given over a very long time, it may cause the adrenal gland to no longer function effectively. It has been observed that when on high dose, long term corticosteroids you may suffer a wasting or atrophy (withering) of the adrenal glands. It may take months to years for this gland to recover completely, long after use of a corticosteroid medication has been discontinued. The daily secretion of corticosteroids from the adrenal glands is essential to remaining healthy, particularly when the body is under physical stress (e.g. severe illness or infection, surgery, acute asthmatic symptoms, or physical trauma). For example, if you become ill and your asthma worsens, the body normally responds to this physical stress by the adrenal glands secreting up to 5 to 10 times the usual amount of natural corticosteroids. In addition, the adrenal gland's response to stress is also required for other important body functions.

Under rare circumstances, when your adrenal glands are malfunctioning from long term corticosteroid use, and no supplemental corticosteroids are administered during an asthmatic attack, there is the possibility that a severe, acute flare of asthma may develop which ultimately may lead to a fatality. In view of this risk, if you are "steroid-dependent," you must be given supplemental corticosteroids during asthmatic attacks or during any other major physical stress (e.g. severe infection, surgery, labor and delivery, or trauma).

The Asthma Center *allergists consider you "Steroid Dependent" if you receive corticosteroids in the following manner:*

- Frequent, short term oral corticosteroid treatment bursts in the past 12 months
- Regular use of high dose inhaled corticosteroids in the past 12 months
- Regular use of injected long acting corticosteroids
- Daily use of oral corticosteroids
- Alternate-day oral corticosteroids
- Prolonged use of oral corticosteroids in the past year

If you are "steroid-dependent," you must be given a booster dose of corticosteroids when you become physically stressed with severe infection, surgery, labor and delivery, acute asthmatic episodes, or following physical trauma. Since you might be brought to a hospital in an unconscious state during an emergency, **The Asthma Center** allergists advise you to carry a card in your wallet/purse or wear a MedicAlert

bracelet, which has the following information:

- Identification that you have asthma and are "steroid-dependent"
- List of all current medications and diagnoses
- How the emergency room and/or hospital personnel can reach your treating physician(s) for further information

Risks and Precautions:

If taking oral corticosteroids, especially large daily doses, for prolonged periods, you should be aware of the potential side effects noted in Table 15. Through careful and regular follow-up visits with your physicians or asthma specialists, many of these side effects may be avoided and/or minimized.

In using oral corticosteroids, **The Asthma Center** allergists always attempt to use the smallest dose or most modest corticosteroid treatment program that will be effective. When the risks of the asthma outweigh the potential side effects of the corticosteroid treatment, your asthma specialists should carefully and thoughtfully consider your well-being (risks versus benefits) in prescribing corticosteroids.

Corticosteroids often disturb the stomach. As with aspirin and theophylline, they are best taken with meals, liquid antacids, and/or anti-ulcer medications (e.g. Zantac®, Nexium®).

TABLE 15

Potential Corticosteroid-Related Side Effects

Weight gain	Water retention
Filling out or rounding of the face	Osteoporosis (weak bones)
High blood pressure	Damage to hip bone (necrosis)
Inhibition of linear growth in children	Muscle weakness
Cataracts	Glaucoma
Gastric ulcer	Thinning of skin
Increased hair growth in women	Acne
Loss of hair	Stretch marks
Increased bruising of skin	Personality changes
Menstrual changes	Depression
Increased blood sugar	Irritability
Increased risk of infections	Euphoria
Fat accumulation on the back	

Corticosteroids and Osteoporosis

Corticosteroids (e.g. prednisone, Medrol®) are known to be among the most effective medications for the treatment of asthma. However, corticosteroid use in high doses and/or over long periods of time is also a known risk factor for osteoporosis. Therefore, when corticosteroids are needed, it is imperative to use the lowest possible dose in order to minimize the risk of potential side effects, particularly the risk of osteoporosis. Osteoporosis, or loss of mineralization of skeletal bone, is a very common disease process that

affects millions of Americans. Osteoporosis is thought to cause more than a million fractures a year, often involving the spine. If you have used oral corticosteroids (e.g. prednisone, Medrol®) over long periods of time, you are at significant risk for the development of osteoporosis since this form of steroid promotes the loss of mineral bone deposits. The higher the dose of corticosteroids and/or the longer the period of use, the greater the risk becomes for you to develop osteoporosis. Fortunately the use of inhaled corticosteroids at recommended doses does not appear to be commonly associated with osteoporosis since only very small amounts of corticosteroids are absorbed in the body. Nevertheless it is prudent to evaluate your status of bone mineralization in order to assess the risk of taking inhaled corticosteroids in any form over long periods of time.

Osteoporosis often develops in middle aged and older individuals. In particular, it will commonly affect postmenopausal women. Under normal circumstances, bones are hard and do not fracture easily. Mineral deposits (e.g. calcium) laid down in bones give rigidity and strength to the skeleton. Osteoporosis or weakening of the skeleton occurs when not enough calcium has been laid down or may be due to increased reabsorption of calcium from the bones. The risk of osteoporosis is increased by the use of some medications (corticosteroids), hormonal change (menopause, Cushing's disease, hyperthyroidism), lack of physical activity, genetic disorders, cigarette smoking, alcoholism, liver disease, uncontrolled diabetes and other disorders (e.g. COPD and asthma independent of medications).

The best way to diagnose early signs of osteoporosis is with a DXA scan.

Osteoporosis is not usually associated with symptoms until a fracture occurs. Fractures most commonly involve the spine, hip and wrist. Loss of height is also a common event with osteoporosis since the weakened spine may become compressed.

Although marked osteoporosis can be identified on a routine x-ray, the best way to diagnose early signs of osteoporosis is with a DXA scan (dual energy x-ray absorptiometry). Early diagnosis can lead to effective treatment that can make a significant long term difference and prevent fractures and discomfort resulting from osteoporosis.

If you have one or more risk factors for osteoporosis and/or are middle-aged or an older adult who has used inhaled corticosteroids (Advair®, Flovent®, Pulmicort®, QVAR®, Arunity® Azmacort®,etc.) regularly over long periods, you should have a bone densitometry study at appropriate intervals to see if you are at risk for this disease.

Treatment consists of prevention through limiting factors that promote bone loss (discontinue smoking and alcohol use), nutrition (increased calcium and vitamin D), hormonal replacement (estrogen), exercise to promote bone mineralization and medical treatment (Fosamax®, Actonel®, Boniva®, Reclast®, Prolia®, Forteo®, Tymos®, Ezenity®, etc.).

"Steroid Phobia" (Fear of Steroids)

Inappropriate fear of corticosteroid (steroid) use in asthma treatment without a balanced view of the issues involved is one way to define "steroid phobia." The steroids used in asthma treatment are corticosteroids, also known as glucocorticosteroids. These steroids have anti-inflammatory effects. They are not the androgen-like muscle building steroids that have had a bad reputation for side effects among athletes and body builders.

Skilled and experienced physicians who prescribe corticosteroids for the treatment of asthma and other inflammatory disorders have a deep respect for the potential risk of corticosteroid side effects. On the other hand, physicians who struggle to treat these difficult chronic medical problems also respect the extraordinary benefits of corticosteroids in effectively treating asthma or improving the quality of life when other forms of treatment have failed.

Although asthma specialists prescribe corticosteroids frequently, **you** *must ultimately decide whether or not to take these powerful medications.*

What makes corticosteroids so effective in controlling inflammatory disease is that they work on many different levels to block the inflammatory process. Specifically, corticosteroids block the invasion of inflammatory cells that are being attracted to the site of chemical mediators released in allergic reactions (chemicals released from mast cells), including those that take place in the asthmatic bronchi. By preventing or diminishing the resulting inflammatory reaction, corticosteroids also reverse asthma symptoms and prevent long term damage to the lungs *(see Remodeling of the Airway, page 11)*.

Although *oral* corticosteroids (e.g. prednisone, Medrol®) have significant systemic (generalized) effects on the body, newly developed *inhaled* corticosteroids have been formulated in such a way to be very effective when directly inhaled into the lungs, sprayed into the nose, or dropped into the eyes, with little resulting systemic absorption or side effects when used in low doses. The use of inhaled corticosteroids has a very low incidence of systemic side effects. They have been specifically designed to be effective in low doses and are quickly inactivated by your body's metabolism. When using any corticosteroids, including these topical (surface acting) medications, you should be monitored every few months to check for early signs of side effects and to reevaluate the doses of medications. For example, the growth acceleration of children using inhaled corticosteroids should be measured by the highly accurate stadiometer (an especially accurate height measuring device) in the doctors' office and charted for growth acceleration every few months in order to detect those unusual cases in which inhaled corticosteroids might affect a child's growth rate. At **The Asthma Center**, all patients' heights are measured by bone stadiometry routinely.

Oral corticosteroids are another matter. Short term use (a few weeks or less) is hardly ever associated with long term side effects. On the other hand, long term treatment (many months to years) is often associated with weight gain, thinning of the skin, loss of bone mass (osteoporosis) and interference with linear growth in children *(see Table 15, page 55)*. The use of alternate-day corticosteroid treatment or "steroid sparing" medications like the newer biologic therapies for asthma (Xolair®, Nucala®, Cinqair®, Fasenera®, Dupixent®, etc.) may allow your physician to lower the total dose of corticosteroids administered, thus lowering the potential for side effects over time. In general, the higher the dose and/or the longer the course of treatment, the greater the chance of side effects.

So why use oral corticosteroids at all? Every asthma specialist in the U.S. and the western world today is using oral corticosteroids to treat a select number of asthmatic individuals. The potential for dying during an acute attack of asthma or the prospect of suffering a very poor quality of life due to constant asthmatic symptoms clearly outweighs the potential risk of oral corticosteroid side effects. In other words, the risks of asthmatic side effects must be carefully considered against the risks of corticosteroid treatment.

In fact, many of the corticosteroid side effects seen by **The Asthma Center** allergists have been, in part, a result of receiving suboptimal care, relying primarily on oral corticosteroids to control severe symptoms.

Many of these individuals were not in an optimal program that offered ongoing monitoring for corticosteroid side effects, nor were their asthma medications optimized to receive the *lowest* dose of corticosteroids in combination with other asthma medications that would permit good control of symptoms.

Although asthma specialists prescribe corticosteroids frequently, you must ultimately decide whether or not to take these powerful medications. This manual should provide you with a thorough understanding of the need to use corticosteroids appropriately and allow you to educate yourself about the specific issues involved (risks vs. benefits) in order to partner with your physician(s) to achieve optimum and informed care.

Other Corticosteroid-Sparing or Anti-Inflammatory Agents

Oral gold therapy (Ridaura® [auranofin]), methotrexate, cyclosporine, azathioprine, hydroxychloroquine, dapsone, immunoglobulin replacement, and biologic therapy with monoclonal antibodies (Xolair®, Nucala®, Cinqair®, Fasenera®, Dupixent®, etc.) are therapeutic agents that have been studied for their ability to suppress steroid-dependent asthmatic symptoms. While initial individual case reports and limited clinical trials offer some promise for these agents, their use for the treatment of asthma is still considered experimental, with the exception of monoclonal antibodies specifically approved by the FDA for different types of asthma. **The Asthma Center** allergists will consider use of these medications only after standard treatments fail to control symptoms and your asthma is moderate to severe and not well controlled.

HYDROXYCHLOROQUINE (PLAQUENIL®)

Hydroxychloroquine, or Plaquenil®, is an uncommonly prescribed agent amongst this group. Plaquenil® is a medication used to treat malaria and inflammatory disease of the skin and joints. It has shown benefit for some steroid-dependent asthma. While its exact mechanism of action is unknown, it may suppress the inflammatory response in the airways. Plaquenil® is used on a daily basis as an oral medication and is generally administered over a six month trial period before a response is noted. Side effects include nausea, vomiting and dizziness. Serious toxicity to the retina of the eye can occur rarely with this therapy after long term use at higher doses than that used for treatment of asthma. **The Asthma Center** allergists recommend baseline and follow-up eye examinations while on this medication.

METHOTREXATE

Description:

Methotrexate is approved by the Food and Drug Administration (FDA) and is currently available for treatment of certain diseases: adult rheumatoid arthritis, severe psoriasis (a skin disease) and certain cancers.

Over the past several years, there have been scientific reports of the use of methotrexate in very difficult-to-treat asthma. This treatment may be used when, in addition to standard asthma drugs, you have required frequent oral corticosteroid treatment or prolonged use of daily oral corticosteroids (prednisone, methylprednisolone, etc.). The use of methotrexate may help reduce the amount of oral corticosteroids needed as well as help decrease the risks of side effects with oral corticosteroid treatment.

Although methotrexate is not approved for use by the FDA as an asthma medication, the experience of

The Asthma Center allergists and the experience reported in the medical literature suggests that the potential benefits of methotrexate if you are steroid-dependent, especially regarding its potential to decrease your need for oral corticosteroids, outweigh its potential risks for side effects.

Use:

Methotrexate is usually given as a weekly intramuscular injection or orally on a weekly basis.

Risks and Precautions:

Methotrexate may cause the following side effects: nausea and/or stomach discomfort, headache, dizziness, skin rash or itchy skin, a decrease in the blood cell count and pneumonia. As with any drug, there may be unanticipated side effects. The amount of the drug administered for asthma treatment is relatively low (much lower than the dosage used for treatment of cancer), and therefore the possibility of these side effects is generally decreased. After prolonged usage of methotrexate, there is a risk of inflammation and/or injury to the kidneys, lungs, or liver and/or increased risk of infection. These potential side effects are carefully monitored during follow-up visits with your asthma specialists.

IMMUNOGLOBULIN REPLACEMENT

Immunoglobulin replacement has been found in several clinical trials to benefit severe chronic steroid-dependent asthma. Immunoglobulin replacement given either IV (IVIg) or subcutaneously (SCIg) is approved by the FDA for treatment of primary immunodeficiency; however, it is not approved for the treatment of asthma at this time. This is an extremely expensive and time consuming form of therapy. Intravenous treatments consist of 4 - 8 hours of infusions once a month.

Risks and Precautions:

Immunoglobulin treatment is a sterile highly purified human immunoglobulin derived from large pools of human plasma. Rapid infusions can cause nausea, vomiting, back or abdominal pain, leg cramps, chest tightness, rapid heart rate, anxiety, itching, hives and flushing. Slowing down the infusion usually eliminates these symptoms. Subcutaneous infusion of gammaglobulin usually has less of these side effects. Rarely, severe anaphylactic (allergic) reactions occur. Aseptic meningitis syndrome has been infrequently reported to occur and is associated with severe headache, stiff neck, drowsiness, fever, nausea and vomiting. Kidney disease has been reported as a complication. The exact mechanism of action is unknown. However, permanent side effects are rare, and immunoglobulin therapy is considered by some specialists to be a reasonable alternative to continuing treatment with high dose, daily oral corticosteroids with their associated risks of significant side effects.

Anticholinergic Medications

Description:

Anticholinergic medications like atropine have been used for centuries in the treatment of asthma. Although this type of medication fell into disfavor in past years, it is currently regaining popularity among asthma specialists. Not only have the anti-asthma (bronchodilator) effects of atropine been rediscovered, but new medications with bronchodilating effects similar to those of atropine have been recently introduced. These

new medications, ipratropium bromide (Atrovent®) and tiotropium bromide (Spiriva®), are now indicated for use in bronchitis and emphysema. Their use for treatment of asthma is increasing even though they are not currently FDA approved for asthma, except Spiriva®. It should be noted that Combivent® contains ipratropium bromide plus a sympathomimetic (albuterol).

The effect of anticholinergic medications appears to come from their ability to interfere with nerve fiber (vagal nerve) pathways, which affect airway constriction (anticholinergic effects). These medications may be particularly helpful when physical stress causes increased vagal nerve stimulation, which could result in bronchospasm. Certain types of asthma may respond to this form of therapy. Currently **The Asthma Center** allergists recommend this therapy if you do not have an adequate response to sympathomimetic inhalers (e.g. albuterol).

Use:

Ipratropium bromide (Atrovent®) is available as a handheld aerosol and a nebulized solution for direct inhalation into the airways. Atropine and an atropine-like medication called glycopyrrolate (Robinul®) are also available as solutions for nebulization. Combivent® (ipratropium bromide plus albuterol) is available as a metered-dose inhaler. Spiriva® (tiotropium bromide) is an anticholinergic dry powder inhaler or mist inhaler that is used once a day with its effects lasting 24 hours.

TABLE 16

Anticholinergic Medications

Brand Name	Concentration	Active Ingredient	Dose
Anoro® Ellipta®	62.5mcg (umeclidinium) and 25mcg (vilanterol)/puff	umeclidinium bromide, vilanterol trifenatate	1 puff once daily
Atrovent® HFA *	MDI: 18mcg/puff, 200 puffs/canister Nebulizer Solution: 0.5mg/2.5mL (0.02% vial)	ipratropium bromide	MDI: 2-3 puffs every 6 hours, not to exceed 12 puffs/24 hours Nebulizer Solution: 1 vial every 6-8 hours
Bevespi Aerosphere®	9mcg (glycopyrrolate) and 4.8mcg (formoterol)/puff, 120 puffs/canister	glycopyrrolate, formoterol fumarate	2 puffs twice a day (twice in the morning, twice in the evening)
Combivent®*	MDI: 18mcg (ipratropium) and 103mcg (albuterol)/puff, 200 puffs/canister	ipratropoium bromide, albuterol sulfate	2 puffs 4 times per day, not to exceed 12 puffs/24 hours
Incruse® Ellipta® *	62.5mcg/puff	umeclidinium bromide	1 puff once a day
Lonhala® Magnair®	Nebulizer Solution: 25 mcg/1mL	glycopyrrolate	1 vial twice a day
Seebri™ Neohaler®	15.6mcg/capsule	glycopyrrolate	1 capsule/inhalation twice a day (1 capsule in the morning, 1 capsule in the evening)
Spiriva® HandiHaler® *⊙	18mcg/HandiHaler® capsule	tiotropium bromide	1 capsule/inhalation once a day
Spiriva® Respimat® *⊙	1.25mcg/puff, 2.5mcg/puff	tiotropium bromide	2 puffs once a day
Stiolto™ Respimat®	3.12mcg tiotropium and 2.74mcg olodaterol/puff	tiotropium bromide monohydrate, olodaterol hydrochloride	2 puffs once daily (at same time of day)
Tudorza® Pressair® *	400 mcg/puff	aclidinium bromide	1 puff twice a day
Utibron™ Neohaler® *also*	27.5mcg indacaterol and 15.6mcg glycopyrrolate/capsule	indacterol maleate, glycopyrrolate	1 capsule/inhalation twice a day (1 capsule in the morning, 1 capsule in the evening)
Yupelri®	Nebulizer Solution: 175 mcg/3mL	revefenacin	1 vial once a day

**also have bronchodilating effect*

⊙Spiriva® is the only FDA approved anticholinergic for asthma.

Risks and Precautions:

The possible side effects of atropine and to a lesser extent ipratropium bromide (Atrovent®), tiotropium bromide (Spiriva®), glycopyrrolate, umeclidinium, and aclidinium include: dry mouth, blurring of vision, palpitations (racing heart) and urinary retention if an enlarged prostate is present. Older adults are more sensitive to atropine side effects and may note flushing or psychological disturbances. These side effects are all reversible.

Immunizations

When you contract a respiratory infection caused by a virus, you often will have a flare of your asthmatic symptoms. In fact, the most frequent cause for emergency room visits and hospitalizations is respiratory infections. However, all viral infections of the respiratory tract are not equal in producing asthmatic symptoms. The one viral infection that has consistently caused major asthmatic attacks and has also been clearly associated with some fatal episodes of asthma is influenza. Therefore, **The Asthma Center** allergists, as well as virtually every professional group of physicians, recommend **an annual influenza vaccine** as part of a comprehensive asthma treatment program. Pneumococcal vaccines (Pneumovax and Prevnar), immunizations for pneumonia, are also recommended if you have asthma. The Tdap (tetanus, diphtheria, pertussis) vaccine is also required over 18 years of age as a booster to prevent whooping cough (pertussis), which can masquerade as an asthma flare.

Unfortunately, you may choose not to receive an influenza vaccine prior to the influenza season because you are concerned that the vaccine has caused "flu-like" symptoms in the past. However, the influenza vaccine is a dead virus and cannot possibly cause the "flu." The symptoms you experienced are adverse reactions and usually can be diminished or avoided by dividing the dose over a few office visits. At this time, guidelines recommend that FluMist®, a live viral vaccine, not be administered to you if you have asthma. There are a variety of flu vaccine options now available. It is appropriate to discuss with your physician to determine which vaccine is most appropriate for you.

Antihistamines

Antihistamines work by competing with histamine released by mast cells and basophils for histamine receptors on the mucosa of the eyes, nose, bronchial airways and skin. The antihistamine binds to the receptor and prevents histamine attachment, thereby blocking the effect of histamine in the tissues (*see Antihistamines, page 82*).

Decongestants

Decongestants constrict blood vessels. This constriction dries out watery secretions in the eyes and nose and reduces swelling of the mucosal tissue caused in part by the release of histamine from mast cells during the allergic reaction. Decongestants are helpful in reducing excessive upper airway secretions and post nasal drip due to allergy and sinus disease which can trigger asthma symptoms (*see Decongestants, page 85*).

Expectorants

Description:

Any medication that promotes the discharge or expulsion of mucus from the respiratory tract is called an expectorant.

Examples of expectorants include:

- guaifenesin (Robitussin®, Mucinex®, Curist Brand Gauifenesin)
- potassium iodide
- acetylcysteine (Mucomyst®)
- fluids

Use:

Although a large number of over the counter expectorants are sold each year, there is little proof that they provide any clinical improvement of asthmatic symptoms. In general, **The Asthma Center** allergists find this treatment ineffective for the typical cough of asthma. However, if you are coughing because of a post nasal drip or have significant amounts of chest secretions (phlegm), then treatment with expectorants may be useful. Increased fluid intake may also promote mucus thinning. On the other hand – there are some individuals with asthma who produce an excess of sputum and/or have difficulty bringing it up. Such individuals may benefit from use of acetylcysteine, which is an expectorant that works by thinning out mucus and making it easier to move through the patient's lungs. The first use will most likely be in the office to make sure there is no paradoxical bronchospasm. Mechanical devices used at home like Flutter® and Acapella® may also help to expectorate mucus. These devices work by generating sound waves. When you use the device and exhale, the sound waves help you physically dislodge mucus into your airway so that you can bring it up.

Risks and Precautions:

Some expectorant preparations contain iodides (potassium iodide) that may result in the development of a goiter (swollen thyroid gland), a severe rash, or salivary gland inflammation. These medications are not recommended for use in children, pregnant women, or individuals with thyroid conditions. Guaifenesin, on the other hand, is well tolerated except for occasional complaints of nausea. Codeine is sometimes found in expectorants or "cough medications." This medication actually suppresses the cough reflex. It should be noted that codeine is a narcotic with side effects of constipation as well as potential risk of addiction. Therefore, its prolonged use should be avoided.

5 Immunological Treatments for Asthma

When allergy plays an important role in provoking asthma symptoms, options are available in addition to traditional pharmaceutical medications *(see Common Allergic Symptoms, page 75).*

Environmental Controls

By removing or limiting exposure to the allergens that cause symptoms (dust, pets, mold, or pollen) in allergic asthma and other allergy related problems, allergy symptoms can be brought under better control. In addition, by avoidance of the offending allergens, an important part of the immune system (e.g. the production of specific IgE antibodies) will no longer be stimulated by allergen exposure. Therefore, the amount of specific IgE antibodies produced will lessen over time. Avoidance techniques can be a powerful tool in regulation of the immune response *(see Environmental Avoidance of Allergens and Irritants, page 30).*

When allergen exposure worsens asthmatic symptoms, immunotherapy can be greatly beneficial.

Immunotherapy (Allergy Injections)

For more than 100 years, allergen immunotherapy (allergy injections) has been recognized as a very effective treatment for hayfever. However, only recently, studies have confirmed the value of immunotherapy in allergic asthma management as well. When you cannot avoid a known, relevant inhaled allergen, **The Asthma Center** allergists recommend the possibility of decreasing your sensitivity to this allergen by the technique of immunotherapy. This is most effectively done through allergy shots. For example, if you suffer from a worsening of your asthma each spring during the season of grass pollination (May and June) and have positive skin tests to grass pollen, allergic sensitivity to grass pollen probably plays a role in your asthma. Other allergens that have been found to worsen asthmatic symptoms include: tree pollen (spring), weeds and ragweed (latter part of the summer and early fall), molds (summer through fall), house dust, house dust mite and animal dander (year-round indoor allergens). To receive the latest pollen and mold spore information relevant to your particular allergy season, visit **The Asthma Center** website at *www.asthmacenter.com.*You can also visit **The Asthma Center Education and Research Fund** website at *www.asthmacenter.com.*

When allergens are provoking asthmatic symptoms, **The Asthma Center** allergists often recommend beginning a course of immunotherapy (allergy injections). Allergy injections (allergy shots) containing relevant allergen(s) are administered in order to decrease your sensitivity to the offending allergen(s). At first, only very weak solutions are administered. The dose of allergen solution is then gradually increased until a high dose maintenance level is achieved. Potential benefits include decreased sensitivity to the offending allergen(s) and decreased asthmatic symptoms following exposure to the allergen(s). Allergy injections should only be given when a physician is immediately available to administer emergency treatment

in the event of an adverse reaction.

In the interest of your safety, allergy shots should not be given at home by self-injection, friends, family members, or neighbors, even if they are health care professionals

Allergy shots should only be given under the direct supervision of a physician who is present to manage a full-blown anaphylactic reaction.

Allergy shots should only be given under the direct supervision of a health care provider, skilled in the management of anaphylaxis (a sudden and severe allergic reaction), who is present in a facility fully equipped to manage a full-blown reaction.

If you receive allergy injections under any other circumstances you are putting yourself at serious risk.

Therefore, allergy injections should only be given in a medical facility with a qualified health care provider immediately available for the management of reactions. Proper medication(s) and equipment must be available to treat mild or severe reactions. You must remain in the office for 30 minutes following your injection(s).

Immunotherapy is thought to work by causing a number of changes in the immune system which ultimately decreases allergic sensitivity. These immunologic changes include: a rise in IgG antibodies that "block" allergen binding to the IgE allergy antibody, a decrease in the production of IgE allergy antibody and a decrease in the release of the chemical mediators that cause allergic reactions.

For allergic asthma, immunotherapy may decrease asthmatic symptoms and reduce use of anti-asthma medications and in children prone to develop asthma, allergy injections may prevent the onset of asthma.

Unlike most asthma medications, immunotherapy is aimed at changing the underlying mechanism of allergy that causes symptoms rather than treating symptoms alone.

With rare exceptions, if you receive beta-blocker medications, you should not receive immunotherapy since you might not respond to emergency treatment in the event you have a reaction to your allergy shots. Recently, allergy extract immunotherapy has been FDA approved for some allergens to be given under the tongue or orally as a home treatment. This is known as sublingual immunotherapy (SLIT). Much higher doses of extract are used and local reactions in the mouth are common. Systemic reactions and anaphylaxis have been reported from SLIT. Most experienced allergists find SLIT not as effective as traditional allergen injections (SCIT) for treatment of allergies or asthma.

Biological Treatments for Asthma

When moderate to severe persistent asthma is not well controlled with corticosteroids and beta agonists, biologic medications can be considered. Biologics are drugs that are made from components of living organisms, such as antibodies, proteins, allergens, and cells. With biologics, you are able to target the specific drivers of asthma, which can then prevent the asthma from occurring as a whole. These drivers are complex and depend on each individual person. Researchers have shown that asthmatic patients can be

divided into 2 groups, depending on the drivers of their asthma. These groups, which are called T2-high asthma and T2-low asthma, can help physicians decide if biologics are the right choice for their patients. The current biologics tend to produce the best results in the T2-high asthma group. Your allergist can determine which group you fall into with blood tests and by seeing if you also have conditions such as allergic rhinitis, food allergies, atopic dermatitis, and nasal polyps.

Omalizumab (Xolair®) is the first biologic that was approved for use in the US and Europe and has now been used for over 16 years. This biologic works well on patients with the T2-high asthma because it targets the allergy antibody, known as IgE, which is overexpressed in most individuals with allergic asthma. Studies have shown that omalizumab reduces the rate of asthma flare-ups by 25-50% and improves overall quality of life in asthmatics by improving quality of sleep, exercise, and activities of daily living. With omalizumab, patients tend to use their inhalers less because their asthma is better controlled. It is approved for use in adults and children over 6 years of age with moderate to severe persistent asthma and certain lab criteria. Of note, it is the only biologic approved for use in children younger than 12 years of age.

Other biologics that are approved for use include Mepolizumab (Nucala®), reslizumab (Cinqair®), benralizumab (Fasenra®), and dupilumab (Dupixent®). These drugs target eosinophils, which are also overexpressed in patients with the T2-high type of asthma. Eosinophils are a subset of white blood cells that circulate in the blood and various tissues – especially lungs, nasal airways, GI tract, and skin, particularly in individuals with allergic diseases. Eosinophils are controlled by a protein called IL-5, and these biologics are known as anti-IL-5 drugs. Mepolizumab, benralizumab, and dupilumab are approved for use in patients 12 years of age and above, whereas reslizumab is approved for use in patients 18 years of age and above. Dupilumab, specifically, works well in patients with symptoms from chronic rhinosinusitis and nasal polyps. All 4 of these drugs work best in asthmatic patients with high levels of eosinophils in their blood, which can be determined by a simple blood test. These 4 biologics also result in reduction of asthma flare-ups, improvement in quality of life, and improvement in overall lung function. If your allergist thinks that mepolizumab is right for you, be sure to get the zoster vaccine 4 weeks before starting the drug if you are age 50 years old or older. Newer biologics, including brodalumab, tezepelumab, fevipiprant, and imatinib, have also been shown to decrease asthma flare-ups. In the right type of patient, biologics can help control asthma in ways never seen before. Asthma specialists at **The Asthma Center** can determine if biologics are the right choice for you.

Use of Special Devices in Treatment of Asthma

6 How to Use a Metered-Dose Inhaler (MDI)

Metered-dose inhalers (MDIs) are devices which are convenient and easy to use for administering medications directly to the airways. If you are taking an MDI, the following instructions will help you develop a proper technique. This technique is important in that it is the key to effective delivery of medication to the airways.

1. Remove the plastic dust cap.
2. Shake the container vigorously immediately before using.
3. Hold the inhaler up to your mouth with the mouthpiece down.
4. Breathe out fully, slowly emptying your lungs of as much air as you can without straining. You are now ready to inhale your asthma medication.
5. Activate the inhaler while very slowly and simultaneously breathing in the medication. Hold the medication in your lungs for 5 - 10 seconds and then slowly exhale (breathe out). See below for three possible techniques *(Figures 5, 6, 7)*.
6. Wait a few minutes, then repeat Steps 2 - 5 for a second inhalation.
7. Rinse your mouth (gargle with water) if you are using corticosteroid inhalers.
8. After each use, replace the plastic dust cap. This will prevent the loss of medication and will keep the valve clean. *Hint:* If you find that you keep your inhaler in your pocket or pocketbook and it gets dirty, it is best to first place it in a plastic bag, which will keep it clean and prevent you from accidentally inhaling dirt or a foreign object into your lungs.

There are 3 possible techniques for inhaling your medication; use the one that works best for you.

FIGURE 6 Closed Mouth Technique

A. The first method is called the *closed mouth technique (see Figure 6)*. Shake the MDI vigorously. Breathe out completely, fully emptying your lungs. Then place the tip of the MDI mouthpiece between your teeth and gently close your lips around the mouth- piece, creating a seal. Begin to breathe in slowly and deeply through your mouth **immediately** before activating your MDI. Just as you begin to inhale slowly, firmly press the container down into the mouthpiece once only. This releases the medication. Since you started to breathe in slowly immediately before activating the MDI, you should be able to continue to inhale slowly after the MDI has been activated until you reach maximum inhalation. Then hold your breath for 10 seconds and breathe out slowly through gently pursed (pressed together) lips.

You can visualize this technique using the following link:
https://www.youtube.com/watch?v=ys6AoOFsP2g

FIGURE 7 Open Mouth Technique

B. A second technique, which is excellent if you are very well coordinated, is called the *open mouth technique (see Figure 7)* in which you perform the above maneuver with the MDI placed approximately 2 inches from your mouth. The medication is sprayed directly into the open mouth during deep slow inhalation. Although many experts claim this is the best technique, **The Asthma Center** allergists do not usually advise using this method because the inhaler spray may be inadvertently misdirected away from your mouth when the technique is not perfectly executed.

You can visualize this technique using the following link: https://www.youtube.com/watch?v=Lrt1nJ3tVFI

C. A third technique, the one most often recommended by **The Asthma Center** allergists, involves the use of an inhaler with a *spacer device* (holding chamber). Here, the MDI is attached to a spacer device *(see Figures 8 and 9)* and you exhale completely before inserting the mouthpiece of the spacer into your mouth. When the MDI is activated, begin to breathe in **slowly**. The rate of flow of medication sprayed into the holding chamber slows down, and it can be completely inhaled even if your coordination is not perfect. Additional benefits include a much lower incidence of sore throats due to reduced impact of medicated spray on the back of the throat, decreased hoarseness, decreased medication taste and less of a chance for development of fungal infections of the mouth and throat for those using inhaled corticosteroids.

You can visualize this technique using the following links for the spacer with and without a mask: https://www.youtube.com/watch?v=hCAsW7OM9Ns , https://www.youtube.com/watch?v=von7cyXcj2c

FIGURE 8 Aerochamber Spacer

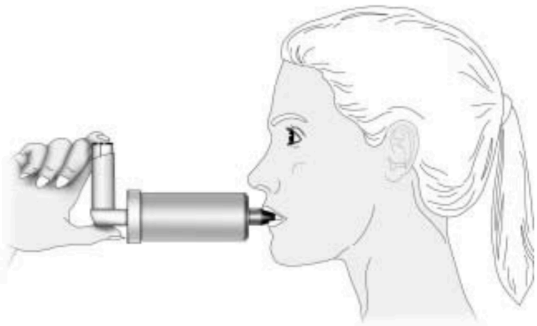
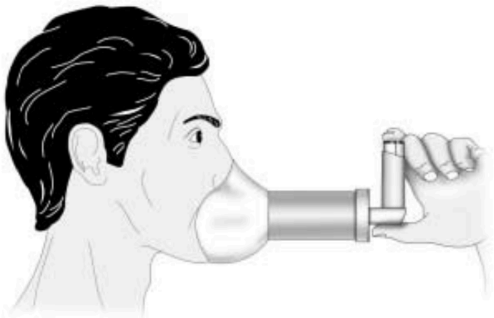


FIGURE 9 Aerochamber Spacer with Mask



Whichever technique you use, please consider the following:

If you notice "smoke" coming out of your mouth, or if you feel most of the medication remains in your mouth and not your chest, you are not using your inhaler properly. You should demonstrate your technique to your asthma specialists.

When you use your inhaler, be sure to clean it at the end of the day or at least every few days. Remove the dust cap and the canister (medication container). Wash the mouthpiece with warm soapy water and rinse it well. Allow 30 minutes for drying before use. Replace the canister and cap in the housing.

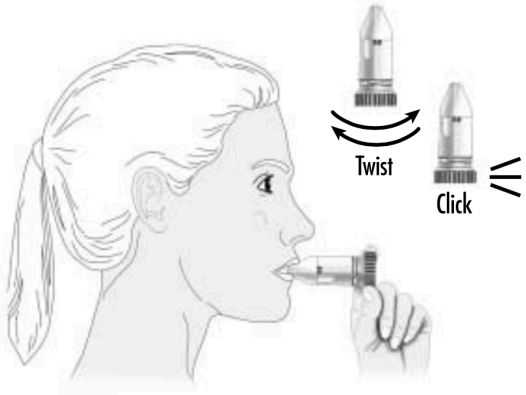
In order to judge if your inhaler is empty, some individuals drop the metal portion of the inhaler in a sink of water, thinking that its position (floating = empty, sinking = full) in the water will tell how much medication is left. This is not accurate. Shaking the inhaler or checking if it still "puffs" are also inaccurate methods for determining the amount of medication left. **The Asthma Center** allergists feel that a much more accurate method is to divide the actual number of doses that a new MDI contains by the number of puffs used each day (daily dose) to calculate the number of days of treatment your inhaler holds.

For example, if your MDI contains 200 puffs and you know that you inhale 2 puffs twice a day (4 puffs a day), you can then divide 200 puffs (total number of doses) by 4 (total daily dose) to determine the total remaining days of use. In this case the MDI contains 50 days of medication use before it will empty (200 divided by 4). Based on this information, simply write the predetermined date of replacement onto the canister with a permanent marking pen and also on your personal calendar. Using this information, you can confidently determine when the canister will be empty and replace it in a timely fashion. It should be noted that it is possible that occasionally there will be less total doses in your MDI than indicated; therefore, replace the canister well in advance of total expiration. **The Asthma Center** allergists have found that this is the best replacement strategy and the one strongly recommended. If you use MDIs only occasionally for symptoms, it is probably best to replace your inhalers at least every 6 months, even though they still may contain lots of medication. Of course, if the inhaler has not been used at all, you can replace it according to the manufacturer's expiration date marked on the box of the MDI and on the canister.

How To Use a Dry Powder Inhaler (DPI)

Dry powder inhalers are currently available as inhaled bronchodilators (Serevent Diskus® and Spiriva® HandiHaler®) and inhaled corticosteroids (Pulmicort Turbuhaler®, Breo® Ellipta®, Advair®, Asmanex® and ProAir RespiClick®, AirDuo™ RespiClick®). The advantage of using a dry powder inhaler is that it is breath activated, and you do not have to coordinate activating the DPI with inhaling (breathing in) your medication. Instead, you simply breathe in quickly to activate the flow of medication. In this way, the breath activated discharge of medication is always properly coordinated with your inhalation effort. The advantages of DPI use include breath activation, no need to shake the canister and no pollution of the atmosphere with fluorinated hydrocarbons. Also, it is usually easy to determine the amount of medication remaining in the DPI device. Some of the DPIs work by scraping a precise amount of medication from a drug storage unit contained within the DPI (Pulmicort Turbuhaler® -*see Figure 10*). Others contain each dose of medication in a blister pack or capsule (Advair®, Serevent®). They all work well when used properly. Unlike MDIs, with the optimum inhalation performed slowly, DPIs require that you breathe in quickly to automatically activate (breath-activate) the proper flow of medication. You should not breathe out through a DPI because the moisture of your breath can gum up the mechanism. You may also need to be more vigorous in cleaning some DPIs than MDIs because of the quick accumulation of powder residue.

FIGURE 10 Dry Power Inhaler (Pulmicort Turbuhaler®)



Since DPIs vary so greatly, you will need to review the specific one prescribed with your physician. However, these general rules apply:

- Read the instructions that come with your DPI.
- Check that the mechanism is clean and the mouthpiece is free of obstruction.
- Load and prepare the medication for inhalation.
- Exhale slowly and completely without straining or breathing into your DPI (moisture from your breath can interfere with your DPI's function).
- Place your teeth over the mouthpiece and seal your lips around it. Take a fast deep full inhalation to activate the flow of medication. Try and hold the medication in your lungs for 5 to 10 seconds. Breathe out slowly against pursed lips.
- Wait 30 seconds before taking a second inhalation (when required).

You can visualize this technique using the following link:
https://www.youtube.com/watch?v=bxC48vQEfZI

How To Use Spacers And Nebulizers

Spacers

If you have difficulty using metered-dose inhalers (MDIs) *(see page 67)*, spacers (also known as holding chambers or reservoirs) have been devised to eliminate the problem of hand-breath coordination, improve the delivery of medication and reduce throat irritation and/or fungal growth in the upper airway.

All spacers receive the medication from the MDI and briefly hold it until you begin to inhale. Therefore, it is not necessary to coordinate precisely the release of medication with inhalation. The spacer also allows for the medicated mist to decrease its speed of flow. As it is temporarily suspended in the holding chamber, it can be inhaled at a slower rate, leading to more complete distribution within the lungs *(see Figure 11)*.

FIGURE 11 Collapsible Spacer (InspirEase® Device)

Even if you are familiar with the correct technique of MDI use, you may benefit from a spacer since it can increase the amount of medication deposited into the airways. Used with inhaled corticosteroids, a spacer may decrease the incidence of thrush (yeast infection in the mouth and throat). Spacers also may reduce the

bad taste that you experience with MDIs.

Adults and most children over 3 years (occasionally younger) of age can become proficient within a week or two of practice using these devices. Two common spacer devices used at **The Asthma Center** are the

Aerochamber® and the Vortex® device. The choice of spacer device is usually based on efficacy of aerosol delivery, how well the spacer fits the inhaler, its portability, convenience of use and price. Your asthma specialists should review the use of the spacer device and offer written instructions.

Nebulizers

Infants, children and adults may have difficulty timing their inhalations when using a metered-dose inhaler, even with the use of a spacer device. For this reason, compressor- driven nebulizer units are recommended, particularly if you are having acute respiratory dis- tress. The nebulizer unit can produce a fine medicated mist that is inhaled while breathing normally. Nebulized medication reaches the lower airways more effectively than with the use of a metered-dose inhaler. For years, nebulizer units have been used to treat asthma attacks in hospitals and emergency rooms. These units have also been incorporated at **The Asthma Center** as part of at-home therapy. Early use of a nebulizer unit in a developing, acute asthmatic attack often allows you to avoid an emergency room visit or hospitalization. The home use of a nebulizer can dramatically increase quality of life and can be a lifesaver when traveling.

The nebulizer has significant advantages over the metered-dose inhaler with or without a spacer in that it does not require coordination. In fact, parents can use a nebulizer even when their asthmatic child is sleeping. Hand-breath coordination is not required, nor is it necessary to hold your breath. In addition, it is possible to administer several medications at the same time. If a nebulizer unit is recommended, specific instructions by your asthma specialists' staff should be reviewed with you regarding use of medication. Whoever delivers the unit to you should also demonstrate its use and check that it is working properly. Written instructional information on the use of a nebulizer should be available from your asthma specialists' staff.

If you travel and need to use a nebulizer unit while away from home, lightweight portable, battery-operated units are available. Some are so light and compact that they can be easily carried in a small handbag all the time. Figure 12 shows the Omron MicroAir NE-U22V Portable Nebulizer.

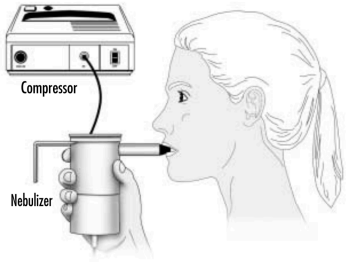
FIGURE 12 Omron MicroAir NE-U22V Portable Nebulizer

How to Use a Nebulizer:

A nebulizer can be used occasionally, daily (1 - 4 times per day), or even more than 4 times a day during an acute asthmatic attack. Treatments usually last 5 - 10 minutes in duration.

- Check that your machine, nebulizer bowl and tubing are clean and in good working order before and after use.
- Hold the nebulizer bowl or chamber stationary, screw off the cap and add your medication.
- Use a single premixed dose vial (albuterol, AccuNeb®, cromolyn, Pulmicort Respules®, Xopenex®) or add the prescribed dose of the medicated solution (albuterol, Proventil®) to a diluent (saline or cromolyn). Place the medication(s) in the nebulizer bowl and close the bowl.
- Insert the mouthpiece into the nebulizer bowl or attach a mask for infants.
- Attach the tubing to the inlet of the nebulizer bowl and turn the unit on.
- Hold the mouthpiece between your teeth and close your mouth gently around the mouthpiece, sealing it with your lips *(see Figure 13)*.

FIGURE 13 Nebulizer



- Turn on the machine and a mist should exit the mouthpiece.
- Breathe slowly and slightly more deeply than usual (10 - 15 times per minute).
- If the treatment needs to be interrupted, just shut off the machine and resume its use later.
- If using an aerosol mask, place the mask over your mouth and nose.
- Clean your machine and nebulizer bowl regularly as per the manufacturer's instructions. Keep a spare nebulizer bowl available should the one you are using suddenly stop working.

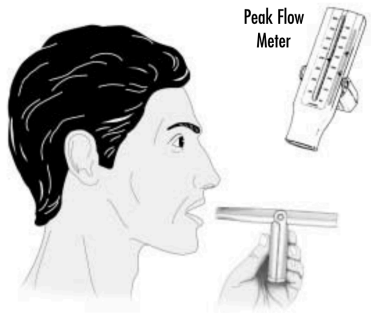
You can visualize this technique using the following link:
https://www.youtube.com/watch?v=q3gwBBsGmUg

Home Peak Flow Monitoring

Monitoring of asthmatic symptoms and periodic measurement of breathing function (pulmonary function tests) are important parts of the asthma treatment program. A peak flow meter is a simple device that may be used to monitor pulmonary function outside your physician's office by documenting the Peak Expiratory Flow Rate (PEFR) *(see Figure 14)*. The peak flow meter is an inexpensive hand-held device that objectively indicates the degree of airflow obstruction and can be used easily at home or at work with proper training and effort. Your asthma specialists may request that you obtain a peak flow meter and record the test results

while at home. The information gathered from measuring your peak flows in some cases will assist both you and your asthma specialists in better controlling your asthmatic symptoms. Peak flow rate monitoring may also offer you an early warning of the impending onset of a severe asthmatic attack.

FIGURE 14 Peak Flow Meter



Increasing differences between the morning and evening PEFR values, which is referred to as Peak Expiratory Flow Rate (PEFR) Variability, *is a sign of worsening asthma.*

PEFRs (Peak Expiratory Flow Rates) are not as sensitive or accurate as the spirometry tests performed in your doctors' office. Nevertheless, it is a valuable tool to self monitor asthma activity. Decreasing PEFRs below your best values are a sign of deterioration of your asthma control. Also increasing differences between the morning PEFR (which is usually lower than evening rates) and the evening PEFR are also a sign of worsening asthma and is referred to as Peak Expiratory Flow Rate (PEFR) variability. Either growing differences between morning and evening measurement of PEFRs and/or decreasing trends in PEFRs indicate that your asthma is getting worse, even if you feel fine, and that it may be time to increase your medications and/or speak to your doctor.

Peak Flow Meter Technique:

- Place the pointer at zero and hold the meter in the horizontal position in front of your mouth.
- Keep your fingers away from the pointer and vents of the meter.
- Empty your mouth of food or gum to avoid inhaling any foreign substance.
- Open your mouth and take in a slow deep maximum breath (inhalation).
- Place your teeth on top of the mouthpiece and close your lips firmly around the mouthpiece so as not to permit any leaks.
- Forcefully blow out as fast as you can with an explosive force in the shortest possible time.
- Observe your score and move the pointer back to zero and repeat the measurement in 30 seconds.
- Select the best reading of two or three efforts and record the results in your diary.

- If you have trouble using the peak flow meter because you are so short of breath or coughing a lot, it is time to increase your asthma medication and speak with your asthma specialist.

You can visualize this technique using the following link:
https://www.youtube.com/watch?v=6oKupWgDu80

You may find it convenient to classify your PEFRs into groups or Zones. The Zones are divided into three groups.

Green Zone: The ability to achieve 80% or more of your best PEFR. This means your asthma appears to be under good control, and you need not increase your medications unless you are having asthmatic symptoms.

Yellow Zone: PEFR values are between 50 to 80% of your best PEFRs. This indicates your asthma is under poor control even if you feel OK. You should increase your asthma medications according to the plan provided by your asthma specialist, check that all your asthmatic triggers are eliminated and speak to your asthma specialist.

Red Zone: Your PEFRs have fallen below 50%. This is an urgent problem, and you should start your emergency medication and call the asthma specialist. If you do not respond to medications, you may need to go to the emergency room.

7 Other Issues Related to Asthma Management

Common Allergic Symptoms

Seasonal Allergic Rhinitis (Hayfever)

Untreated allergic rhinitis can worsen asthma symptoms. Commonly called hayfever, allergic rhinitis describes allergy symptoms experienced primarily in the nose and eyes. The term hayfever is misleading because it is not caused by hay nor is it accompanied by a fever. It is the result of your body's reaction to the presence of allergens and foreign particles such as pollen, dust mites, mold spores and pet dander. If you are sensitive to one of these allergens, your body reacts by releasing histamine and other chemicals. These chemicals cause the common hayfever symptoms – runny nose, itchy watery eyes, sneezing, swelling and congestion. Over 45 million Americans (more than 15% of the population) are affected by this condition each year.

Fall Hayfever

From mid-May through October, ragweed and other weeds (*English Plantain, Pigweed, Cocklebur, Sheep Sorrel, Lamb's Quarters, Yellow Dock and Sagebrush*) are the main triggers of allergy attacks.

Ragweed is the most common pollen causing hayfever in the United States. It affects about 75% of allergic rhinitis sufferers. Over 1/4 million tons of ragweed pollen are produced per season in the United States.

Ragweed blankets most of the United States, sparing only the southern-most tip of Florida, Northern Maine and the northern West Coast. The ragweed plant looks like a young tomato plant and thrives in poor soil conditions. A single ragweed plant is capable of producing one billion pollen grains per season. Invisible to the naked eye, these microscopic grains have a diameter of approximately 1/25,000th of an inch (10 - 20 microns). Being very light, ragweed pollen is dispersed by the wind and can travel up to 500 miles in some cases. Ragweed plants are hard to eliminate because the seed retains its germinating powers for years.

The beginning of ragweed pollen season in the metropolitan Philadelphia area depends on the relative length of night and day. As summer days shorten and nights lengthen, ragweed begins to bloom. In the Delaware Valley, based on the past 30 years' ragweed pollen data collected by **The Asthma Center**, the ragweed season usually begins in early August and lasts 10 - 12 weeks through October. Weather conditions such as current temperature, rainfall and wind may affect day-to-day pollen counts, but these conditions do not shorten the ragweed season. However, an early hard frost can kill most ragweed plants in one night.

Spring Hayfever

Allergic rhinitis that occurs during the spring is sometimes called rose fever. Similar to hayfever, the term rose fever is misleading. It is true that roses are in full bloom during the spring hayfever season. However, roses and other bright flowering plants spread pollen through insects such as bees rather than through wind currents.

The common allergens in the spring are pollens from trees and grasses. These pollen grains are spread by the wind and cause typical hayfever symptoms. The beginning of the spring hayfever season can be as early as February and lasts until June. Pollen data from **The Asthma Center** pollen and mold spore monitoring station has established a second season for grasses, starting in August and ending in September. Weather conditions can cause day-to- day variations in the counts.

Pollen and Mold Spore Counts

Pollen and mold spore counts, as reported by **The Asthma Center** at *www.asthmacenter.com*, represent the concentration of pollen in the air. These pollen counts are reported in grains of pollen or mold spores per cubic meter of air collected. Pollen and mold spore counts tend to correlate with the severity of symptoms. Tables 17, 18, and 19 provide a calendar of allergen exposure and a general guide for symptom correlation. This is only a general guide because allergic sensitivity can only be objectively determined by a physician trained in allergy testing. If you have questions regarding correlating your symptoms with pollen and mold spore counts, **The Asthma Center** allergists advise you to contact your treating physician. It is helpful for individuals with allergies and/or asthma to monitor the pollen and mold counts.

TABLE 17 Calendar of Allergen Exposure

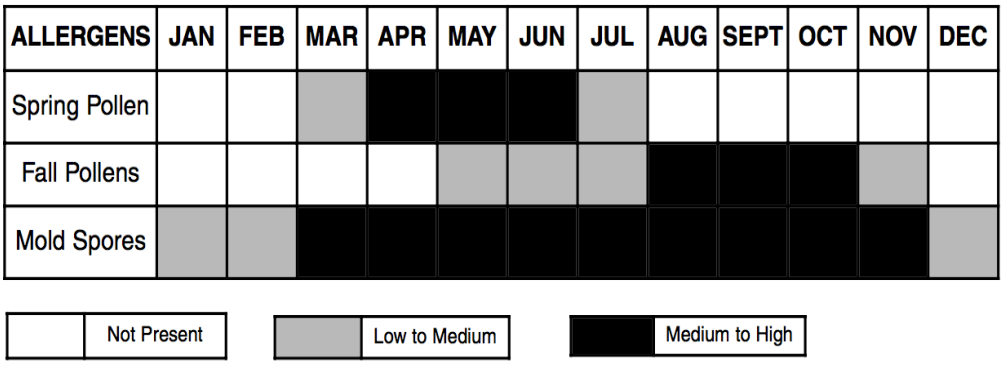


TABLE 18 Pollen Counts and Symptom Correlation

Quantitative Count	Qualitative Count	Symptom Correlation
0 – 5.0	Very low	Minimal symptoms
5.1 – 10.0	Low	Mild to moderate symptoms for those exquisitely sensitive
10.1 – 30.0	Moderate	Moderate symptoms
30.1 – 60.0	High	Moderate to severe symptoms
60.1 and above	Very high	Moderate to severe symptoms
Trees 1000 and above	Extreme	Severe symptoms
Grasses 100 and above	Exreme	Severe symptoms
Weeds (excl. ragweed) 100 and above	Extreme	Severe symptoms
Ragweed 100 and above	Extreme	Severe symptoms

TABLE 19 Mold Spore Counts and Symptom Correlation

Quantitative Count	Qualitative Count	Symptom Correlation
0 – 300	Very low	Minimal symptoms
300.1 – 600.0	Low	Mild to moderate symptoms for those exquisitely sensitive
600.1 – 1000.0	Moderate	Moderate symptoms
1000.1 – 2500.0	High	Moderate to severe symptoms
2500.1 and above	Very high	Moderate to severe symptoms
7000 and above	Extreme	Severe symptoms

Treatment for Allergic Rhinitis

A wide variety of allergy medications are available for the treatment of hayfever. It is estimated that hayfever sufferers annually spend $2 billion on over-the-counter (OTC) medications and nearly $300 million on prescription medications. Knowing what medication to take depends on your symptoms. Over-the-counter decongestants and antihistamines are the most frequently used medications. Decongestants provide relief for nasal congestion. Antihistamines relieve a watery, runny nose, sneezing and itchy eyes. These medications are not without adverse effects. If you have heart disease, high blood pressure, glaucoma, prostate problems, or are pregnant or nursing, consult a medical doctor before taking any of these OTC medications. One of the best treatments for nasal allergies is Dymista®, a prescription that is a combination of a nasal steroid and a nasal antihistamine. This unique medication can be used daily or as needed for symptomatic relief.

Avoidance of pollen is the cornerstone of allergy treatment.

Antihistamines like Allegra®, Clarinex®, Zyrtec® and Astelin® Nasal Spray offer allergy relief with minimal or no sedation. Generic versions of these antihistamines are much less expensive (see Curist brand generics at curistrelief.com). A variety of nasal steroid sprays like Flonase®(fluticasone), Rhinocort Aqua®, Nasonex®, Nasarel® and Nasacort® AQ are effective for the treatment of hayfever symptoms, many of which are now available over the counter, and generics (ie Curist brand fluticasone).

Avoidance of pollen is the cornerstone of allergy treatment. However, this is often easier said than done. Some helpful maneuvers include the following:

1. Use HEPA-filter air purifiers or air-conditioning units in indoor spaces as much as possible and avoid work or play outdoors during early mornings.
2. Keep windows and doors closed as this can significantly reduce pollen entering the indoor environment. Keeping windows and doors open is about the same as being outdoors. For example, when windows are open, inside air contains about 70% as much pollen as the outdoors. The air inside a moving car with open windows contains roughly 90% as much pollen as the air outside.
3. Plan your outdoor activities (such as gardening and mowing the lawn) in the late afternoon and evening when pollen counts are at their lowest. Use a dust or surgical mask to help reduce direct inhalation of pollen.
4. Large amounts of pollen may be attracted to clothing and the fur of pets. To reduce this exposure, clothes should not be hung outside to dry. Change your clothes after spending time outdoors. Outdoor clothing should then be immediately stored or laundered. Store shoes worn outside in a closed closet or cabinet away from the bedroom and living area. Bathe pets regularly or keep pets exclusively either outdoors or indoors during the allergy season to reduce the amount of pollens entering the indoor environment.
5. Keep your indoor environment clean during the allergy season. Allergies may be triggered by exposure to pollen plus indoor irritants like cigarette smoke, perfumes and house dust. Vacuum frequently with a high-efficiency vacuum and/or use an air cleaner in living areas *(see Environmental Avoidance of Allergens and Irritants, page 30)*.

If you have ragweed allergies, traveling or vacationing in areas with minimal ragweed pollen may help lessen symptoms. Less ragweed pollen seems to be found around large bodies of water, so the seashore is a likely area of relief for pollen sufferers.

Severe allergies often do not completely respond to medications or pollen avoidance. Allergy injections may be used to desensitize you to particular allergens. This form of therapy can effectively block allergic reactions. The program involves a series of allergy injections of increasing concentrations and amounts over time. If you receive allergy injections, you should be reevaluated periodically for continued indications for allergy injections. Allergy injections are currently the most effective long term treatment available for hayfever sufferers *(see Immunotherapy, page 64)*.

Allergic Conjunctivitis

Causes of Allergic Eye Reactions

One of the most commonly encountered allergic eye reactions is due to "hayfever," also referred to as allergic conjunctivitis. In this reaction sensitized mast cells on the surface of the eyes are triggered by pollens from trees, grasses and weeds, or by mold spores and indoor allergens such as animal dander and dust mite.

Pollens and mold spores appear seasonally in the atmosphere. These pollens and mold spores may cause a variety of annoying symptoms including runny/stuffy nose and the discomfort of itchy and watery eyes. Indoor allergens are present throughout the year.

Symptoms of Allergic Conjunctivitis

If you have ocular (eye) allergies, you may experience intense itching of your eyes and watery discharge. Itchy eyes often require special attention because of the extreme distress this symptom can cause.

Suppressing the severe itch associated with allergic conjunctivitis is essential in preventing repetitive rubbing of your eyes. Excessive rubbing can increase your discomfort by irritating the delicate structure of the eyes. If not controlled, this irritation can lead to a cycle of more itching and rubbing - possibly causing harm to your eyes.

Complications of allergies in the eyes can lead to other problems including swelling and infection of the eyelids and bacterial infection of the conjunctivae causing a "gritty eye" feeling with pus-like discharge. Your eyelids may even become crusted shut when you awaken in the morning.

Treatment

1. Avoidance of the allergen causing symptoms is the best strategy, but this may not be possible. Environmental controls including use of air cleaners, removal of offending pets and dust control precautions are essential in avoiding allergen exposure. Use of swimming goggles to protect the eyes from exposure may be appropriate.
2. Avoid rubbing or touching your eyes to reduce secondary problems in and around your eyes. Avoid wearing contacts during these times.
3. Cool compresses to the affected area may provide temporary soothing relief of swelling and redness.
4. Eye washes, like artificial tears, flush out the allergens and provide temporary relief.
5. Eye drop solutions such as antihistamine and decongestant eye drops may offer significant relief. Cromolyn eye drops and nonsteroidal anti-inflammatory eye drops may also be of benefit. Occasionally, use of mild ophthalmic steroid eye drops may be required in severe cases of allergic conjunctivitis. Steroid eye drops should be used with great caution. Their use should be supervised

by a physician. Frequent or long term use of corticosteroid eye drops should be undertaken with great caution since their use may be associated with significant side effects.

6. Frequent hand washing reduces the risk of introducing irritant or infectious substances into the eyes.

7. Oral antihistamines help relieve the itchy sensation.
8. Oral corticosteroids (prednisone, Medrol®) can be used for short periods of time for severe symptoms that are unresponsive to other treatments.
9. Allergy injections can reduce allergic reactions over time in both the eyes and nose by lowering sensitivity to various allergens. This form of treatment may also decrease the need for medications. Sublingual immunotherapy is also available for pollen and dust mite allergies. In most allergists' opinions, this is not as effective, however, as subcutaneous immunotherapy, also known as conventional allergy injections.

FIGURE 15 Instructions for Use of Eye Solutions

1. Shake the bottle if necessary.
2. Remove contact lenses if necessary.
3. Tilt your head back.
4. Pull your lower lid away from your eye to form a "pocket" by either (1) pulling your lower lid down with your index finger or (2) pinching the lower lid with your thumb and index finger and pulling out.
5. Shake the bottle if necessary. Hold the bottle upside-down with the other hand, and let a drop fall into the "pocket." Do not let the tip of the bottle touch your eye or eyelid.
6. Close your eyes for at least 20 seconds.
7. Before you open your eyes, wipe the unabsorbed drops and tears from the closed lids with a tissue. If you are taking more than one type of eye medication at the same time, wait three to five minutes before using the second medication.
8. Reapply contact lenses, if applicable, 10 minutes after eye drop use.

You can visualize this technique using the following link:
https://www.youtube.com/watch?v=SnAfc6h4ax4

Alternative Methods

If application of eye drops becomes difficult because of excessive blinking, the same steps can be followed by focusing directly at your eye in a mirror. Alternatively, you can tilt your head to the side and place the eye dropper in the inner corner of your dependent (closest to the ground) eye and allow gravity to spread the solution into the eye. Applying drops in a child's eye may be very difficult. Have the child lie down with the

eyes closed. Place a drop into the inner corner of the eye (nearest to the nose) and then have the child open his/her eyes. The drops should roll into the eye

Important Reminders

Do not touch the tip of the container to your eye or any surface. This may cause contamination (infection) of the eye and of the eye solution inside the container. In addition, most eye solutions have short shelf lives and should be refrigerated. Generally speaking, eye drops should not be applied while wearing contact lenses. Consult with your treating physician if you wear contact lenses and have symptoms suggestive of allergic conjunctivitis.

Here is some general advice about putting ointments in your eyes correctly:

- Always wash your hands before handling medications.
- Begin by expressing and discarding a 1/8-inch of ointment from the tube at each use.
- If applying to your eye's surface, form a pocket by gently pulling the skin of your lower eyelid between your thumb and index finger to create a pocket for the ointment. Then express a 1⁄4 to 1⁄2 inch strip of ointment into the pocket (unless your doctor prescribes a different amount).
- Twist your wrist to break the strip of ointment from the tube.
- After placing the ointment in your eye, blink or close your eyes briefly. Your body heat will melt the ointment so it can spread across the surface of your eyes.
- If you are applying the ointment to the edges of your eyelids, express about a 1⁄2 inch strip of ointment onto your finger and glide it across the length of your closed lids near the base of your lashes.
- Use a soft, clean tissue to remove any excess ointment from the skin around your eyes. Be sure not to disturb the ointment placed in your eyes or on the edges of your eyes.

Medications

Antihistamines

TABLE 20 Antihistamines

Brand Name	Antihistamine
Allegra® Tablets Allegra-D® Extended-Release Tablets®	fexofenadine 30mg, 60mg, 180mg, oral 30mg/5mL
Benadryl®	diphenhydramine 12.5mg, 25mg pill, 12.5mg/5mL elixir
Chlor-Trimeton®	chlorpheniramine maleate 4mg, 8mg, 12 mg tablet, 2mg/5mL syrup
Clarinex®	desloratadine 2.5mg, 5mg tablet, 2.5mg/5mL syrup
Claritin®	loratadine 5mg, 10mg tablet, 5mg/5mL syrup
Claritin-D® 12 or 24 Hour Extended Release Tablets*	loratadine 5mg, 10mg
Claritin RediTabs®	loratadine 10mg tablet
Xyzal®	levocetirizine 5mg tablet, 2.5mg/5mL syrup
Zantac®	ranitidine 75mg, 150mg tablet, 75mg/5mL liquid
Zyrtec®	cetirizine 5mg, 10mg pill, 5mg/5mL syrup
Actifed® Cold and Allergy Tablets	triprolidine HCl 2.5mg
Alavert®	loratidine 5mg, 10mg tablet, 5mg/5mL syrup
Antivert® Tabs	meclizine HCl 12.5mcg, 25mcg, 50mcg
Astelin® Nasal Spray	azelastine HCl 137mcg
Dimetapp® Tablets*	brompheniramine 1mg, 4mg
Doxepin (Sinequan®)**	doxepin 10mg, 25mg, 50mg, 75mg, 100mg capsules, 10mg/mL liquid
Duradryl®*	chlorpheniramine 2mg
Dura-Vent/DA®*	chlorpheniramine 8mg
Extendryl®*	chlorpheniramine 2mg, 4mg, 8mg tablet, 2mg/5mL syrup
Phenergan®	promethazine 12.5mg, 25mg, 50mg pill, 6.25mg/5mL, 25mg/5mL syrup
Rynatan®*	chlorpheniramine 8mg tablet, 2mg/5mL oral suspension
Semprex-D® Capsules	acrivastine 8mg
Sinutab® Sinus Allergy Medication Tablets	chlorpheniramine 2mg
Viravin-S®*	pyrilamine 30mg/5mL
Viravin-T®	pyrilamine 25mg

**Medication also includes a decongestant*
***Medication also has antidepressant activity*

Antihistamines work by competing with histamine released by mast cells and basophils for histamine receptors on the mucosa of the eyes, nose, bronchial airways and skin. The antihistamine binds to the receptor and prevents histamine attachment, thereby blocking the effect of histamine in the tissues. Antihistamines are most helpful in controlling itching of the eyes, nose, throat and skin. Antihistamines can control sneezing. Antihistamines can be divided into classical and non-sedating antihistamines. Generally, you should respond well to antihistamines of either group. However, the ultimate selection of an antihistamine is individualized by **The Asthma Center** allergists. Some common antihistamines are listed above in Table 20.

Use:

Although antihistamines are not directly effective agents in the control of asthma, they can be helpful in controlling upper respiratory allergy symptoms that often worsen asthma. Many years ago their use was thought to worsen asthma. Product information labels of older classical antihistamines still reflect this view, which has not been borne out by clinical experience. Antihistamine therapy generally can safely be used. In fact, they may indirectly benefit you by suppressing symptoms of itchy eyes and nose and sneezing if allergic symptoms accompany asthma. Consequently, you may benefit from antihistamine therapy as part of your overall treatment of asthma.

Although occasionally you may have mild worsening of your asthma as a result of taking antihistamines, this is not a common problem. Therefore, **The Asthma Center** allergists may recommend classical and/or non-sedating antihistamines if you have nose, throat and eye allergies.

Risks and Precautions:

Many antihistamine package inserts note the need for avoiding antihistamines in asthma. **The Asthma Center** allergists can test for your particular sensitivity. As noted above, generally you will not experience asthma flares with antihistamine use.

Examples of the newer (non-sedating or modestly sedating) antihistamines include:

- **fexofenadine** (Allegra®), non-sedating
- **loratadine** (Claritin®), **desloratadine** (Clarinex®), non-sedating
- **cetirizine** (Zyrtec®), less sedating than classical antihistamines, but not non-sedating
- **topical azelastine** (Astelin®), low sedation, only because it is topical
- **levocetirizine** (Xyzal®), mildly sedating

Antihistamine Side Effects:

- Fatigue and drowsiness (classical antihistamines)
- Dry mouth, nausea, gastritis, stomach ache (classical antihistamines)
- Dizziness, excitement, personality changes, irritability
- Central nervous system depression if used with alcohol and other drugs
- Tendency to worsen glaucoma, urinary tract obstructions (classical antihistamines)
- Abnormalities of the blood
- Slowed reflexes (classical antihistamines)

Nasal Sprays

Nasal sprays are a topical approach for the treatment of allergies, which allow direct administration of the medications to the involved area (nasal cavity). This avoids many of the systemic side effects seen with medications that come in pill and liquid form. These topical medications include antihistamines, anticholinergics, mast cell inhibitors and corticosteroids *(see Table 21)*.

TABLE 21 Nasal Sprays

Brand Name	Active Ingredient	Concentration	Dose
Astelin®	azelastine (antihistamine)	137mcg/spray	5-11 years of age: 1 spray per nostril 2x/day 12 years and older: 2 sprays per nostril 2x/day
Atrovent®	ipratroprium (anticholinergic)	0.03mcg/spray, 0.06mcg/spray	1-2 sprays per nostril 2-3x/day
Afrin®	oxymetazoline (decongestant)	0.025mcg/spray, 0.05mcg/spray	2-3 sprays per nostril 2x/day
Clarispray®	fluticasone propionate (corticosteroid)	50mcg/spray	1-2 sprays per nostril 1x/day
Dymista®	azelastine (antihistamine) and fluticasone (steroid)	azelastine HCl 137mcg, fluticasone propionate 50mcg	1 spray per nostril 2x/day
Flonase®	fluticasone propionate (corticosteroid)	50mcg/spray	Adults: 2 sprays per nostril 1x/day initially, 1 spray per nostril 1x/day for maintenance Children and Adolescents 4 years and older: 1 spray per nostril 1x/day initially, 1 spray per nostril 1x/day for maintenance
Flonase® Sensimist™	fluticasone furoate (corticosteroid)	27.5mcg/spray	2-11 years of age: 1 spray per nostril 1x/day 12 years and older: 2 sprays per nostril 1x/day
Nasacort® AQ	triamcinolone acetonide (adrenocortical steroid)	55mcg/spray	2-12 years of age: 1 spray per nostril 1x/day initially and for maintenance 13 years and older: 2 sprays per nostril 1x/day initially, 1 spray per nostril 1x/day for maintenance
Rhinocort® Allergy Spray, Rhinocort® Aqua®	budesonide (corticosteroid)	32mcg/spray	6 years and older: 1-2 sprays per nostril 1-2x/day
Omnaris®	ciclesonide (steroid)	50mcg/spray	6 years and older: 2 sprays per nostril 1x/day
Patanase®	olopatadine HCl (antihistamine)	600mcg/spray	6-11 years of age: 1 spray per nostril 2x/day 12 years and older: 2 sprays per nostril 2x/day
Nasonex®	mometasone furoate monohydrate (steroid)	50mcg/spray	2-11 years of age: 1 spray per nostril 1x/day 12 years and older: 2 sprays per nostril 1x/day
QNASL®	beclomethasone dipropionate (corticosteroid)	40mcg/spray, 80mcg/spray	4-11 years of age: 1 spray per nostril 1x/day 12 years and older: 2 sprays per nostril 1x/day
Zetonna®	ciclesonide (steroid)	37mcg/spray	12 years and older: 1 spray per nostril 1x/day
Ocean®, Ayr®, Baby Ayr®	sodium chloride (saline solution)	0.9% (isotonic)	2 sprays per nostril as needed
Sinus Buster® Nasal Spray	capsaicin (active component of chili peppers)	1000M attenuation on Korsakovian Scale	1-2 sprays per nostril 1-2x/day
Beconase AQ®	beclomethasone (corticosteroid)	42mcg/spray	6 years and older: 1-2 sprays per nostril 2x/day
Nasalcrom®	cromolyn sodium (mast cell inhibitor)	5.2mg/spray	2 years and older: 1 spray per nostril 3-4x/day

Decongestants

Decongestants constrict blood vessels, drying out secretions in the eyes and nose and reducing swelling of the mucosal tissue caused by histamine release from mast cells during allergic reactions. They help reduce excessive upper airway secretions and post nasal drip from allergy and sinus disease that trigger asthma symptoms. Many decongestants also contain an expectorant (*see Expectorants, page 63 and Table 23 below*).

TABLE 23

Decongestants

Brand Name	Decongestant	Expectorant
Deconsal® II (Carolina)	phenylephrine 20mg	guaifenesin 375mg
Deconsal® II (Celltech)	pseudoephedrine 60mg	gauifenesin 600mg
Dimetapp® Decongestant Pediatric Drops	pseudoephedrine 7.5mg/0.8mL	
DuraTuss® Tablets	phenylephrine 25mg	gauifenesin 600mg
DuraTuss® GP Tablets	phenylephrine 25mg	gauifenesin 1200mg
Entex LA®	phenylephrine 30mg	gauifenesin 600mg
Entex Liquid®	phenylephrine 7.5mg/5mL	gauifenesin 100mg/5mL
Entex PSE®	pseudoephedrine 120mg	gauifenesin 600mg
Guaifed® Capsules reformulated (pink and white)	phenylephrine 15mg	gauifenesin 400mg
Guaifed-PD® Capsules reformulated (pink and white)	phenylephrine 7.5mg	gauifenesin 200mg
Nasatab® LA Tablets	pseudoephedrine 120mg	gauifenesin 500mg
Profen Forte®	pseudoepherine 90mg	gauifenesin 800mg
Prolex®-D Tablets	phenylephrine 20mg	gauifenesin 600mg
Prolex®-PD Tablets	phenylephrine 10mg	gauifenesin 600mg
Pseudovent™ (blue and white)	pseudoephedrine 120mg	gauifenesin 250mg
Pseudovent™-PED (blue and white)	pseudoephedrine 60mg	gauifenesin 300mg
Robitussin®	pseudoephedrine 30mg	gauifenesin 100mg/5mL
SINA®-12X	phenylephrine 25mg	gauifenesin 200mg
SINA®-12X Suspension	phenylephrine 5mg/5mL	gauifenesin 100mg/5mL
Sudafed® Children's Nasal Decongestant Liquid	pseudoephedrine 15mg/5mL	
Sudafed® Nasal Decongestant Tablets	pseudoephedrine 30mg	
Sudafed® 12 Hour Tablets	pseudoephedrine 120mg	
Sudafed® 24 Hour Tablets	pseudoephedrine 240mg	
Zephrex LA®	pseudoephedrine 120mg	gauifenesin 600mg

Risks and Precautions:

- Dry mouth, loss of appetite, thickened secretions
- Tachycardia, palpitations, rise in blood pressure
- Headaches, insomnia, nervousness, depression
- Urinary retention, gastrointestinal upset

Ophthalmics (eye drops)

Ophthalmics are a topical approach for the treatment of allergies, which allow direct administration of the medications to the involved area (the eyes). Some common ophthalmic medications are listed in Table 24.

TABLE 24 Ophthalmics

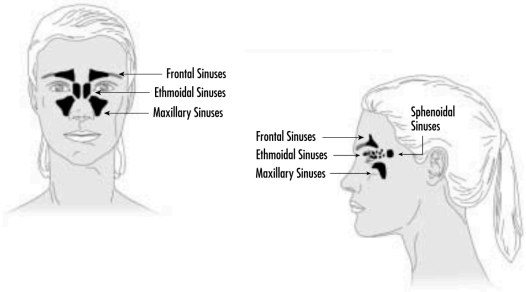
Brand Name	Active Ingredient	Concentration	Dose
Acular®	ketorolac tromethamine	5mg/1mL	1 drop per affected eye 4x/day
Alaway® (OTC)	ketotifen	0.025%	Children 3 years and older: 1 drop in affected eye 2x/day Adults: 1 drop in affected eye 2x/day
Alocril®	nedocromil	20mg/1mL	1-2 drops per eye 2x/day
Alomide®	lodoxamide ophthalmic	1mg/1mL	2 years and older: 1-2 drops per affected eye 4x/day
Alrex®	loteprednol	2mg/1mL	1 drop per affected eye 4x/day
Bepreve®	bepotastine besilate	15mg/1mL	1 drop per affected eye 2x/day
Crolom®	cromolyn sodium	40mg/1mL	1-2 drops per eye 4-6x/day
Elestat®	epinastine HCl	0.5mg/1mL	1 drop per eye 2x/day
Emadine®	emedastine	0.5mg/1mL	1 drop per affected eye 4x/day
Lastacaft®	alcaftadine	2.5mg/1mL	1 drop per eye 1x/day
Naphcon A® (OTC)	naphazoline/pheniramine	naphazoline 0.025%, pheniramine 0.3%	1-2 drops per eye up to 4x/day
Opcon-A® (OTC)	naphazoline HCl/ pheniramine maleate	naphazoline HCl 0.2675mg/1mL, pheniramine maleate 3.15mg/1mL	6 years and older: 1-2 drops per eye up to 4x/day
Optivar®	azelastine HCl	0.5mg/1mL	1 drop per affected eye 2x/day
Pataday®	olopatadine HCl	2mg/1mL	1 drop per affected eye 1x/day
Patanol®	olopatadine HCl	1mg/1mL	1 drop per affected eye 2x/day
Pazeo®	olopatadine HCl	7mg/1mL	1 drop per affected eye 1x/day
Restasis®	cyclosporine	0.5mg/1mL	1 drop per affected eye 2x/day
Tobradex®	tobramycin/ dexamethasone	tobramycin 3mg/1mL, dexamethasone 1mg/1mL	1-2 drops per eye 4-6x/day
Vigamox®	moxifloxacin HCl	5mg/1mL	1 drop per affected eye 3x/day
Zaditor® (OTC)	ketotifen fumarate	0.025%	1 drop per affected eye 2x/day
FML Ophthalmic Ointment® (FML® Liquifilm®)	flurometholone	1mg/1mL	Small amount applied to conjunctival sac 1-3x/day

Asthma and Sinusitis

It has often been observed that sinusitis can trigger asthmatic symptoms. Sinusitis is a term for inflammation and/or infection of the mucous membranes of the sinus cavities. The sinuses are hollow air spaces located within the skull surrounding and connecting to the nasal passageway. The four sets of sinuses include the frontal sinuses which are located over the eyes and the brow area, the maxillary sinuses which

are inside each cheekbone, the ethmoid sinuses which are in between the eyes and just behind the bridge of the nose, and the sphenoid sinuses which are behind the ethmoid sinuses in the upper region of the nose *(see Figure 16)*

FIGURE 16 Your Paranasal Sinuses



Each sinus has an opening into the nose for the free exchange of air and mucus. Each sinus is lined with a continuous mucous membrane. Therefore, anything that causes swelling and inflammation of the nasal mucous membranes including allergic reactions or viral and/or bacterial infections can similarly affect the sinuses. Air trapped within obstructed sinuses along with thick mucus or pus may also produce pressure on the sinus walls. This results in the intense pain of a sinus attack. When swollen membranes at the opening of a sinus prevent air from entering, a vacuum that causes similar sinus pain can be created. A stuffy nose and loss of the sense of smell may be signs of sinusitis. Post nasal drip with sore throats, hoarseness and persistent cough may also be symptoms of chronic sinus disease. The combination of allergic and infectious sinusitis is considered to be the most difficult form of sinus disease to treat. If you have uncontrolled nasal allergies, you may experience a high degree of congestion, swelling and excess secretions as well as discomfort in the nose and sinus areas. In addition to allergies, medications may also set off reactions in the nose and paranasal sinuses. For example, intolerance to aspirin has been associated with bronchial asthma, nasal polyps and chronic sinusitis.

Chronic sinusitis may be associated with asthmatic attacks. Control of sinusitis, either medically and/or surgically, is an important part of management if you have bronchial asthma.

Prevention and Treatment of Sinusitis

Sinus disorders cannot be prevented any more than colds or bacterial infections can be avoided. However, certain measures can be taken to reduce the number and severity of attacks of sinus disease. In particular, if you have sinusitis, you may find partial relief from your symptoms with the use of a humidifier, especially when the room is heated by dry forced-air and has little humidity. Air-conditioning helps control temperatures and humidity during the summer months. Electrostatic air cleaning and HEPA filters in the heating system and air-conditioning units reduce dust, pollen and other airborne irritants in the home. Cigarette smoke and other air pollutants should be avoided if you are susceptible to sinus disease or if you suffer from respiratory allergy. Alcoholic beverages also may cause swelling of the nasal or sinus membranes, and therefore ingestion should be limited.

If you are prone to sinusitis, you may be uncomfortable in swimming pools treated with chlorine since this substance is irritating to the lining of the nose and the sinuses. Divers can experience congestion and infection when water is forced into the sinuses or the nasal passage as well as from pressure effects when sinus disease is active.

Air travel can pose a problem if you suffer from respiratory allergies, chronic sinusitis, or an acute respiratory infection. Air trapped within the body expands as air pressure in a plane is reduced. This expansion causes pressure on the surrounding tissues and can cause blockage of the sinuses or eustachian tubes. The result may be a sudden and severe discomfort in the sinuses and middle ear as the plane ascends or descends. The use of nasal decongestant sprays and oral decongestants as well as chewing gum may be of benefit prior to flying or descending to land to prevent or lessen these difficulties.

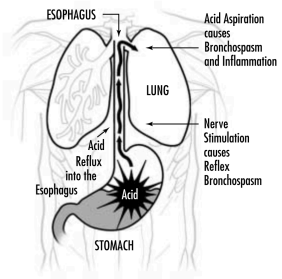
Treatment of sinusitis is aimed at reestablishing an open connection between the sinuses and the nasal passages, decreasing mucus production, controlling inflammation and infection as well as relieving the pain. To accomplish this, your asthma specialists may prescribe medications to reduce congestion, antibiotics for bacterial infection and pain medications to relieve discomfort. Medications to reduce mucus production and thin the mucus also may be prescribed. If you are not responding to treatment, you may require allergy injection therapy to control the allergic aspect of your sinus disease. Sinus infections cannot be cured by home remedies, but the discomfort that accompanies sinus problems may be lessened by inhaling steam from a hot shower or vaporizer, or by applying hot water bottles, warm wet compresses, or an electric heating pad applied to the inflamed area. Short term use of nasal decongestant sprays also may provide temporary relief.

When chronic sinus infections cannot be eliminated by medical therapy, surgery known as functional endoscopic sinus surgery may be required. Children with marked enlargement of the adenoids contributing to their sinusitis may benefit from an adenoidectomy (removal of adenoid tissue in the nasopharynx). If you have had allergies and/or aspirin intolerance, you may develop nasal polyps (small growths in the membranes of the sinuses), which interfere with proper drainage. Removal of these polyps and, in some cases, repair of a septal deviation (the septum is the bony partition separating the 2 nasal passages) often provide considerable relief of symptoms if you have chronic sinusitis.

Gastroesophageal Reflux Disease (GERD)

Gastroesophageal Reflux Disease (GERD), or the backward flow of acid from the stomach into the esophagus (food tube connecting the mouth to the stomach), can cause local esophageal irritation (heartburn) as well as asthma *(see Figure 17)*.

FIGURE 17 Gastroesophageal Reflux Disease (GERD) And Asthma



This problem is most apt to occur at night while lying down in bed or soon after eating. Local irritation in the esophagus can cause symptoms that vary from indigestion-like chest discomfort (heartburn) and abdominal pain to coughing and wheezing. If the gastric acid reaches the back of the throat, it may cause a bitter taste in the mouth and/or aspiration of the gastric acid into the lungs. The acid can cause throat irritation, post nasal drip and hoarseness as well as recurrent cough, chest congestion and lung inflammation leading to asthma and/or bronchitis/pneumonia.

GERD causes asthma in two ways:

- By irritating sensitive asthmatic airways following inhalation of even tiny amounts of stomach acid and/or
- By nerve stimulation of the vagus nerve in the wall of the esophagus directly triggering bronchospasm (airway muscle contraction).

Effective control of GERD, therefore, is an important part of treating asthma or other respiratory disorders caused by stomach acid. Gastroesophageal reflux is more likely to occur after ingestion of certain foods and beverages, large evening meals and bedtime snacks. It is more likely to occur in the presence of excessive body weight, tight fitting clothes and constipation. Alcoholic beverages, peppermint, tobacco and caffeine stimulate the production of stomach acid, which can increase the likelihood of GERD symptoms. Excess body weight increases the chance that the valve between the esophagus and stomach will leak stomach acid contents. Tight clothes about the waist put pressure on the stomach and can promote reflux during daytime hours. Decreased gastrointestinal motility (i.e. movement of food in the bowels) and constipation increase the chance of GERD as well. There are a number of simple measures you can per- form to reduce or eliminate symptoms of GERD. Medications can also help, but they are not as effective without the following simple measures:

1. Eat small meals.
2. Wear loose or properly fitted clothing.
3. Avoid caffeine (cola drinks, coffee, tea), chocolate, alcohol, and peppermint.
4. Use 2 tablespoons of a high potency liquid antacid (e.g. Maalox®) alone or with the use of an H_2 blocker or proton pump inhibitor (see Table 24) 1 hour before or 2 hours after meals and at bedtime for troublesome symptoms of heartburn and indigestion.

TABLE 24

H_2 Blockers and Proton Pump Inhibitors (PPI)

H_2 Blockers	Proton Pump Inhibitors (PPI)
Axid®/ Axid AR® (nizatidine)	Aciphex® (rabeprazole)
Pepcid®/ Pepcid AC® (famotidine)	Dexilant® (dexlansoprazole)
Tagamet® (cimetidine)	Nexium® (esomeprazole)
Zantac® (ranitidine)	Prevacid® (lansoprazole)
	Prilosec® (omeprazole)
	Protonix® (pantoprazole)
	Zegerid® (omeprazole and bicarbonate)

5. Raise the head of the bed 6-8 inches by inserting 2-3 bricks or a single block under each front bedpost. Do not leave the bed flat or use pillows to elevate your head and back. Pillows are not effective because they raise only the head and neck rather than the chest, and this position tends to place pressure on the contents of the stomach at the waist.
6. Remain upright at least 2 hours after eating.
7. Lose excess body weight (obesity is a major cause of GERD).
8. Avoid constipation by drinking fluids, increasing dietary fiber and participating in regular exercise.
9. Stop smoking.
10. Avoid aspirin and aspirin-like medications.

Certain medications may cause gastrointestinal upset and may worsen heartburn symptoms. Among these are two medications, which are commonly used for the treatment of asthma: oral corticosteroids (prednisone and Medrol®) and theophylline. Your asthma specialists should take into consideration the presence of GERD when prescribing medications for control of asthma. Blood levels of theophylline are closely followed as elevated theophylline levels in the blood are associated with more frequent occurrences of nausea, stomach upset and vomiting.

After careful individual consideration of your symptoms, your physicians may determine that your condition requires the use of theophylline and/or oral corticosteroids to provide more effective control of your breathing problem. In addition, your physician may use medications to reduce or prevent the production of stomach acid (H_2 blocker or pro- ton pump inhibitor), especially when using theophyllines and oral corticosteroids. In extreme cases of GERD that do not respond to medications, surgical procedures may be an alternative treatment.

Laryngopharyngeal Reflux

Laryngopharyngeal reflux often presents with a chronic cough that can mimic the cough associated with asthma.

Definition and Symptoms:

If you suffer from laryngopharyngeal reflux (LPR), it is likely you complain of dry cough, chronic throat clearing, post nasal drip, intermittent hoarseness, thick or large amounts of post nasal mucus in the throat, heartburn, a sensation of something being stuck in the throat ("globus sensation") and/or difficulty swallowing. These symptoms develop from acid produced in the stomach backing up or refluxing into the throat and voice box (larynx). This is in contrast to gastroesophageal reflux (GERD) where acid regurgitates only to the level of the esophagus, the food pipe between the mouth and stomach, not the throat *(see Table 24)*. Acid that persistently pools in the throat and/or voice box causes chronic irritation and inflammation resulting in the symptoms of LPR.

TABLE 25

Laryngopharyngeal Reflux (LPR) v. Gastroesophageal Reflux (GERD)

	LPR	GERD
Main symptoms	• post nasal drip • sensation of something stuck in the throat • intermittent hoarseness	• heartburn
Site of inflammation	• larynx	• esophagus
Treatment	• proton pump inhibitors • fundoplication surgery in extreme cases	• antacids • H_2 receptor blockers • proton pump inhibitors • fundoplication surgery in extreme cases
Length of treatment	• 6 months	• 2 – 3 months

Diagnosis:

Laryngopharyngeal reflux (LPR) may be confused with allergies, asthma and/or GERD because of several shared symptoms. The diagnosis of LPR is based on symptoms and a careful examination of the nose, throat and voice box (larynx). LPR usually is not accompanied by evidence of lower esophageal inflammation or esophagitis or complaints of heart- burn.

Laryngopharyngeal reflux (LPR) may be confused with allergies, asthma, and/or GERD.

A flexible fiberoptic laryngoscope is a thin flexible fiberoptic lens that allows the physician to look directly at your voice box and throat. This examination is usually done after the nose and throat have been decongested and numbed with a local anesthetic. Redness and swelling of the laryngeal tissues support a diagnosis of LPR. This exam may also rule out other possible voice disorders that can mimic the symptoms of LPR.

If symptoms do not resolve with medical treatment, a special examination of acid movement in the esophagus can be performed. This procedure, called ambulatory 24 hour pH monitoring, can be carried out as an outpatient and involves inserting a tiny tube through the nose into the esophagus. Monitors on the tube can measure and record the amount of acid that backs up in the lower (distal probe) and upper (proximal probe) portions of the esophagus.

Treatment:

Treatment of LPR can include behavioral modification, posture changes during sleep, weight reduction, diet modifications, medications to reduce stomach acid or to promote esophageal motility (clearance of food and acid) and surgery. If you have LPR, you should avoid smoking since it can cause reflux. Avoidance of tight fitting clothing around the waist, eating at least 3 hours prior to bedtime, avoidance of large meals at night and weight loss may all improve your condition. Foods that exacerbate reflux should be avoid- ed, such as caffeine, cola drinks, citrus beverages, mints, alcoholic beverages, cheese, fried food, chocolate and eggs. Elevating the head of the bed by 6 inches will also decrease reflux significantly at night.

Medical treatment usually includes proton pump inhibitor medications that reduce acid secretion. Symptoms usually resolve after at least 2 months of treatment but may take as long as 6 months. Follow-up examination of the larynx shows slow resolution of the inflammation, but symptoms may return if treatment is stopped too quickly. Most experts believe that treatment should be ongoing for at least 6 months. In refractory cases, a surgical procedure called fundoplication is done, which tightens the lower esophageal sphincter, thus reducing reflux.

Chronic Cough

Chronic cough can be the first sign of developing asthma. However, there are many causes of chronic cough aside from asthma that need to be considered.

Coughing functions as a natural response to irritation of the airway, by removing mucus and other irritants, thus cleansing the airways. It is also a protective mechanism for expelling foreign substances and mucus that may obstruct the airway. Coughing, which is an explosive expiration (a fast and forceful breath out), can clear or dislodge dangerous objects, particles, irritants and mucus from the airway. A major function of coughing is the clearance of accumulations of mucus and the removal of "sticky" or thick secretions containing bacterial, viral, or toxic materials.

Coughing commonly follows infections (e.g. "colds") of the nose, throat, sinuses, trachea, bronchi and/or lungs. However, a persistent cough that lasts many weeks or months is not normal and may be a sign of an underlying disease. Coughing is mostly a non-voluntary automatic reflex action based on irritation of the bronchial or upper airway mucosa. Rarely it results from irritation outside of the respiratory mucosa. The exceptions to this include irritation of the ear canal, pleural inflammation (the membrane around the lungs), lung tumors and heart disease.

When present for more 4 or more weeks, the cough is considered to be chronic. In contrast, an acute cough usually lasts less than 3 weeks. Chronic cough can be a serious health issue. It is often associated with many additional symptoms including: loss of sleep, chest pain, sore throat, vomiting, stress incontinence (urine leakage), fainting, dizziness, social problems and inability to function at home, school, or work. A chronic cough can be quite painful, and at times, disabling.

Chronic cough is one of the most common symptoms for which you may seek medical attention. Identification of the cause of a persistent or chronic cough can be particularly challenging. The cause of an acute cough is often diagnosed early in the process since the cause is usually easy to diagnose and treat. Common causes of acute short term coughing include upper respiratory viral infections, such as the common cold, acute bacterial sinusitis, nasal allergies and occasionally lower respiratory disorders, such as viral bronchitis, pneumonia and acute flares of asthma. In these instances, the cause of the cough is usually

apparent after some investigation and often quite responsive to treatment.

The diagnosis of a chronic cough is usually more difficult since the cause is often atypical in its appearance or simply uncommon. However, an in-depth evaluation can often accurately diagnose the cause of the chronic cough. A treatment approach will have a good chance of success if the diagnosis is accurate.

A persistent cough that lasts weeks or months is not normal and may be a sign of an underlying disease.

Chronic cough may be a sign of the airway's natural response to:

- Altered mucus quality or quantity (e.g. chronic bronchitis, chronic sinusitis)
- Increased sensitivity of cough receptors* (e.g. asthma, cigarette smoking)
- Inhalation of an irritant (e.g. gastroesophageal reflux, neurological disease)
- Direct stimulation of cough receptors* (e.g. tumors, thyroid enlargement, inhaled foreign body)
- Indirect stimulation of cough receptors* (e.g. lung disease, heart failure)
- Psychological causes (e.g. cough tic)
- Tumor in the lung

**Cough receptors are sensitive sites on the respiratory mucosa that can be stimulated by pressure, inflammation, or irritation to cause a cough.*

Chronic cough may last for years, causing unnecessary discomfort because a correct diagnosis has not been made and effective treatment has not been started. Further, a chronic cough may be a warning sign of a major medical problem, which, if identified early in its course, may potentially respond to effective treatment (e.g. lung cancer). The correct diagnosis of the cause of a chronic cough can result from taking a careful and complete history, listening to the quality of the cough, physical examination, x-rays, allergy testing, lung function tests and other specialized studies such as endoscopies and laboratory (blood) studies. Treatment is dependent on the underlying disease process. Effectively treating the under- lying disease process causing the cough will resolve the problem in most cases. Gabapentin (Gralise®, Horizant®) is a medication, typically used for epilepsy and neuropathic pain, which has recently been used as a suppressant for refractory chronic cough.

Common Causes of Chronic Cough

- Allergy of the nose, throat and sinus (chronic post nasal drip)
- Post infection (following a cold or other respiratory infection)
- Chronic sinusitis
- Gastroesophageal reflux (GERD, acid reflux, or heartburn)
- ACE inhibitors (blood pressure medications)
- Asthma (cough-variant)
- Chronic bronchitis
- Cigarette smoking
- Psychological causes

Uncommon Causes of Chronic Cough

- Lung cancer
- Laryngeal cancer (cancer of the voice box)
- Throat cancer
- Congestive heart failure
- Other pulmonary diseases (i.e. cystic fibrosis)
- Foreign body inhalation
- Cardiac arrhythmia (abnormal heart rhythm)
- Interstitial lung disease (scarring of lung tissue)
- Pleural disease (disease of the membrane surrounding the lungs)
- Pressure on the lungs (e.g. tumors, cysts, blood vessels)

Vocal Cord Dysfunction: A Medical Condition that Mimics the Symptoms of Asthma

Asthma is commonly associated with symptoms of chest tightness, shortness of breath, coughing and/or wheezing. Although these symptoms are mostly associated with asthma, they actually may be signs of an entirely different respiratory problem. The statement "all that wheezes is not asthma" is well known to allergists, and this is particularly true of the condition known as vocal cord dysfunction (VCD) or paradoxical vocal cord adduction. Unlike asthma, vocal cord dysfunction is caused by a restriction of air flow in the upper airway resulting from sudden spasm or constriction of the vocal cords. If you suffer from vocal cord dysfunction, you usually present with symptoms of troubled breathing and/or wheezing. Since these symptoms are so similar to those of asthma, it is possible to be initially misdiagnosed as having asthma. This is why a specialist should perform a comprehensive evaluation if you are presenting with symptoms of coughing, wheezing, or shortness of breath before labeling you with the diagnosis of asthma. Vocal cord dysfunction results in symptoms when the vocal cords pull together tightly during inspiration (breathing in), thus closing off or narrowing the passageway of the upper airway. This results in symptoms of shortness of breath and noisy breathing due to the restricted air flow, which becomes most prominent during inspiration. Although whistling sounds heard during inspiration may bear some similarity to wheezing, they have a higher pitched quality than the typical wheezing usually heard in asthma. In contrast, asthmatic wheezing is most prominent during expiration (breathing out). The sound due to vocal cord dysfunction is most prominent during inspiration (breathing in), and this sound has been termed stridor. If you have VCD, but have been misdiagnosed with asthma, it is not surprising that you may be treated unsuccessfully with medications designed for asthma. You could be admitted to emergency rooms and even hospitalized while continuing to be misdiagnosed and treated for asthma. Failure to recognize vocal cord dysfunction often leads to usage of even more potent asthma medications (e.g. corticosteroids) in an effort to control persistent symptoms. However, it should be noted that occasionally both vocal cord dysfunction and asthma can coexist. In this situation, both respiratory disorders will need to be treated simultaneously in order to fully control symptoms. In addition to difficulty breathing, you may commonly complain of throat tightness, hoarseness and difficulty getting air in more than out. Episodes of vocal cord dysfunction often occur more during the day than at night, while poorly controlled asthma symptoms are often worse at night. Asthma inhalers, nebulizer treatments and even steroids (prednisone) do not help vocal cord dysfunction unless you also have asthma. Vocal cord dysfunction can be triggered by stress, exercise and irritants (like gas, smoke, fumes, dust, cleansing agents, pungent odors, solvents), but in many cases the cause is unknown.

Treatment usually involves working with a speech pathologist and a behavioral therapist. Occasionally Botox® injections temporarily can relax vocal cords. Surgical intervention is rarely necessary.

FIGURE 18

Appearance of Vocal Cords During Normal Inhalation (A) and Inhalation with Vocal Cord Dysfunction (B)

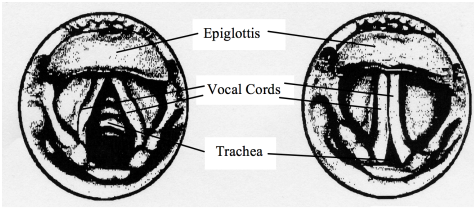


TABLE 26

Asthma vs. Vocal Cord Dysfunction

Feature	Asthma	Vocal Cord Dysfunction
Age	Not specific	Adolescent predominance
Sex	Equal male and female	Female predominance
Symptoms	Wheeze Worse at night Expiration difficulty Rapid onset / gradual resolution	Stridor Least at night Inspiration difficulty Rapid onset / rapid resolution
Trigger	Infection Stress Exercise Allergies Cold air Irritant odor / smell	Stress Exercise Irritant odor / smell
Physical exam	Wheeze in lung during expiration	"Wheeze" (stridor) over neck during inspiration
Chest x-ray	Over inflation	Normal
PFT	Expiration abnormal	Inspiration abnormal
Laryngoscopy	Normal vocal cord movement	Abnormal vocal cord movement
Treatment	Bronchodilation / anti-inflammatory	Speech and behavioral therapy

Chronic Obstructive Pulmonary Disease (COPD)

Chronic obstructive pulmonary disease, or COPD, refers to a group of lung diseases that are associated with

difficulty in breathing (shortness of breath) due to obstruction of the bronchial airway and/or poor oxygenation of the blood due to damaged alveoli (air sacs of the lung tissue). The two chief types of COPD include chronic bronchitis and emphysema. Asthma and COPD can present with similar symptoms, which can lead to errors in diagnosis.

COPD is the third leading cause of death in the United States and Canada. It affects approximately 15 million Americans and causes 100,000 deaths each year. Ninety percent of all COPD cases are caused by chronic cigarette smoking. However, a small percentage of individuals with emphysema have an inherited type of disease, known as alpha-1 antitrypsin Deficiency, or develop COPD from occupational or environmental exposures.

The two most common types of COPD are chronic bronchitis and emphysema. It is possible to have one or both of these diseases.

Chronic bronchitis causes inflammation of the air passageways in the lungs (bronchial tubes) and increased mucus production. The mucous glands are enlarged and produce excessive amounts of mucus. This often causes a chronic cough. As the inflammation progresses over time, the airways become narrow and irreversibly obstructed. If you suffer from chronic bronchitis, it is likely you experience symptoms of coughing and increased sputum as well as shortness of breath and wheezing.

Emphysema is a disease caused by damage to the lung tissues called alveoli where oxygen and carbon dioxide exchange occurs. Cigarette smoking is the most common cause of destruction of these air sacs, leading to an inability to absorb oxygen into the lungs. If you suffer from emphysema, shortness of breath is often the primary symptom, although symptoms of coughing and wheezing may also be prominent.

With COPD, you will often have elements of both chronic bronchitis and emphysema, rather than purely one or the other. Early in the disease process, symptoms may be obvious only when you have a "chest cold" or during strenuous physical exertion. In between these periods, you may feel quite well and be free of symptoms. Unfortunately, your COPD will progress silently over time, causing ever more permanent lung damage, especially if you continue to smoke cigarettes. Inevitably, symptoms become more frequent over time, and eventually symptoms of coughing, shortness of breath and wheezing become disabling, requiring you to use supplemental oxygen to carry out simple everyday chores. In the worst cases, COPD causes the heart to fail, and you can ultimately succumb to your disease.

COPD is usually caused by cigarette smoking, while asthma is not. But, asthma may be worsened by it.

COPD is an obstructive airway disease, and in this way it is quite like asthma. In fact, early in COPD development, you may have very similar symptoms to those seen in asthma (e.g. coughing, wheezing and shortness of breath). However, the cause of COPD is usually due to cigarette smoking, and the resulting inflammation is different than the inflammation found in the asthmatic airway, thus leading to an entirely different outcome.

COPD is often misdiagnosed as asthma early in its development. While the obstructive nature of asthma and COPD may be similar in some ways, they are two very different diseases.

Asthma and COPD differ in many ways. COPD is usually caused by cigarette smoking, while asthma is not caused by smoking, although it will be worsened by smoking. Asthma is frequently associated with allergy while COPD is not. Asthma

is usually highly responsive to medications, and avoidance of symptom triggers usually results in significant reversibility of airway obstruction. In contrast, the airway obstruction in COPD shows milder levels of reversibility with treatment. However, the progression of COPD may be stopped or slowed down with smoking cessation. An allergist or pulmonologist can tell the difference between asthma and COPD and offer appropriate treatment.

Finally, it should be realized that asthma and COPD can coexist. This is known as Asthma COPD Syndrome (ACOS). If you have asthma and smoke cigarettes for years, it would not be unusual for you to develop COPD. In this case, both COPD and asthma coexist (ACOS). Patients with ACOS tend to have a poorer prognosis than those with just COPD.

Treatment:

Although treatment will not reverse permanent lung damage that has already occurred, it can slow down or stop further damage, offer relief from symptoms, increase the quality of life and increase the duration of your life span.

Treatment includes:

- Smoking cessation - This is the only way to stop the relentless progress of COPD *(see Smoking Cessation, page 99)*
- Bronchodilators (albuterol, Serevent® Diskus®, Foradil® Aerolizer®, Arcapta® Neohaler®, Striverdi® Respimat®, Ventolin®, Nebulized solutions – AccuNeb®, Xopenex®, etc.) *(see β_2-Agonists, page 44)*
- Anticholinergic medications (ipratropium bromide – Atrovent®, Combivent®; tiotropium bromide – Spiriva® HandiHaler®, Spiriva® Respimat®; glycopyrrolate – Seebri™ Neohaler®; umeclidinium bromide – Incruse® Ellipta®; aclidinium bromide – Tudorza® Pressair®) *(see Anticholinergic Medications, page 59)*
- Long acting anticholinergics (LAMA) combined with long acing bronchodilators (LABA): Duaklir Pressair® (aclidinium/formoterol), Bevespi Aerosphere® (glycopyrrolate/formoterol), Utibron Neohaler® (glycopyrrolate/indacaterol), Stiolto Respimat® (tiotropium/olodaterol), Anoro Ellipta® (umeclidinium/vilanterol)
- Inhaled corticosteroids or combined with bronchodilators (Advair Diskus®, Breo® Ellipta®, etc.) *(see Corticosteroids, page 50)*
- Theophyllines *(see Methylxanthines, page 41)*
- Antibiotics (when infection is present)
- Oxygen - continuous and on demand (if required)
- Pulmonary rehabilitation (reconditioning)
- Surgery - lung reduction surgery/transplantation

The Goals of COPD Treatment

Aside from relieving symptoms, it is important to realize that you can affect the natural history of your disease by beginning treatment early. The earlier COPD is diagnosed and treated, the greater the odds of limiting permanent lung damage and the natural progressive nature of the disease. The goal is to help you better manage the effects of your disease and to live as fully and actively as possible.

Cigarette Smoking

Cigarette smoking has become a major cause of illness and death among Americans. At this time, it appears to be the number one preventable health problem. In fact, about 600,000 Americans die each year as a result of tobacco use. Smoking accounts for as many as 8 out of 10 COPD-related deaths. Further, the vast majority of lung cancers are also a direct result of cigarette smoking or passive exposure to second hand cigarette smoke.

Passive exposure to second hand cigarette smoke is a major, yet hidden, health issue for much of the unsuspecting population. Cigarette smoke contains more than 7,000 compounds, some of which are clearly carcinogenic (cancer causing). Many of these compounds are derived from the tobacco leaf or from the processing of tobacco and the manufacturing of cigarettes, while others result from the burning of the processed tobacco and paper when smoking the cigarettes.

Tobacco smoke contains compounds that can cause cell mutation (changes in normal cell characteristics). These compounds can ultimately lead to significant medical problems (e.g. chronic lung disease, cancer, emphysema, asthma and heart disease).

Although cigarette smoking has decreased from 40% to 25% of the population over the past four decades, tobacco related disease is still the most important preventable public health problem in the United States. In spite of widespread knowledge about the relationship between smoking and disease, tens of millions of people continue to smoke due to addiction.

It is clear that cigarette smoking is highly addictive, based on the symptoms of withdrawal from its use and the drug seeking behavior of its users. It appears that nicotine addiction is related to its pharmacokinetic effects on the central nervous system. Smoking allows for rapid uptake of nicotine. Concentration of nicotine in the brain rapidly increases, leading to a noticeable psychoactive effect that stimulates addiction to smoking.

Statistics indicate that most people in the United States become addicted to cigarettes during adolescence. The peak period for developing a regular smoking habit is during adolescence. Most teenagers who begin smoking initially do it on an occasional basis. However, over a period of 8 - 10 years (or sooner), it often evolves into a regular habit as they become addicted. Individuals that do not smoke before the age of 20 are much less likely to become addicted. Once a person is fully addicted, his/her tobacco consumption usually remains stable, unless he/she is stressed. If the number of cigarettes is restricted, the smoker will actually inhale each cigarette more deeply in order to maintain the same nicotine level.

Smoking and COPD

Smoking is a major cause of COPD. It is estimated that perhaps 80% or more of COPD cases are a direct result of smoking cigarettes. More than 90% of those with a diagnosis of emphysema have been cigarette smokers. The more you smoke, the greater your risk of developing COPD. However, even passive exposure to cigarette smoke increases your risk of developing COPD.

Although lung function is gradually lost as part of the normal aging process, it has been observed that smokers lose their lung function at twice the rate of non-smokers.

Smoking and Malignancy (Cancer)

Developing lung cancer is 20 times more common in smokers than in non-smokers. It is estimated that approximately 80% of women that have lung cancer were smokers, and that 90% of men with lung cancer were smokers. The risk of lung cancer increases in relation to the cumulative amount of cigarettes smoked and the length of time that you have smoked.

In addition to statistical evidence that cigarette smoke causes cancer, there is much experimental evidence that cigarette smoke is carcinogenic and will induce all sorts of cancerous tumors in many animal models. In many smokers, there also appears to be an increased risk of cancer of the head, neck, bladder and pancreas.

Smoking and Cardiovascular Disease

Smoking is a major risk factor for the development of cardiovascular disease. Cigarette smoking appears to be equal to other risk factors, such as hypertension and elevated cholesterol, in causing heart disease.

Cigarette smoking contributes to the development of heart disease in a number of ways including: direct damage to blood vessels, increased lipids, increased tendency for blood to coagulate and increased heart rate. Cigarette smoke directly enhances the tendency for a blood vessel in the heart to become inflamed and blocked. Smoking also puts diabetic individuals at special risk by advancing diabetic vascular disease and affecting the heart, kidneys, brain and retina of the eyes.

In addition, once cardiac disease has been established, cigarette smoking can increase the risk of an irregular heart rhythm, lower oxygen to the heart leading to new damage and possibly even lead to a fatal heart attack.

Asthma and Cigarette Smoking

Asthma does not originate as a result of cigarette smoking. It begins as an independent process and is characterized by airway inflammation and hyper-reactivity. However, exposure to cigarette smoke, either by active or passive means, is among the worst triggers causing flares of asthma and the perpetuation of chronic asthma.

Exposure to cigarette smoke, either by active or passive means, is among the worst triggers causing flares of asthma and the perpetuation of chronic asthma.

Family members and friends who smoke around children and adults with asthma play a major role in contributing to their asthma. If you smoke and have asthma, you have little chance of getting your asthma under control. Cigarette smoking in pregnant women increases the risk of asthma in their offspring.

Smoking Cessation

There are two distinct approaches to discontinuing smoking: behavioral therapy and pharmacological approaches.

Behavioral Therapy: Behavioral therapy can include education, individual and group counseling, hypnosis, psychotherapy, conditioning, desensitization, sensory deprivation and transcendental meditation. Although some have benefited from this approach, it has not met with great success and is associated with a high long term failure rate. Of these methods, group or individual counseling is best when used in conjunction with pharmacological treatment as listed below.

Pharmacological Approaches: There are many pharmacological antismoking aids available today.

Some of these include: nicotine replacement therapy, tranquilizers, antidepressants, anti-anxiety medications, anticholinergics and clonidine. The use of Zyban® or Wellbutrin® in combination with nicotine replacement therapy offers the best results for smoking cessation.

Nicotine Replacement Therapy

Nicotine has been incorporated in tablets, lozenges, chewing gum, nasal sprays, aerosols and skin patches for use as smoking cessation aids.

Nicotine Polacrilex. This consists of chewing gum or lozenges in which nicotine is bound to a resin that allows for better absorption through the mucosal tissues of the mouth. Significant nicotine blood levels can be achieved with chewing this compound, reducing symptoms of tobacco withdrawal. Chewing gum with Nicotine Polacrilex (2 - 4mg/tab) has improved quitting rates. Using nicotine lozenges, in addition to the patch, may help lessen failure rates. This treatment is available without a prescription.

Transdermal Nicotine. This patch delivery system allows nicotine to be absorbed through the skin. It helps reduce tobacco withdrawal symptoms. This method has consistently improved quitting rates. Plasma nicotine concentrations using the 21mg per day patch typically provides up to half the nicotine levels achieved by smoking. In general, a minimum of 4 weeks of therapy is necessary to be effective for long term cessation of smoking. While using the patch, you may experience some withdrawal symptoms following the first day of quitting. The first few weeks of wearing the patch are critical. Continuation of smoking during the first few weeks of patch use usually ends in failure and is also dangerous since overload of nicotine can lead to acute heart disease. This treatment is available without a prescription.

Chantix® (varenicline tartrate) is a prescription tablet that is typically taken for 12 weeks in order to help patients quit smoking. It is used together with behavior modification and counseling support.

If you do not succeed on the first attempt at tobacco cessation, you often will meet with success if you persist in trying to stop smoking. There is no one best approach for smoking cessation. The great majority of individuals who stop smoking use no smoking cessation aids. Motivation is the key factor in smoking cessation. You simply need to totally commit to the belief that discontinuing smoking is a major life issue and be determined to succeed.

E-Cigarettes

E-cigarettes are alternative sources of nicotine that are now widely available. They reduce exposure to the over 7,000 chemicals and carcinogens in tobacco smoke and, thus, may reduce the health risks of cigarette smoke and improve lung function. However, clinically significant adverse lung effects have been reported (ie E-Cigarette Vaping Associated Lung Injury (EVALI). E-cigarettes are may still be an option to help decrease nicotine dependency over time in some individuals.

Passive Cigarette Smoke Exposure (AKA Second Hand Smoke Exposure)

Passive or second hand cigarette smoke exposure ranks near or at the top of the list of triggers for most asthmatics. Research is beginning to show the true impact of passive smoke exposure on the health of people in all age groups. When you are exposed to cigarette smoke in the environment, it is called involuntary or passive smoke. Passive smoke is a combination of two types of smoke: 1) the "mainstream"

smoke exhaled by the person who smokes; and 2) the "sidestream" smoke released from the burning tobacco. Mainstream cigarette smoke is a mixture of over 7,000 substances, 40 of which are known or suspected cancer-causing agents (carcinogens) in humans. Sidestream smoke contains all of these same carcinogens, and many of them are more concentrated because the lower burning temperature of a smoldering cigarette burns up fewer carcinogens. In a report released in 1992, the Environmental Protection Agency (EPA) declared "the wide- spread exposure to environmental tobacco smoke (ETS) in the United States presents a serious and substantial public health impact." The EPA further concluded that, in adults, passive smoke is a Class A (known human) carcinogen "responsible for approximately 3,000 lung cancer deaths annually in U.S. non-smokers."

The most frightening statistics regarding passive smoke exposure are related to its effects on children. Children who live in a house where someone smokes have more respiratory infections and experience more frequent flares of asthma symptoms. Their symptoms are also more severe and last longer than those of children who live in a smoke-free home. The impact of passive smoke is worse during the first five years of life, when children spend most of their time with their parents. The more smokers there are in a household and the more they smoke, the greater the risk for children with asthma.

Third Hand Smoke Exposure

Third hand smoke exposure is a term used to describe the type of tobacco exposure when tobacco smoke lingers in a place long after the physical act of smoking has stopped. The smoke remains on clothes, furniture, walls, other indoor surfaces, etc. and may be indicative of the presence of tobacco toxins.

The following conditions are worsened by second and third hand smoke exposure:

- Asthma
- Wheezing
- Croup or laryngitis
- Cough or bronchitis
- Pneumonia
- Flu (Influenza)
- Ear infections
- Middle ear fluid collections and blockage
- Colds/upper respiratory infections
- Sinus infections
- Sore throats
- Eye irritation
- Crib deaths (SIDS)

Steps to Avoid Second and Third Hand Smoke Exposure

1. Keep your home and automobile free from passive cigarette smoke.
2. Never smoke in your bedroom.
3. Have guests and family members smoke outside.
4. Consider asking family members to quit smoking.
5. Talk to your doctor or nurse about smoking cessation programs available in your community.

6. Sit in non-smoking sections of public areas (restaurants, airports, shopping malls, etc.). Visit restaurants and shopping centers that are smoke-free.

7. Contact your local nonprofit organization for more information. The American Lung Association (1-800-LUNGUSA; www.lung.org), the American Cancer Society (1-800-ACS-2345; www.cancer.org) and the American Heart Association (1-800-AHA- USA-1; www.heart.org) all have information about smoking and health.

8 Physician/Patient Relations

A patient-physician relationship that is truly based on mutual respect is something of great value and is worth pursuing by both parties.

No one physician, no matter how knowledgeable or communicative is the best physician for every asthmatic individual. Therefore, you need to find the physician that is right for you if you hope to achieve optimum medical management of your asthma. In this regard, you might consider the following:

Communication. Does the physician(s) adequately explain the nature of your problem, its causes and strategies to control your asthma? Do you feel the physician(s) answers your questions in a way that you can understand? Do you walk out of the office and feel confident that the physician(s) and staff are thorough and have carefully checked all aspects of your asthma? Does your physician(s) educate you to the nature of your problem, explain how your medications work and warn you of potential dangers? Does the physician(s) respect you enough to allow you to participate with him/her in a partnership in the management of your asthma? If you do not feel comfortable and confident with the doctor(s), look elsewhere for a physician.

No one physician, no matter how knowledgeable, is the right doctor for every asthmatic individual.

Availability. No matter how good the doctor, if he/she or the covering physician is not available when you need help, then that doctor(s) is probably not the best one to treat your asthma. You need to have complete confidence that, when your asthma flares, you can immediately contact your physician(s) for expert guidance. If the doctor(s) is not available, the person covering him/her should be competent and knowledgeable about asthma, and his/her approach should be consistent with your physician's approach. It would be best if the covering physician(s) is part of the doctor's group, not a fellow in training or a specialist from another practice. When your asthma flares, your doctor should find time to see you in the office even if he/she is very busy.

Skill. It will not take you long to determine if the physician(s) is a master of asthma management. Look for organization, attention to detail and thoroughness. At each visit, all your medications should be reviewed, symptoms discussed, and an examination and pulmonary function testing performed. The physician(s) should review all of these to determine what to prescribe, not just write refills. In fact, if the physician(s) just

refills your medication over the phone without a careful office review, you should be concerned about thoroughness. You should expect the physician(s) and staff to guide you through positive reinforcement with education and demonstration of use of respiratory devices. He/she should provide you with an emergency back-up plan and prevent you from getting lax with medication and follow-up visits. A skilled physician (s) will insist that you avoid risky behavior such as smoking or poor compliance with medication and/or follow-up visits, even if it makes for a difficult discussion.

Caring. Does the doctor(s) seem interested in you and your problem and concerned with your welfare? Does the doctor(s) relate to you as a person and are you comfortable with him/her? Are they paying adequate attention to your concerns and addressing them? Since your life is literally in the doctor's hands, you had better feel completely comfortable. If you do not, consider changing doctors.

So how do you get a great doctor?

In general, using a specialist for management of a chronic disease such as asthma will provide a consistently higher level of treatment. Since this is what the asthma specialist does every day, he/she should have a superior knowledge base as well as an organization (educational literature, nurse educators and specialized equipment) that is set up to efficiently and expertly deal with asthma and its related problems. Locate an asthma specialist (allergist or pulmonologist) within a reasonable commute to your home or office. Check on his/her reputation by asking your pharmacist, family doctor and friends who have asthma. Take a look at the practice website – it should include the physician's educational background, academic affiliations, teaching experience, publications, etc. If the physician is affiliated with a medical school and/or teaching hospital, this is a sign of credibility and commitment to adhering to the highest standards of the field. Physicians who have these associations have academic appointments with their respective medical schools (i.e. clinical professor, associate professor, instructor, etc.). Equally as important is whether physicians actively teach medical students, residents, and other practicing physicians. It shows the physician's desire to treat his or her patients with the best treatment possible.

To find the right doctor for you, you will need to do some investigative work and critical thinking.

What about cost and insurance issues?

In general, following the initial evaluation, costs for doctors' visits for outpatient care are relatively modest compared to the costs of medications. It is not unusual for the entire annual outpatient cost for the asthma specialist (excluding tests, allergy shots, etc.) to be less than the cost of a few months' medications.

You will need to check your insurance directories to see which physician(s) are in your plan. A good asthma specialist can be found in most insurance plans. However, when your medical needs are not met, consider seeing a specialist outside of your plan after you have exhausted the resources of your insurance plan's options. In this case, your insurance may cover your medications and laboratory tests while you pay for office visits. If you are in an HMO, check your directory for participating specialists. You will need an initial referral from your HMO primary care physician for a work up. If you are unhappy with your asthma management and your primary care physician will not give you a referral, speak to your insurance company. If you cannot resolve the problem, consider changing your primary care physician, your insurance, or seek an asthma specialist outside your plan.

Remember that the real cost of suboptimal treatment can result in long-term permanent lung damage and years of poor quality of life. In the worst circumstances, poor asthma control can result in emergency room visits, hospitalization, disability, or death. If you are unhappy with your physician(s), discuss your concerns. If the problem is not resolved to your satisfaction, get a second or even a third opinion.

It is **The Asthma Center** allergists' observation that almost all individuals and/or their families can work out a good asthma treatment program with a skilled and communicative asthma specialist. However, in a small minority of individuals, the problem of suboptimal asthma care is not in the medical delivery system but mainly resides in an individual's behavior and attitude. Those who are unusually inflexible, uncooperative, unwilling to educate themselves, unwilling to work in partnership with the physician(s), or are irresponsible in complying with the physician's recommendations for treatment and/or follow-up will find that even an excellent medical delivery system will not meet their needs.

Although there are a number of excellent specialists treating asthma in most urban centers, there are far more individuals needing treatment than these specialists can possibly accommodate. Since your physician-patient relationship may be your most valuable asset, it is worth spending the time and effort to identify and partner with a specialist that fits your needs.

9 Other Consultants Who Work with the Allergist/Asthma Specialist

Although an allergist is an expert in asthma, he/she is not an expert in all diseases.

Ear, Nose and Throat specialists (ENT). ENT specialists can help evaluate and manage those with sinusitis, nasal polyps, nasal septal deformities, vocal cord dysfunction and other respiratory disorders of the upper airway.

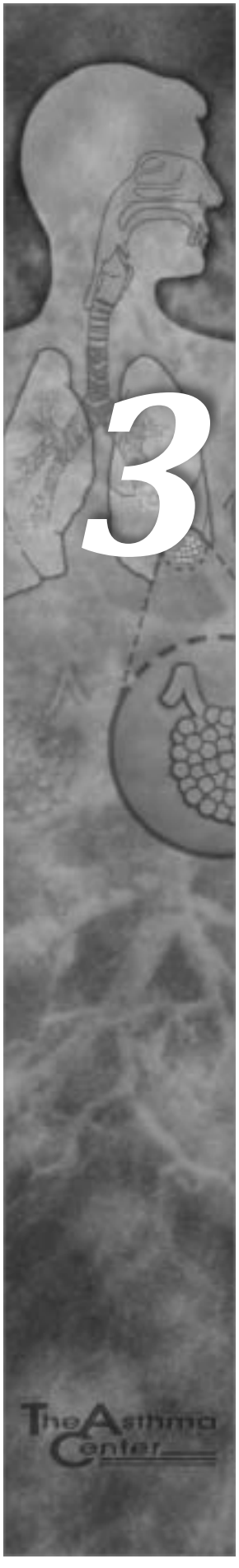
Gastroenterologists (GI). GI specialists may help those with gastroesophageal reflux disease (GERD) and the evaluation and management of other GI disorders.

Pulmonologists. Pulmonologists can help in evaluating those with asthma and other pulmonary diseases. The pulmonologist is an expert in all lung diseases, but not an expert in allergy. The pulmonologist can also act as a consultant when a second opinion is required for those that are not doing well or have unusual findings.

Psychologists/Psychiatrists. Psychologists/psychiatrists can help those that suffer from stress that appears to be a trigger of their asthma and/or evaluate for anxiety disorders such as panic attacks, which can produce symptoms similar to asthma.

Registered Dieticians. Occasionally food allergy plays a significant role in asthma. Food allergy issues and diet in a growing child will often benefit from input from a registered dietician who can supervise a nutritionally balanced diet while avoiding foods that provoke symptoms.

Speech Pathologists. Speech pathologists can help manage vocal cord dysfunction, which can cause asthma-like symptoms, or can prevent aspiration from the esophagus that can also lead to asthma symptoms or pneumonia.



PART THREE

Frequently Asked Questions

1. Did You Inherit Your Asthma?

Under the right circumstances, it is possible to inherit the genes that are ultimately responsible for bronchial asthma. Even if you inherit the potential for asthma, you still may not have symptoms unless you are exposed to the appropriate triggers. Asthma does run in families; however, asthma may affect some members of a family but not others or may actually skip one or two generations.

If one of your parents has an allergic problem, you have a 1 in 3 chance of developing an allergic illness. If both of your parents have an allergic problem, then you have about a 2 in 3 chance of getting one or more allergic illnesses including asthma. Environmental exposures and other factors also play a role in the development of allergies and asthma.

2. Does Age Have Anything to Do with Asthma?

Asthma can occur at any age. Most childhood asthma begins before the age of 5 or 6 years. Sometimes asthma is the result of exposure to a new environmental factor such as a new animal in the house. Asthma may begin with an upper respiratory tract infection ("cold") or as an infection of the chest ("bronchiolitis").

Although milder childhood asthma often resolves during the early teenage years, symptoms may continue throughout life or in some cases resolve during adolescence only to recur later in adult life. On the other hand, the first appearance of asthma may occur as an adult ("adult onset asthma"). This often occurs between the ages of 40 - 50 without any specific allergy being detected. The worst cases of lifelong asthma often begin before 6 months of age. However, many cases of adult-onset asthma can also be quite severe.

3. Are Your Symptoms of Asthma Unusual?

Asthmatic symptoms may vary from mild to severe. Symptoms of asthma may include an occasional dry cough or shortness of breath only when exercising. In allergic asthma, symptoms may be provoked by freshly cut grass or follow exposure to other allergens. Others may note mild chest tightness when running on cold days. You may have symptoms each winter following a "cold" which was misdiagnosed as bronchitis and treated with antibiotics. If you have chronic asthma, you may have symptoms a few times a week. In more advanced cases, symptoms may be continuous and vary in severity from day to day. You have the potential to develop a sudden episode of bronchospasm, and your breathing may become extremely difficult. On occasion, the usual asthma medications are not successful in relieving symptoms, and you may need emergency treatment. Fortunately, most severe episodes of asthma respond to treatment. However, there are occasional reports of individuals dying during an acute asthmatic attack. Therefore, if you suffer from a sudden episode of acute asthma, you should be treated promptly and thoroughly since the outcome of the asthmatic attack is not always predictable.

4. Does Coughing Cause Asthma?

Coughing is often an early sign of asthma. The asthmatic cough is usually dry, hacking, or barking and often repetitive. Usually, little or no phlegm is produced early in an attack. You may never wheeze but only cough. If you experience this, the cough is your main problem and this is often referred to as cough-variant asthma *(see Types of Asthma, page 12)*.

You also may have a common cough that is the result of an upper respiratory infection, accompanied by a post nasal drip and irritation of the upper airway. Some children with asthma may develop a croupy cough which is unrelieved by asthma medications. Under these circumstances, a previously well-controlled asthmatic individual may actually begin to wheeze and develop an asthmatic attack. Persistent coughing for any reason in conjunction with asthma can cause further irritation of the sensitive airway combined with rapid and often explosive movement of air through the bronchial tubes resulting in bronchospasm. This phenomenon is associated with air moving rapidly through the airways and thus cooling the airways by enhanced evaporation of airway moisture. Inhaling cool or dry air also can cause similar symptoms.

If you have asthma, coughing initially should be considered a sign of bronchospasm and often can be stopped immediately with a bronchodilator. On the other hand, coughing may be the result of a cold, bronchitis, pneumonia, or secondary to a post nasal drip or other disease entities (lung tumor, tuberculosis, etc.) that may require further investigation and treatment *(see Chronic Cough, page 92)*.

5. Does Work Make Your Asthma Worse?

If your work environment exposes you to substances to which you are allergic or that irritate your bronchial tubes, then the answer is yes. If you work in an environment that is free of airborne pollutants or allergens, then the answer is no unless job-related stress is a factor.

Examples of asthma-triggering factors in work environments include:

- Animals (cats, dogs, mice, rats, rabbits, guinea pigs, horses, birds): lab workers, veterinarians, pet shop and zoo workers
- Pollen: farmers, gardeners, landscapers, outdoor and field workers
- Fish: food handlers, fishermen
- Dust and mold: janitors, housekeepers, tradesmen
- Cigarette smoke: office workers, casino workers, bartenders
- Chemicals: factory workers, workers in "tight buildings"
- Exhaust fumes: auto mechanics
- Chalk dust: teachers
- Latex: healthcare workers or outdoor workers in urban areas

You may notice that your symptoms are much milder or resolve on your days off from work. Using a protective mask at work, improving ventilation, introducing an air cleaning system, or treatment with asthma medications all may improve asthma at work. Of course, the ultimate solution when all else fails is to consider a change of job or profession.

6. Are Pets Causing Your Asthma?

If you have symptoms around any fur-bearing animal and/or your allergy skin tests reveal sensitivity to domestic animal dander (flakes of dead skin), then pets may be playing a significant role in your asthma symptoms. Asthma symptoms may persist long beyond the time you have been exposed to a pet. You may suffer from chronic symptoms as a result of animal dander exposure and yet find it hard to believe that your pet is causing your symptoms since the symptoms are not clearly related to exposure. On the other hand, negative allergy skin tests for pet dander and a negative history of symptoms around animals would strongly

suggest that a pet is not playing a significant role in your asthma.

Keeping the pet out of the bedroom, using preventive asthma medications (e.g. cromolyn), maintaining excellent control of asthma to severe allergy. However, there are times that the risks of severe asthma are so great that the pet must be removed from the home in order to bring symptoms under control *(see Environmental Avoidance of Allergens and Irritants, page 30)*.

7. Why Do You Wheeze at Night (Nocturnal Asthma)?

There are at least three reasons for wheezing at night or early in the morning:

1. You are allergic to house dust, house dust mites, animal dander, and/or other allergens (dust mites are concentrated in bedding). After inhaling these allergens for a few hours, you may begin to develop allergic asthmatic symptoms.
2. There is a natural decrease in circulating corticosteroids and epinephrine substances in the body late at night. These reach a low point about 2:00 a.m. - 3:00 a.m. each morning and may play a role in nocturnal asthma.
3. You may suffer from gastroesophageal reflux disease (GERD) *(see page 88)*. This may be associated with a hiatal hernia. In these situations, there is the possibility that stomach acid may be regurgitated and/or aspirated at night while in a reclined position. Acid reflux can cause marked bronchospasm.

8. What is the Difference Between Asthma and Emphysema?

Asthma and emphysema are two entirely different diseases with some symptoms in common. Asthma is a spastic and inflammatory disease of the airways that causes reversible obstruction of the bronchial tubes. It usually responds to treatment. Emphysema is a disease of the lung tissue, especially the alveoli (air sacs) at the end of the bronchial tubes. Emphysema results from destruction of these alveoli. This process is not reversible and responds less well to medical treatment. Emphysema is slowly progressive; you will get short of breath and become more disabled as time goes on. Eventually you may require continuous concentrated oxygen to be comfortable. This irreversible disease (and other obstructive lung diseases such as chronic bronchitis) is often referred to as chronic obstructive pulmonary disease (COPD). The majority of COPD individuals have a long history of smoking cigarettes. It is possible to suffer from both COPD and asthma. Rigorous treatment of the asthmatic component can often significantly improve your quality of life.

In recent years, some asthmatic individuals have developed an irreversible obstruction of their bronchi *(see Remodeling of the Airway, page 11)* and appear to have a syndrome that is very much like the fixed obstructive disease seen in COPD *(see COPD and ACOS, page 95)*.

9. Besides Asthma, What Else Can Make You Wheeze?

The Asthma Center allergists consider the following when evaluating symptoms of wheezing. Wheezing may result from some object pressing on the bronchial tube (a tumor, blood vessel), an aspirated particle (a peanut, egg shell fragment, etc.), recurrent pneumonia due to a deficiency of antibodies, cystic fibrosis, cardiac disease, emphysema, chronic bronchitis, pulmonary infections and reactions to medications. Special diagnostic studies help to rule in or rule out these disease processes *(see Tests the Doctor Often Orders, page 19)*.

10. Is Asthma an "Emotional Disease"?

In the past it was thought that asthma was mainly an emotional disorder. Today **The Asthma Center** allergists know that the basis of bronchial asthma is a biochemical abnormality in the cells lining the bronchial tubes as well as hyper-irritability of the airways. However, a subgroup of individuals who are under or have undergone stressful situations may find themselves suddenly wheezing. Therefore, it is apparent that while emotional stress can be a significant triggering factor in asthma, it is not the sole cause.

When stress is a suspected triggering factor, **The Asthma Center** allergists may recommend that you undergo psychological evaluation. In some cases, the use of stress control techniques, including training in self-hypnosis and/or biofeedback, may be appropriate. Various treatments used to prevent stress related asthma are called behavior modification therapies. You may find that breathing exercises often will relax you and prevent a panic situation that would worsen the asthma attack from developing. Therefore, relaxation training may be helpful.

Severe asthma can impact on work, school, families and leisure activities to such an extent that it causes a significant change in quality of life. Asthmatic symptoms, when severe or limiting, can cause both physical as well as psychological discomfort. If you have asthma, you may live in constant fear of an asthmatic attack or become overly restrictive or limited in the choices of home life, work, travel, or other activities. On the other hand, asthmatic symptoms rarely can be primarily the result of stress or in some cases significant psychological illness. Stress from fear, anger, work, or home related problems can have a significant impact on worsening asthmatic symptoms. In some rare situations, psychological illness can somehow be an underlying cause or trigger for recurrent asthmatic symptoms that often respond poorly to medical treatment. Even though this mechanism is not completely under- stood, most experienced asthma specialists are familiar with this phenomenon. Also, if you are affected by this condition, you likely are unaware of the presence of a psychological problem causing your symptoms.

When psychological illness plays a central role in your asthma-like symptoms, you may not do very well with traditional asthma treatments. You could have a history of multiple acute episodes of shortness of breath and eventually become disabled because of the symptoms. The best physicians may not be able to help you in this situation. Even if you are cooperative in your treatment program, you may have an ever increasing need for medications and become frequently sick without any clear trigger.

This form of asthma appears to be primarily a psychosomatic disease. The best way to assist you is to help you find a psychologist and/or a psychiatrist who can effectively treat the underlying stress or psychological problem.

In childhood, poorly controlled asthma may limit a child's ability to participate in sports, go to overnight camps, or even visit a friend's house. As a result, some children may develop a poor self image and feel that they are less than equal to their peers or inadequate in some way. It is for this reason that it is imperative to optimally treat children early, soon after their onset of asthma, and encourage them to participate in sports using supplemental asthma treatment. Treatment with medications prior to visiting a friend's house, educating the friend's parent(s) regarding asthma issues related to your child's visit and having emergency backup medications with him/her will allow the child to experience a more normal childhood.

Finally, family problems may play a significant role in a child's asthma. At times, a child caught up in a dysfunctional family may subconsciously call the family together through the drama of an acute asthmatic attack. In the past, when a severe steroid-dependent asthmatic child was sent to a very distant hospital

specializing in asthma, the child's asthmatic symptoms often subsided as soon as they were outside of the family structure. This phenomenon was referred to as a parentectomy (removal of parents).

The examples above highlight the complex nature of asthma and the need to consider the possible psychological issues on an individual basis. In summary, stress and psychopathology, as with other physical stimuli, must be considered as possible triggers for asthma. On the other hand, stress or psychological problems as an important trigger in asthma are seen in far less than 1% of asthmatic individuals.

11. What Medications Do You Need to Avoid?

Certain medications are likely to trigger an asthmatic attack. A group of drugs, which should be strictly avoided by asthmatic sufferers are beta-blockers. Beta-blockers are used to treat high blood pressure, some forms of heart disease, migraine headaches, glaucoma and to prevent cardiovascular disease. They may also be used in hyperactive thyroid disorders. Sometimes beta-blockers are prescribed when you have no obvious asthmatic symptoms, and then you subsequently develop asthmatic symptoms while on this medication. In such a case, the potential for asthma had been present, but it required a beta-blocker to bring it out. If you require beta-blockers, you should consult your asthma specialists regarding this matter. See lists of common beta-blockers in Table 26

TABLE 26

Beta-Blockers

Brand Name	Generic
AKBeta®, Betagan®, Betagan Liquifilm® (eye drop)	levobunolol
Betapace®, Betapace™ AF	sotalol
Betimol® (eye drop)	timolol
Betoptic®, Betoptic S®	betaxolol
Blocadren®	timolol
Brevibloc®	esmolol
Bystolic®	nebivolol
Coreg®	carvedilol
Corgard®	nadolol
Corzide®	nadolol + diuretic
Cosopt® (eye drop)	timolol + dorzolamide
Dutoprol®	metoprolol + hydrochlorothiazide
Inderal®, Inderal® LA	propranolol
Inderide®	propranolol + hydrochlorothiazide
InnoPran XL®	propranolol
Istalol® (eye drop)	timolol
Kerlone®	betaxolol
Lopressor®	metoprolol
Lopressor® HCT	metoprolol + hydrochlorothiazide
Normodyne®	labetalol
Ocupress® (eye drop)	carteolol
OptiPranolol® (eye drop)	metipranolol
Sectral®	acebutolol
Tenoretic®	atenolol + chlorthalidone
Tenormin®	atenolol
Timoptic®, Timoptic-XE® (eye drop), Betimol®	timolol
Toprol-XL®	metoprolol
Trandate®	labetalol
Visken®	pindolol
Zebeta®	bisoprolol
Ziac®	bisoprolol + hydrochlorothiazide

Another group of antihypertensive medications called ACE inhibitors (e.g. Vasotec®, Capoten®) also may cause you to cough and should be avoided if an acceptable alternative is available.

TABLE 27 ACE Inhibitors

Brand Name	Generic
Vasotec®	enalapril
Capoten®	captopril
Lotensin®	benazepril
Monopril®	fosinopril
Prinivil®	lisinopril
Univasc®	moexipril
Aceon®	perindopril
Accupril®	quinapril
Altace®	ramipril
Mavik®	trandolapril

A minority of asthmatic individuals have a worsening of symptoms if they take aspirin or other nonsteroidal anti-inflammatory drugs (e.g. Advil®, Motrin®, and Naprosyn®). Aspirin hypersensitivity is suspected in asthmatic individuals with chronic sinusitis and nasal polyps. When it is important to know whether you are aspirin sensitive, an aspirin challenge can be performed under controlled conditions. There are other circumstances in which medications used for asthma may interact with medications prescribed for other conditions. These drug interactions can best be avoided by reviewing all of your medications with your asthma specialist during your follow-up visits. If you ever have a doubt or a question about whether a newly prescribed medication may interfere with your asthma medication, contact your asthma specialist.

A new class of medications similar in benefit to aspirin and NSAIDs are referred to as Cox-2 inhibitors. These medications include Celebrex® and Mobic®. These medications selectively suppress certain elements of inflammation. If you cannot tolerate aspirin or NSAIDs, you may be able to tolerate these medications. The safety of the Cox-2 inhibitors is being investigated by the FDA and may be withdrawn from the market for general use. Please consult your physician before starting these medications if you have known aspirin sensitivity.

12. Should You Avoid Sulfites and/or Other Preservatives?

In addition to natural foods, chemicals are introduced into the diet in the form of additives (chemicals purposely added to foods such as flavor enhancers, preservatives, sweeteners, food colorings, stabilizers and antioxidants) or in the form of inadvertent contaminants such as pesticides and toxic man-made chemicals. Both additives and contaminants may have medical repercussions after ingestion either acutely or over an extended period. If there is a suspicion of food-related exacerbation of asthma, oral food challenges, special food skin testing and/or oral additive or contaminant challenges may be performed.

The most common additives reported as a problem in conjunction with asthma are sulfites (sodium and potassium bisulfite, sodium and potassium metabisulfite, sodium sulfite and sulfur dioxide). In order to make food appear fresh and retain its natural color, many restaurants used to spray foods with sodium

metabisulfite. Although it is now against federal law to spray metabisulfite on restaurant food, this activity may still be practiced in some locations. Ingesting a certain quantity of these sulfites may cause a sudden and severe episode of asthma if you are sensitive. Sulfites may still be sprayed on foods such as lettuce, salad greens, bananas, avocados, mayonnaise based foods and shrimp in restaurants. Sulfites are also found as ingredients in certain foods such as potato-based foods (french fries, potato chips) and in certain wines. They prevent many foods from turning brown as they oxidize. Sensitivity to metabisulfites can be identified by performing challenges under controlled conditions. If you are sensitive to metabisulfite, you should read all content labels of processed food. Certain medications may also contain sulfites. You need to question the preservative basis of all prescription and over-the-counter medications.

Under rare circumstances, other food additives, like monosodium glutamate (MSG), sodium benzoate, sodium nitrate, saccharin, aspartame (NutraSweet®) and tartrazine (FD&C dye #5), can worsen asthma. Special challenge procedures can be performed to establish sensitivity to these food additives.

13. Should You Exercise?

EIB or Sports Asthma can usually be prevented with treatment, or at least its severity modified in a way that you can participate in some physical activity.

Generally, it is unwise to restrict you from participating in sports. In recent Olympic trials, about ten percent of American athletes, many of whom won medals, had asthma. **The Asthma Center** allergists recommend taking your asthma medications prior to sports if you have sports-related bronchospasm. Symptoms of coughing, wheezing, shortness of breath, or chest tightness may be a sign of bronchospasm resulting from the act of exercising even if you have no history of asthma. This syndrome is often referred to as Exercise- Induced Bronchospasm (EIB) or, in those with a known history of asthma, as Exercise- Induced Asthma (EIA). More recently, the term Sports Asthma has been adopted to describe these symptoms. It is important to understand that physicians may use the terms "EIA" and "Sports Asthma" interchangeably; however, the term EIB is also commonly used to include the symptoms of individuals who suffer bronchospasm when exercise induces asthma-like symptoms *without* a prior history or findings that are typical of asthma.

Most individuals diagnosed with asthma are able to find a sport that can be tolerated when their asthma is optimally treated. Running, riding a bike, or vigorous exercising in a symptom-free person with a history of asthma can lead to symptoms of coughing, wheezing, chest tightness and/or significant shortness of breath. This is often referred to as Sports Asthma or exercise-induced bronchospasm (EIB) because the symptoms are typical of asthma and result from exercise. EIB or Sports Asthma can occur during exercise or begin shortly after completing exercise. Symptoms often last a short time and may resolve without treatment simply by resting. On the other hand, untreated symptoms occasionally may evolve into a serious asthmatic attack requiring emergency treatment or even hospitalization. In any case, EIB or Sports Asthma can usually be prevented with treatment, or at least its severity modified in a way that you can then participate in some physical activity. EIB or Sports Asthma is thought to be caused by the hyperventilation or intense breathing that takes place

during exercise that results in evaporative water loss from the lungs. It is the loss of water vapor during this process that cools the breathing tubes, thus provoking asthmatic symptoms. The drop in temperature of the airways provokes the bronchospasm. In fact, EIB or Sports Asthma is most common when exercising during the winter when the air is cold and dry, thus enhancing the cooling of the airways. However, the degree of EIB or Sports Asthma also can be worsened during the allergy season when you are exposed to pollen. In addition, uncontrolled asthma or asthma that is suboptimally controlled will promote exercise-related symptoms. Symptoms of coughing, wheezing and chest tightness are often prominent following exercise, reaching a peak within fifteen minutes if left untreated. You may have a second phase of symptoms occurring some hours after the initial symptoms have appeared to resolve. This is often referred to as a "late phase reaction." Diagnosis of EIB or Sports Asthma can be confirmed by evaluating your pulmonary function tests or peak flow rates before and after exercise. Usually there will be a fall of these measurements by more than 15% after exertion. The diagnosis can be confirmed by giving you a trial of a bronchodilator medication (e.g. albuterol, Maxair™, Ventolin®, Proventil®, etc.) before exercise in an attempt to prevent or lessen the symptoms of EIB or Sports Asthma. Bronchodilator medications also will help relieve or shorten the duration of symptoms if given when you first develop symptoms. Other medications, which seem to be helpful in controlling EIB or Sports Asthma are mast cell stabilizers such as cromolyn or Tilade®. Newer asthma medications, such as the leukotriene modifiers (e.g. Accolate® and Singulair®), may also help reduce the symptoms of EIB or Sports Asthma. If you have underlying chronic asthma, you can often optimize your treatment with a combination of medications that include inhaled corticosteroids and long acting bronchodilators, which assist in limiting exercise-related asthma symptoms by optimally controlling asthma.

EIB or Sports Asthma at School:

Clear communication with the student, parents, teachers and school nurses is central to man- aging EIB or Sports Asthma at school. **The Asthma Center** allergists recommend the following:

- Pretreatment (prophylactic treatment) with asthma medications including short acting bronchodilators (Proventil®, Ventolin®, albuterol, Combivent ®, and Xopenex ®) and/or cromolyn sodium at least 15 - 30 minutes prior to exercise (1 hour prior to exercise may be optimal).
- Pretreatment with leukotriene modifiers (Singulair ®, Accolate ®) and/or theophylline preparations may also be beneficial if control of EIB is not adequate with short acting bronchodilators and/or cromolyn sodium medications alone. A combination of medications may be necessary to achieve adequate control of EIB.
- Regular maintenance treatment of asthma with daily controller medication, such as inhaled corticosteroids, long acting bronchodilators and other controller agents, may be necessary if adequate control of EIB is not achieved with exercise pretreatment alone.
- If a student has been diagnosed with asthma and has some chest symptoms even when not exercising, maintaining optimum treatment throughout the year is very important in minimizing EIB or Sports Asthma.
- Performing warm-up exercises before and cool down exercises after exertion can help prevent EIB or Sports Asthma or modify its severity. Following each episode of EIB or Sports Asthma, a refractory (symptom-free) period begins within 30 minutes and can last 90 minutes where little or no bronchospasm can be induced even if rechallenged with vigorous exercise. Athletes often take advantage of this fact by warming up vigorously in order to induce a refractory period prior to competition.
- Conditioning through a regular exercise program will decrease the potential for EIB or Sports

Asthma.

- Quick relief medications (bronchodilators) should be available to individuals with EIB or Sports Asthma at all times. All students with EIB or Sports Asthma should be taught how to use an inhaler properly, and inhaler technique should be reviewed periodically. Keep tabs on the frequency of bronchodilator use and discuss the dangers of overuse.
- Cold, dry air provokes EIB or Sports Asthma and should be avoided. When this is difficult to achieve, students with EIB or Sports Asthma should wear a mask or scarf over their face during physical activities when outdoors in the cold air. This will warm and humidify the air before it reaches the lungs.
- Students with EIB or Sports Asthma should not exercise when their asthma is poorly controlled. They should stop exercising if they develop breakthrough symptoms and become short of breath. At this point, they need to rest and take a bronchodilator treatment (e.g. albuterol). When symptoms resolve, they can attempt once again to exercise.

Most children and adults with EIB or Sports Asthma can participate in most sports and exercise with proper treatment. However, a small percentage of asthmatic sufferers may still have some trouble when they exercise vigorously even with a comprehensive treatment program. These individuals would do better to select sports that are less likely to provoke asthma. Sports that require a high level of running with little time for breaks and vigorous continuous activity (long distance running, soccer, basketball) are more likely to cause symptoms than sports such as baseball or tennis that allow rest periods. Swimming, which takes place in warm, humid air, is often the best type of exercise for individuals with EIB or Sports Asthma. It is a good idea for parents to review their child's EIB or Sports Asthma treatment plan personally with the gym teacher or coach, teacher and school nurse in order to avoid any delays in treatment or any potential misunderstandings. Using a peak flow meter to measure pulmonary function before and after sports can be useful in objectively identifying the severity of the problem and its response to treatment. Finally, it is important to recognize that EIB or Sports Asthma may vary greatly from person to person. Some individuals wheeze loudly while others do not wheeze at all. Some children develop a hacking cough while others complain of chest tightness and shortness of breath. If your child's symptoms seem out of control or your child is simply not doing well, schedule an office visit with your doctor and review the situation with your child's teacher or coach. Perhaps your child's medication or exercise program needs to be modified. On the other hand, something else may be troubling your child, and infrequently, some children may use their EIB or Sports Asthma to avoid involvement in sports.

Treatment of EIB or Sports Asthma:

1. Optimize control of underlying asthma with a comprehensive treatment program.
2. Warm up prior to engaging in sports and cool down afterwards.
3. Physical conditioning.
4. Use bronchodilators (Proventil®, Ventolin®, ProAir®, albuterol, Xopenex®)15-30 minutes prior to exercise.
5. Use mast cell inhibitors (cromolyn sodium) 30 - 60 minutes prior to exercise.
6. Consider optional treatments including: Long acting bronchodilators and inhaled steroids each morning; Leukotriene modifiers (Accolate®, Singulair®) or theophylline.

14. Will Asthma Affect Pregnancy?

Most women with asthma can complete pregnancy without any special problems affecting them or their infants. However, about one third of these women will experience worsening of their asthmatic symptoms at some point during pregnancy. Your asthma specialists may have to alter medications and follow these women more frequently during this time. In spite of this, most pregnant women, even those with flares of asthmatic symptoms, usually have childbirths, which are not complicated as a result of their asthma or asthma medications.

Of the medications used during pregnancy by asthmatic women, theophylline, beta-agonists (e.g. Proventil®, Maxair ™, Serevent ®), cromolyn sodium, inhaled corticosteroids, and a short burst of prednisone are relatively safe and have been used in pregnant asthmatic women. In **The Asthma Center** allergists' experience, and from reviewing the experience of other asthma specialists, the risks of using such medications far outweigh the risks of having untreated or undertreated asthma. The greatest risk to both mother and fetus is low oxygen from a severe asthmatic episode, which is usually the result of not receiving adequate treatment. Check with your asthma specialists before using any asthma or allergy medication during pregnancy.

15. Can Your Asthma Get Better Without Treatment?

During childhood, it is possible for mild asthma to resolve without treatment. However, if you were untreated in your youth, you may develop chronic asthma as an adult. This does not mean that appropriate treatment will cure asthma or prevent severe asthmatic symptoms in every case. However, it will usually limit the development of severe asthma and allow you to lead a more functional life. In contrast, poorly controlled asthma may lead to permanent pulmonary damage resulting in lifelong chronic asthmatic symptoms *(see Remodeling of the Airway, page 11)*.

When you begin to wheeze severely and do not receive appropriate medical care immediately, you face the potential complication of status asthmaticus (a severe, unresponsive asthma attack). In such a situation, your wheezing and shortness of breath are unresponsive to commonly used medications. In this case, you will need to begin a special intensive treatment program. If these intensive methods are not effective or a complication occurs, death is possible. Although this rarely occurs today, there are less than 4,000 cases of deaths due to asthma reported each year in the United States. Careful analysis of the death of an asthmatic individual often reveals that the severity of the asthmatic attack was not recognized early enough. Other associated factors include: seeking help too late; life saving corticosteroids being withheld or given too late; a complication of asthma not identified in time; an inappropriate medication or dose of medication was administered; a severe allergic exposure occurred; or a complicated severe asthmatic episode was not managed expertly. However, there are times that appropriate therapy is given in time, and factors beyond your control play a role in fatal outcomes of severe asthma.

16. Is It Asthma or Is It Allergy: What's the Difference?

Asthma is a disease of the airways, which can be triggered by allergy. It typically is caused by spasm and inflammation of the bronchial tubes. The blockage of the airways is usually partially or totally reversible with medications. Allergies are a common cause of asthmatic symptoms. In fact, greater than 80% of children with asthma have allergies, and the majority of adults with asthma have allergies as well. However, allergy often also causes other problems such as itchy eyes and nose (hayfever). Allergic symptoms result from the

activity of specific antibodies of the IgE type. About 20% of the population produces these allergy antibodies in sufficient quantity to produce typical allergy symptoms. If you are asthmatic and are also allergic, then upon exposure to the appropriate allergen, these anti- bodies can attach to both allergen and mast cells in your bronchial tubes and cause an allergic reaction in your airways. When this occurs, the release of chemical mediators from mast cells will cause asthmatic symptoms. If you have nose and eye allergic symptoms, you can have allergic triggers precipitating your asthmatic symptoms *(see Common Allergic Symptoms, page 75)*.

17. How Can You Find Out the Pollen or Mold Spore Count?

Asthma and allergy attacks in sensitive individuals are often triggered by exposure to pollen allergens from trees, grasses and weeds and to mold spores. **The Asthma Center** website *www.asthmacenter.com* can direct you to the local pollen and mold counts in metropolitan Philadelphia. For more information on pollen and mold spores (*see Common Allergic Symptoms, page 75*).

18. Should You Use Alternative Medicine Remedies to Treat Your Asthma?

Alternative medicine remedies are nontraditional medical treatments whose effectiveness has not been established by commonly accepted scientific studies. Specifically, these treatments have not been approved by the FDA as medicines that are safe and effective for the treatment of asthma.

Many of these treatments have been used in non-Western societies and have been imported into the US over the last hundred years. In general, alternative medicines are not classified as medical treatments by the FDA but rather as nutritional supplements that have little or no proven pharmacological effect (e.g. herbal medicines, homeopathy, aromatherapy, certain vitamins and supplements, etc.). Other types of nontraditional treatments include acupuncture, breathing exercises, chiropractic treatment, etc. This latter group has also failed to clearly demonstrate the effectiveness of these treatments for asthma in carefully conducted clinical research, as is the case with every single FDA approved asthma medication. Review of the world scientific literature does not support the use of many of these medications as effective. Acupuncture may be somewhat risky since needles in the chest may rarely result in a pneumothorax (collapse of the lungs). On the other hand, few of these treatments currently appear to be associated with major side effects, except when they deter you from seeking traditionally accepted treatment.

If you feel strongly that you would like to try these unproven treatments, a prudent approach would be to first discuss these treatments with your physician. Such an approach needs to take your current state of asthma into consideration including the risks involved and the current control of your asthma.

You can always try taking these alternative medication treatments in conjunction with physician prescribed medications. If there is a clear and objective improvement, then, with your physician's assistance, you can try to reduce physician prescribed medications.

In summary, **The Asthma Center** allergists do not feel that there is good reason to recommend unproven treatments. Since their content is not always known or regulated and their effects are not entirely clear, this could put you at risk for an adverse reaction or suboptimal treatment.

19. How Can You Prevent a Flare of Asthma?

1. Determine your best Peak Expiratory Flow Meter reading (PEFR) using the peak flow meter to measure your breathing two or more times a day for a few weeks when you are feeling your best. Monitor the PEFRs occasionally thereafter to keep in practice. When you do not feel well, use the meter at least twice a day to see if your PEFRs are dropping. Have your peak flow readings available when you speak to your doctor. If you have difficulty recognizing the severity of your asthmatic symptoms until late in the course of an asthmatic attack, you should use your peak flow meter twice a day every day even if you "feel fine." Daily PEFR readings can alert you to a pending asthmatic attack in order to begin effective treatment, thus preventing unnecessary emergency room visits and/or hospitalizations.
2. If the number of times you need to use your bronchodilator MDI (Proventil®, Ventolin®, ProAir® etc.) begins to increase, it is usually a sign of worsening asthma.
3. Waking up at night short of breath, coughing, wheezing, and/or feeling chest tightness are signs of worsening asthma.
4. A decreased tolerance of physical exertion or decreased ability to work or exercise is usually a sign of worsening asthma.
5. Decreased responsiveness to medications or persistence of symptoms in spite of treatment is a sign of worsening asthma.

When you feel your asthma is worsening, check your PEFR, and if necessary, increase your asthma medications as directed and call your doctor to review a plan of action. Check on your stock of emergency medications including solution for your nebulizer and oral corticosteroids at home before calling the doctor.

20. How is Asthma Treated in the Emergency Room?

Emergency rooms vary in staffing, equipment and quality like any other element within the medical system. If you are asthmatic, you have the potential to have an acute asthmatic attack (onset of strong wheezing, coughing, shortness of breath and/or cyanosis [turning blue]) and thus may have the need for emergency treatment. If you are prepared to treat a flare of asthmatic symptoms early in its development at home with nebulizer treatment and possibly oral corticosteroids under the direction of your asthma specialist, you may never need an emergency room. Remember it is important to communicate with your asthma specialist as soon as your asthmatic symptoms flare.

Nevertheless, occasionally your asthma may get out of control because you do not follow recommendations, run out of medication, fail to attend follow-up visits as recommended, lack emergency back up medications, or carelessly put yourself in risky situations (e.g. exposure to cigarette smoke or known allergens). You may also experience severe flares related to situations that you cannot avoid including respiratory infections, exposure to certain medications, inadvertent exposure to air pollution or allergens and stress.

When you have a bad flare of asthmatic symptoms and find your symptoms are not responding to treatment, check with your doctor for advice, and if necessary, ask him/her to call ahead to the emergency room (ER) in order to notify the staff of your condition and what medication(s) you have received.

Just before leaving the house make sure you have your medications with you (e.g. nebulizer treatment and/or oral corticosteroids). If you have an EpiPen®, take it with you as a backup while on route to the ER. Although medications do not always work immediately, they will be on board and may start working while

you are in transit or waiting to start treatment in the ER.

Once you are evaluated by an ER physician, you will most likely receive oxygen, another nebulizer treatment and possibly IV corticosteroids. Occasionally the doctor may give you epinephrine injections. Usually you will receive 1 - 3 treatments of a nebulized bronchodilator, improve and go home. If you show no clear signs of improvement within a few hours, you will be hospitalized. If the doctor finds a complication of asthma while in the ER (e.g. pneumothorax or air in the chest), you will also be hospitalized.

The doctor could decide to hospitalize you when he/she feels that the asthmatic attack could soon exhaust you to the point that you may not be able to breathe effectively on your own. Occasionally, your oxygen will decrease markedly, the waste gas (carbon dioxide [CO_2]) will increase, and you are in danger of entering into respiratory failure. When your CO_2 rises significantly, you enter into respiratory failure and may stop breathing, fall unconscious, develop an irregular heart rate, and/or die if aggressive treatment is not started.

If you are hospitalized with asthma, you will typically receive oxygen, nebulized albuterol or similar bronchodilators, IV corticosteroids and other treatments as necessary over a few days. Your condition typically will improve rapidly within a day or two. Hospitalization for the majority of asthmatic attacks lasts from 3 to 5 days. Severe episodes requiring intensive care unit (ICU) admission may last much longer.

When it appears that you may be at risk for respiratory failure, you may be admitted to the ICU for frequent monitoring and, if necessary, respiratory support. When you get so tight that you cannot breathe on your own, an endotracheal tube is inserted through the mouth or nose into the airway, and a respirator will be attached to temporarily help you breathe until the attack resolves. This phase rarely lasts more than a few days.

It is very uncommon that you will die of asthma if you arrive in the ER early enough in the course of your attack. However, a delay in getting to the ER causing you to arrive already in respiratory failure is certainly one of the main reasons for dying from asthma. Possible complications include stopping breathing before arriving in the hospital and severe irreversible damage already occurring due to low oxygen and pneumothorax.

You should know the location of an ER close to your home. If you have severe asthma, it would be wise to know the location of an ER close to wherever you are traveling and along the travel route if you are driving. This knowledge can save your life.

You should be aware that if you go to an ER that does not participate in your medical insurance program, or if you are in an HMO and you do not first get approval from your primary care physician, you may be liable for all financial charges. However, if you sense that you do not have time to resolve these issues, do not delay vital treatment. Go immediately to the nearest ER. Documentation of a severe asthma attack usually will be accepted by most insurance companies.

21. What Do You Do When Your Asthmatic Symptoms Worsen?

1. Check your peak flow meter readings.
2. Increase your medications as recommended by your asthma specialists for these situations.
3. Call your asthma specialists. In an emergency, a physician is available 24 hours a day and can be

reached during off hours through a page operator. Normally, you will receive a response within 5 - 10 minutes for an emergency.

4. Before you call, be sure to determine what medications and nebulizer solutions you have at home and know the telephone number of a local pharmacy that is open.

Your asthma specialists should give you instructions regarding which medications to take, what danger signs to look for and arrange for appropriate follow-up.

22. How Do You Prevent Flares of Asthma?

- Know your type of asthma and its triggers.
- Know your allergies and avoid unnecessary exposures.
- Have a written list of emergency instructions.
- Keep your follow-up appointments as recommended.
- Never run out of medications.
- Be compliant with all of your doctor's recommendations.
- Do not smoke or allow yourself to be exposed to cigarette smoke.
- Reduce exposure to your known asthmatic triggers at home, work, school and recreation.
- Monitor your asthma (symptoms and peak flow rates) - do not deny problems.
- Always have emergency medications on hand at home and when traveling.
- Call your doctor when your asthma first begins to flare.
- Control medical problems that worsen your asthma (sinusitis, allergy, GERD, obesity, deconditioning, and heart disease).

23. How Can You Control Asthma When Traveling?

- Keep a written list of all your diagnoses and medications in your wallet or purse.
- Speak with your asthma specialists if you are concerned about travel affecting your asthma.
- Carry a written emergency plan and possibly a portable nebulizer and solutions, prednisone, and two sets of all of your medications.
- Keep one set of your medications and a portable nebulizer *(see Omron MicroAir NE-U22V Portable Nebulizer on page 72)* in your hand luggage and never let it out of your sight.
- Reserve a non-smoking room in all hotels and check out the room with a "sniff test" before bringing up your luggage.
- In warm weather travel, do not overexert yourself. If you are having trouble breathing, stay in air-conditioned or cool environments such as hotel lobbies, museums, movies, restaurants, etc. In cold weather travel, use an air warming mask or put a scarf over your mouth. Pretreat yourself before leaving the hotel for outside activities.
- If you are concerned about an asthmatic flare, know the location of the emergency room nearest to your destination.
- If you are allergic to dust mites, carry one or two dust mite proof pillow covers (king size).
- Check your medical insurance to see what coverage you will have when traveling. If necessary, purchase additional travel medical insurance.

24. Will Your Child Outgrow His/Her Asthma?

Although it is commonly believed that children "outgrow" asthma, there is good evidence that children with moderate to severe asthma that persists into adolescence will likely have symptoms as adults. Poorly controlled asthma in childhood can lead to permanent lung damage *(see Remodeling of the Airway, page 11)*. Many children with less severe symptoms triggered by viral upper respiratory infections become asymptomatic as young adults when viral infections occur less frequently. Children with mild asthma have a good chance of having complete remission from their symptoms as adults. The best way to assist in resolution of asthmatic symptoms is to keep asthma under tight control at all times since inadequately controlled childhood asthma has a tendency to become chronic or resurface in the adult years.

25. Is Surgery a Special Risk for Asthma Patients?

The answer is both yes and no. If your asthma is optimally controlled, you generally can undergo major surgery without any significant complication resulting from your underlying asthma. If you have poorly controlled asthma or are steroid-dependent *(see page 55),* you are at considerable risk and need specific medical preparation by your asthma specialist well before surgery. Surgery may result in a severe flare of asthma or other complications during or immediately after surgery. In addition, persistent coughing following surgery can complicate surgery by causing wound separation and other surgical complications. If you are asthmatic and steroid-dependent, you are at risk for both a flare of your asthma as well as adrenal gland failure, which can result in a sudden drop in blood pressure as you enter into a state of shock.

Finally, if you are sensitive to latex, you must notify the surgeon and anesthesiologist to this fact and review with them what precautions will be taken during surgery to limit your exposure to latex.

If you have chronic asthma, you should be evaluated by the physicians managing your asthma prior to surgery and should have a written plan to give to the surgeons and anesthesiologists regarding asthma medication recommendations pre- and post-surgery.

Your asthma specialists' goals should include:

- A thorough pre-surgical evaluation including review of symptoms, pulmonary function test results, physical examination, medications and past medical problems including potential risks for asthmatic flares.
- If pulmonary function is not optimal based on your known potential (i.e. previous pulmonary function studies), then the physician must treat you intensively and post- pone surgery until your asthma is under the best possible control prior to giving medical clearance.
- Review the use of corticosteroids over the past year(s) and any other issues that may put you at risk for steroid-dependence. In particular, careful review of oral corticosteroid use over the past 6 months, use of high dose inhaled corticosteroids and any history of prolonged use of oral corticosteroids in the past is necessary.
- Continue asthma medication(s) throughout surgery. Inhaled medication can be administered by nebulization when required. Consider the need for intravenous corticosteroid administration pre- and post-surgery.

26. How Can You Find More Information About Asthma and Allergies?

Need More Information About Asthma and Allergies?

The Asthma Center
www.asthmacenter.com

American Academy of Allergy, Asthma & Immunology (AAAAI)
www.aaaai.org
1-414-272-6071

American College of Allergy, Asthma & Immunology (ACAAI)
www.acaai.org
1-847-427-1200

American Lung Association
www.lung.org
1-800-LUNG-USA

Allergy & Asthma Network Mothers of Asthmatics (AANMA)
www.aanma.org
1-800-878-4403

Asthma and Allergy Foundation of America (AAFA)
www.aafa.org
1-800-7-ASTHMA

The Food Allergy & Anaphylaxis Network (FAAN)
www.foodallergy.org
1-800-929-4040

Asthma Tips

Signs of Worsening Asthma:

- Increase in symptoms of shortness of breath, chest tightness and/or wheezing
- Decrease in Peak Expiratory Flow Rates (PEFR)
- Increase in frequency of use of short acting bronchodilators
- Waking at night with asthmatic symptoms
- Decrease in exercise tolerance
- Need for emergency care
- Missing school or work due to asthmatic symptoms
- Decrease in quality of life due to asthmatic symptoms

Patient Guidelines:

1. Know your exact diagnosis
2. Write your medications down and keep the list with you at all times
3. Have a written list of emergency instructions
4. Keep your follow-up appointments
5. Never run out of medication
6. Reduce exposure to triggers of asthma at home, work, school, and when outdoors
7. Monitor your asthma (PEFR).
8. Call your doctor when your asthma first flares.

Goals of Asthma Management:

- Good quality of life in spite of having asthma
- No sleep disturbances due to asthma
- Ability to work or go to school
- No ER visits or hospitalizations
- No life-threatening events
- Maintaining normal activity levels and the ability to participate in physical activity
- Avoiding side effects of treatment
- Excellent patient education (know your medications)
- Knowing what triggers your symptoms
- Establishing a good relationship with your physician(s)
- Knowing what to do in an emergency
- Being prepared at all times
- Good inhaler techniques
- Compliance with physician recommendations
- Environmental controls

Glossary

Adrenal Glands Tiny glands that are found on top of each kidney. They secrete hormones called glucocorticosteroids (cortisol) and mineralocorticoids (aldosteroids). The glucocorticosteroids are important in the body's metabolism and have potent anti-inflammatory effects. The production of glucocorticosteroids is necessary for the body to function properly.

Adrenal Failure When the adrenal glands fail to function, for example if you have been taking daily oral prednisone for a very long time, you can no longer produce adequate cortisol. If you are stressed and the body cannot react by producing cortisol, there is a risk that your blood pressure may drop and you may enter into a shock-like state. If you suffer adrenal failure, you are at high risk for a very severe asthmatic attack, which is potentially fatal if you do not receive supplemental corticosteroid medication in a timely fashion.

Allergens Substances which cause abnormal sensitivities and allergic reactions, such as pollens, molds and dust mites.

Allergic Rhinitis Redness, swelling and itching in the nose caused by an allergic reaction. Seasonal allergic rhinitis is known as hayfever *(see Common Allergic Symptoms, page 75)*.

Allergist A specially trained physician who treats suffering from allergy of the eyes, nose, throat and sinuses; asthma and other lung diseases; allergic skin disorders (poison ivy, eczema, etc.); and problems of the immune system (frequent infections). An allergist also evaluates and treats drug allergy, insect reactions, food allergy, autoimmune disorders (lupus, vasculitis) and allergy to materials in the work environment.

The allergists at **The Asthma Center** are Board Certified Allergists and Clinical Immunologists. This means the doctors have completed 4 years of medical school, 3 years of residency in Internal Medicine or Pediatrics and 2 or more years of specialized training in Allergy and Immunology at leading medical institutions. In addition, the doctors have passed certification examinations for Allergy and Immunology as well as Internal Medicine or Pediatrics. All are certified by the American Board of Allergy and Clinical Immunology as well as the American Board of Internal Medicine or Pediatrics.

Allergy An abnormal sensitivity based on the reaction of the body's immune system to a substance or substances which are generally harmless to others.

Antihistamine A medication which decreases the body tissues' response to histamine (some antihistamines cause drowsiness).

Asthma A disease characterized by reversible narrowing and inflammation of the bronchial tubes often accompanied by wheezing, shortness of breath and/or coughing.

β_2-Agonists (Beta-2 Agonists)

Medications of the sympathomimetic class (e.g. albuterol) that are used in the treatment of asthma. These bronchodilators work by selectively stimulating the β_2 receptors on the bronchi to cause bronchodilation. Older sympathomimetic inhalers also stimulated the β_1 receptors of the heart, often causing the side effect of a racing heart beat.

Challenge Test

A medical procedure used to identify those substances to which you are sensitive by deliberately exposing you to dilute amounts of those substances until allergic symptoms are provoked.

Chemical Mediator

These are substances released from mast cells as well as other cells lining the bronchial tubes and the mucosal membranes of the eyes and nose that cause allergic or asthmatic symptoms. They include histamines, leukotrienes, and other chemicals that can result in congestion, swelling of tissues, mucus production, bronchospasm, itchiness, and inflammation.

Corticosteroids (glucocorticosteroids or steroids)

One of many types of steroids secreted by the adrenal gland and also manufactured for use as a powerful medication in the treatment of inflammatory reactions from asthma and allergy *(see Corticosteroids, page 50)*.

DPI (dry powder inhaler)

DPI is a device used to deliver asthma medication by inhalation. The medication is in a dry form. Asthma medications can be inhaled so that they go directly to the lungs and bypass the rest of the body, thus decreasing side effects. Inhaled medications can be administered as DPIs, which have the advantage of being breath-activated.

Gastroesophageal Reflux Disease (GERD)

GERD occurs when acid in the stomach leaks past the upper stomach valve and rises up the esophagus *(see GERD, page 88)*.

Hayfever

See "Allergic Rhinitis" *(see Common Allergic Symptoms, page 75)*.

Histamine

A substance produced by the body in reaction to exposure to allergens; it causes eyes to tear and itch, nasal passages to swell, the nose to run and sneezing to occur (*see Common Allergic Symptoms, page 75*).

Hives

See "Urticaria."

IgE (Immunoglobulin E)

IgE is one of 5 human antibodies and is important in causing allergic symptoms. The IgE antibody attaches selectively to mast cells lining the respiratory mucous membrane, gastrointestinal tract and skin. When the part of the IgE antibody is exposed to its matching allergen, then the mast cell is stimulated to release chemical mediators that cause allergic symptoms.

Immunoglobulins

Immunoglobulins are antibodies that fight disease by damaging foreign organisms that invade the body. Certain immunoglobulins such as IgG and IgM act as a primary defense against invading bacteria. Deficiency of these antibodies can result in recurrent infections that can provoke recurrent asthmatic symptoms, ear infection, sinusitis and pneumonia.

Increased levels of IgE are usually associated with allergy symptoms.

Immunotherapy

A treatment for hayfever and allergic asthma that involves periodic injections of the allergens (such as pollens, mold spores and dust mite) that are causing the allergic reactions or asthmatic attacks. Injections, commonly called allergy shots or allergen injections, work to build up an immunity to the allergens and help prevent attacks of hayfever or asthma. Sublingual administration is also available.

Mast Cells

Mast cells are uniquely rich in chemical mediators that when released, either as a result of an allergic reaction or for any reason, can cause edema, itching, bronchospasm and inflammation. They line the mucous membranes of the bronchial tubes, respiratory mucosa of the eyes, nose, sinuses and intestinal tract. The skin is also rich in mast cells. The mast cells have special receptors for IgE and play a central role in allergic reactions and asthma.

MDI (metered-dose inhaler)

MDIs contain asthma medication in an aerosolized form in which you inhale a precise dose of medication mist from the device directly into the lungs. MDIs require good coordination during inhalation or the use of a spacer device.

Metabolize

Breaks down and eliminates.

Mold

Parasitic, microscopic plants without stems, roots, or leaves. Molds are found outdoors in soil, vegetation and rotting wood. Indoors, they are often found in attics, bathrooms, basements, and in and around plants. Mold is also known as mildew.

PEFR (Peak Expiratory Flow Rate)

PEFR represents the maximum rate of flow of air you can blow out which is one way of measuring the function of your lungs. If you have some airway obstruction, you will notice that your PEFR measurements will begin to decrease as symptoms get worse *(see Home Peak Flow Monitoring, page 73)*. Defined as the difference in measurement between the value of the PEFR taken in the morning and the one taken in the evening. Usually the morning rate is somewhat lower than the evening rate. As your asthma gets out of control, your PEFR variability increases *(see Home Peak Flow Monitoring, page 73)*.

Pollen

The male fertilizing agent of plants that consists of microscopic, powdery granules.

Pollen and Mold Spore Count

A measure of the pollen grains or mold spores in the air. Counts are reported as the number of pollen grains or mold spores per cubic meter of air per 24 hours *(see Pollen and Mold Spore Counts, page 76)*.

Pulmonary Function Test

An objective measure of lung function performed by breathing into specialized equipment.

Sinusitis

Sinusitis means inflammation of the sinus(es). Sinusitis can result from allergy, infections, or even chemical exposure. If you suffer from sinus disease, it is likely you often com- plain of nasal and head congestion, headaches and post nasal drip *(see Asthma and Sinusitis, page 86)*.

Skin Tests

Application of a small dilute amount of allergens to the skin through a scratch or injection. If you are allergic to that substance, a small raised area surrounded by redness (hive) will appear at the test site within 15 minutes.

Spacer

A spacer is a tube-like device that is placed between the MDI (inhaler) and your mouth. It

allows the inhaled medicated mist to slow down after you activate the MDI so that it can be inhaled more efficiently even if your coordination in using the MDI is not perfect.

Spores

The reproductive cells of molds.

Steroid-Dependent

If you receive daily doses of corticosteroids over time, you can lose your ability to secrete cortisol from your adrenal gland in the natural way. If you are on long term daily corticosteroids, you may have shrunken adrenal glands, and it may take months to years, if ever, to regain the ability to function normally once daily treatment is discontinued. You are at steroid risk when your asthma flares or whenever you are stressed since you can no longer produce the life sustaining corticosteroid levels that are necessary. You must self- administer supplementary corticosteroid treatment with every flare of asthma or stressful situations under your physicians' guidance.

Sympathomimetic

Sympathomimetic asthma medications (e.g. epinephrine, albuterol and pseudoephedrine) are used as either bronchodilators in asthma or decongestants in eye, nose and sinus allergy. Modern sympathomimetic asthma medications are usually selective in that they stimulate mostly the $ß_2$ receptors in the lung causing bronchodilation (e.g. albuterol). Those sympathomimetics used to treat upper respiratory allergy also stimulate alpha-receptors causing the blood vessels to contract and thereby decrease congestion due to allergic reactions (e.g. pseudoephedrine, phenylpropanolamine).

Urticaria

A reaction in the skin marked by swelling, redness and itching. This reaction is known as hives.

Appendix

Instructional Videos

You can visualize the various techniques explained in this manual using the following links

For Inhalers and Spacers:

- Closed mouth technique: https://www.youtube.com/watch?v=ys6AoOFsP2g
- Open mouth technique: https://www.youtube.com/watch?v=Lrt1nJ3tVFI
- Aerochamber spacer without mask technique: https://www.youtube.com/watch?v=hCAsW7OM9Ns
- Aerochamber spacer with mask technique: https://www.youtube.com/watch?v=von7cyXcj2c
- Dry powder inhaler: https://www.youtube.com/watch?v=bxC48vQEfZI

For Nebulizers:

- Nebulizer: https://www.youtube.com/watch?v=q3gwBBsGmUg

For Peak Flow Meters:

- Peak flow meter: https://www.youtube.com/watch?v=6oKupWgDu80

For Eye Drops:

- Eye drops: https://www.youtube.com/watch?v=SnAfc6h4ax4

Cost of Medications

The cost of medications for respiratory problems are often prohibitory. Many drug companies often have coupons for certain drugs. Unfortunately, this does not apply to Medicare patients. See our website (*www.asthmacenter.com*) for manufacturer drug discount coupons.

The Authors

The authors are allergists at **The Asthma Center** with offices in Pennsylvania and New Jersey. They are clinicians, teachers and researchers and are on the staff of Drexel University College of Medicine. They have written extensively in professional and lay journals, textbooks and monographs and frequently honor requests to lecture to other physicians and public groups.

The authors are committed to continued medical education, patient care, teaching and clinical research.

If you have a question regarding this manual, you can speak to one of the authors at **The Asthma Center Education and Research Fund** at 215-569-1111.

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The Asthma Center Education and Research Fund

The Asthma Center Education and Research Fund is a nonprofit organization dedicated to education and research advances in asthma.

To make a tax-deductible donation or memorial contribution call:

The Asthma Center Education and Research Fund

(215) 569-1111

What Should You Do in Case of an Emergency?

1. Prevention

- Always know the location of the closest emergency room.
- Do not overuse your beta-agonist inhaler – increased use signals worsening asthma control.
- Never run out of medications
- Always take your medications regularly as prescribed by your physician.
- Do not make changes in your medications without discussing it with your physician.
- Never travel without your medication.
- Never miss a scheduled follow-up visit.
- Avoid known asthma-provoking situations or allergens.

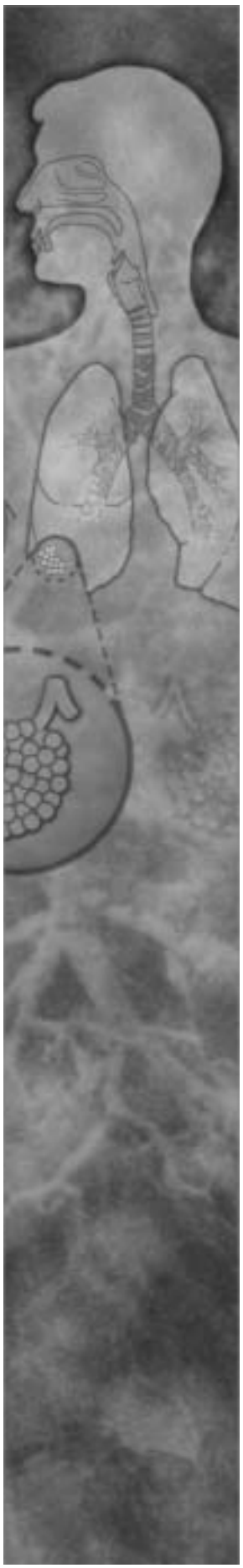
2. Call

- Telephone your asthma specialists whenever you find your asthmatic symptoms are not responding to medications prescribed. Call your asthma specialists during regular working hours for nonurgent problems (best time is early in the morning). For urgent problems or emergencies, call at any time.

3. Follow Protocol of Emergency Treatment

- At all times, have your emergency medications available for immediate use.
- A nebulizer treatment can be given initially as often as every 20 minutes for the first 2 or 3 doses.
- If you do not immediately respond to your nebulizer, begin oral corticosteroid treatment (prednisone or similar medications such as Pediapred®, methylprednisolone, or Deltasone®). Once you begin this corticosteroid, talk to your specialists within 24 hours for guidance and dosage. Ideally, contact your asthma specialists prior to starting oral corticosteroids.
- If you need to administer epinephrine (EpiPen®) because of a severe asthmatic episode, call your asthma specialists immediately for guidance and be prepared for immediate transport to the closest emergency room.
- Call your asthma specialists if you are not responding to medication.

These recommendations are only examples, and you may receive your own individual emergency treatment schedules.



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