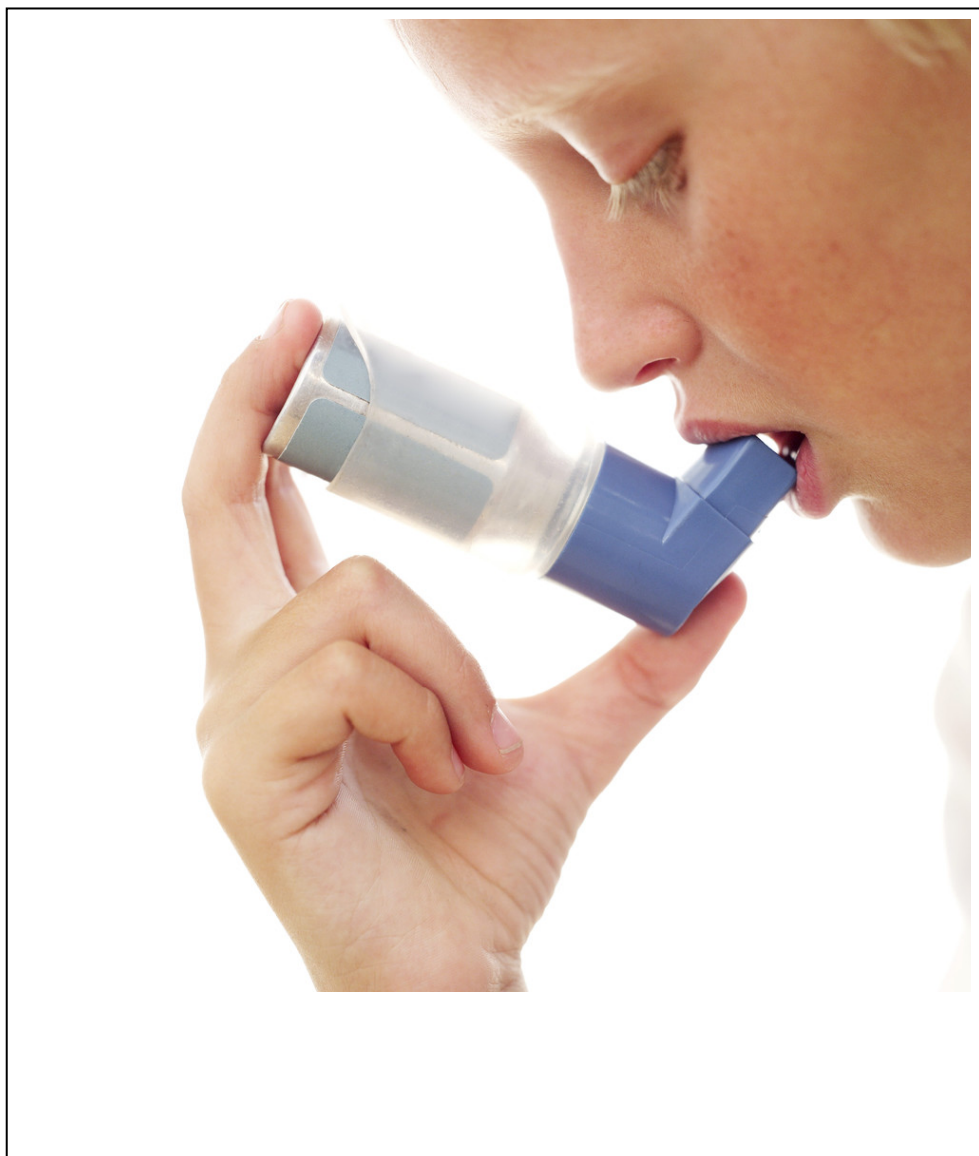


Asthma



Asthma

Introduction/ Purpose Statement

Asthma is a growing problem affecting people of all ages, races, and incomes. Asthma is the most common chronic disease among U.S. children, as well as a common chronic condition in adults, both in the U. S. and around the world. The purpose of this home study is to give you information on what asthma is, the risk factors for acquiring it, and how it is diagnosed and treated.

Target Audience

This home study was designed for nurses with no familiarity with asthma; however, all health care professionals are invited to complete this packet.

Content Objectives

1. Describe the signs and symptoms of asthma.
2. Identify tests that are used to help in the diagnosis of asthma.
3. List 3 or more medications used to treat asthma.
4. Describe how to treat an acute exacerbation of asthma.
5. Identify important topics for patient education for the asthma patient.

Disclosures

In accordance with ANCC requirements governing approved providers of education, the following disclosures are being made to you prior to the beginning of this educational activity:

Requirements for successful completion of this educational activity:

In order to successfully complete this activity you must read the home study, complete the post-test and evaluation, and submit them for processing.

Conflicts of Interest

It is the policy of the Twin Cities Health Professionals Education Consortium to provide balance, independence, and objectivity in all educational activities sponsored by TCHP. Anyone participating in the planning, writing, reviewing, or editing of this program are expected to disclose to TCHP any real or apparent relationships of a personal, professional, or financial nature. *There are no*

conflicts of interest that have been disclosed to the TCHP Education Consortium.

Relevant Financial Relationships and Resolution of Conflicts of Interest:

If a conflict of interest or relevant financial relationship is found to exist, the following steps are taken to resolve the conflict:

1. Writers, content reviewers, editors and/or program planners will be instructed to carefully review the materials to eliminate any potential bias.
2. TCHP will review written materials to audit for potential bias.
3. Evaluations will be monitored for evidence of bias and steps 1 and 2 above will be taken if there is a perceived bias by the participants.

No relevant financial relationships have been disclosed to the TCHP Education Consortium.

Sponsorship or Commercial Support:

Learners will be informed of:

- Any commercial support or sponsorship received in support of the educational activity,
- Any relationships with commercial interests noted by members of the planning committee, writers, reviewers or editors will be disclosed prior to, or at the start of, the program materials.

This activity has received no commercial support outside of the TCHP consortium of hospitals other than tuition for the home study program by non-TCHP hospital participants.

If participants have specific questions regarding relationships with commercial interests reported by planners, writers, reviewers or editors, please contact the TCHP office.

Non-Endorsement of Products:

Any products that are pictured in enduring written materials are for educational purposes only. Endorsement by WNA-CEAP, ANCC, or TCHP of these products should not be implied or inferred.

Off-Label Use:

It is expected that writers and/or reviewers will disclose to TCHP when “off-label” uses of commercial products are discussed in enduring written materials. *Off-label use of products is not covered in this program.*

Expiration Date for this Activity:

As required by ANCC, this continuing education activity must carry an expiration date. The last day that post tests will be accepted for this edition is **December 31, 2017**—your envelope must be postmarked on or before that day.

Planning Committee/Editors

Linda Checky, BSN, RN, MBA, Assistant Program Manager for TCHP Education Consortium.

Lynn Duane, MSN, RN, Program Manager for TCHP Education Consortium.

Author

***Linda Checky, BSN, RN, MBA**, Assistant Program Manager for TCHP Education Consortium.

Content Experts

Sharon Stanke, MSN, RN, Critical Care Instructor, Minneapolis VA Medical Center.

***Cleo Bonham, MSN, RN**, Clinical Instructor, Minneapolis VA Medical Center.

*Denotes reviewer of current edition

Contact Hour Information

<p>For completing this Home Study and evaluation, you are eligible to receive:</p>	<p>2.0 MN Board of Nursing contact hours / 1.66 ANCC contact hours</p> <p>Criteria for successful completion: You must read the home study packet, complete the post-test and evaluation, and submit them to TCHP for processing.</p> <p>The Twin Cities Health Professionals Education Consortium is an approved provider of continuing nursing education by the Wisconsin Nurses Association, an accredited approver by the American Nurses Credentialing Center’s Commission on Accreditation.</p>
---	---

Please see the last page of the packet before the post-test for information on submitting your post-test and evaluation for contact hours.

What exactly is asthma?

While there is currently not a universally accepted definition, most experts agree that asthma is a "reversible" chronic obstructive lung disease. Even though asthma tends to occur in episodes, the underlying airway inflammation is continuous. This inflammation is almost always the cause of the asthmatic condition.

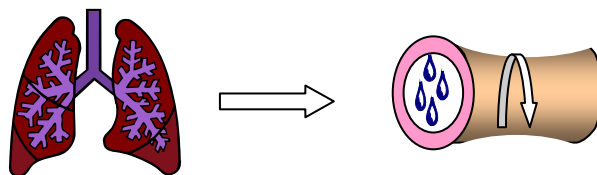
The airway inflammation in asthma is thought to be potentially acute, subacute, and/or chronic. Chronic inflammation causes a persistent level of cell damage and an on-going repair process. These changes may cause permanent airway abnormalities. Viewed microscopically, the airways often contain inflammatory cells, cellular debris, and mucus plugs. There may be microvascular leakage and the smooth muscle is often hypertrophied. This can lead to new vessel formation and deposition of collagen beneath the airway epithelium causing remodeling. These changes in the airway wall may not be completely reversible. It is thought that once the airway remodeling has occurred, the airway obstruction may be persistent and will not respond to treatment. Current treatment is aimed at avoiding factors that contribute to asthma severity and giving medications to suppress airway inflammation.

Asthma episodes or "attacks" are characterized by increased mucus production with airway inflammation and spasm. This narrows the airways, making it difficult to breathe. Wheezing and mucus plugs are frequently present.

Asthma attacks are usually caused by certain "triggers", such as cigarette smoke, viral infections, or contact with allergens. They can happen suddenly or gradually develop over hours or even days. Studies indicate that allergic reactions produce both immediate and delayed reactions. When there is an allergic reaction to an inhaled allergen (mold, dust, etc.), about 50% of cases will go on to have a delayed reaction. The "late phase" or delayed reaction produces more serious injury and airway inflammation than the immediate reaction. This leads to irritability of the airways. Prolonged airway inflammation can cause scarring.

Figure 1: Asthma Episodes

With asthma, the airways become inflamed and swell, the muscles that surround the airways tighten, and mucus production is increased.



Asthma symptoms include coughing, shortness of breath, wheezing, and a tight feeling in the chest. Any one of these symptoms can mean asthma. Some people will have all of these symptoms; others will have only one of these symptoms or even different symptoms.



How do you get asthma?

Asthma is characterized by excessive sensitivity of the lungs to certain types of stimuli. The reason why certain people develop this hypersensitivity is not completely understood. Asthma often begins in childhood and there appears to be a genetic predisposition and a strong allergic component (atopic asthma). Approximately 75-80% of children with asthma have significant allergies.¹ There are also some perinatal factors that can place children at greater risk for getting asthma. A recent study indicated that Cesarean section, vacuum extraction, use of forceps, and low Apgar scores at one and five minutes after birth all increased the odds of developing asthma by the age of seven.²

Even though asthma most often begins in childhood and adolescence, it can develop anytime in life. In adult-onset asthma, allergens may continue to play an important role. Adults with asthma often have coexisting nasal polyps, sinusitis, and sensitivity to aspirin or related nonsteroidal anti-inflammatory drugs. The mechanisms of nonallergic or intrinsic asthma are less well established. The inflammatory process with intrinsic asthma is similar, but not identical to, atopic or allergic asthma.

Occupational exposure to certain materials [animal products, biological enzymes, plastic resin, wood dust (particularly cedar), and metals] can cause clinical signs of asthma. Identification of the agent responsible for the reaction and removing it from the

Asthma

©TCHP Education Consortium, 2007

Page 4

workplace can reduce symptoms, but the individual will still have asthma. The mechanisms involved with this type of asthma are not clearly understood.



Why should I worry about it?

The prevalence of asthma has been increasing for all age, sex, and racial groups since the early 1980's. Between 1980 and 1994 the overall age adjusted prevalence of asthma increased 75%. For children up to 4 years old, the prevalence increased 160% during the same time period.³ Of the total asthmatics that live in this country, almost one-third of them are children under 18 years of age.⁴ Asthma is the most common chronic condition among U.S. children, affecting 4.8 million of America's 70 million children under age 18.⁵ Asthma also disproportionately affects females and African Americans. Between 1982 and 1996, the prevalence rate increased by almost 22% in males and 97% in females.⁶ The prevalence rate in blacks was 15% higher in 1997 and 30% higher in 1998 compared to the rate seen in whites.⁷

The estimated cost of asthma in 2000 was \$12.7 billion in both direct and indirect (lost productivity) costs. Inpatient hospital services accounted for the single largest portion of the direct costs (over \$3.5 billion) and reduced productivity accounted for the single largest indirect cost (\$1.5 billion).⁸

Not only has the prevalence and cost of asthma increased, the mortality rate has also risen. Between 1979 and 1998, the age-adjusted mortality rate increased 56%. In contrast, the age-adjusted death rate attributed to all causes decreased 18 percent.⁹ Like the rate of prevalence, though, the mortality rate did not affect everyone equally. White males experienced a 12.5% increase in mortality, while white females increased 50%. During the same time period, the age-adjusted mortality increased by 78.9% for black males and 90% for black females.¹⁰



How is asthma diagnosed?

Asthma should be considered if any of the following symptoms are present:

- Wheezing--especially in children.
- A history of cough (especially at night), recurrent wheezing, difficulty breathing, or chest tightness.

- The airflow limitation is reversible. This is sometimes ascertained by using a peak flow meter. The patient will be asked to measure their peak expiratory flow on arising in the morning before using their inhaler and again in the afternoon after their medications have taken effect. If the measurements vary by 20% or more, asthma is suspected.
- Symptoms recur or worsen in the presence of exercise, viral infection, animals with fur or feathers, house dust mites, mold, smoke, pollen, changes in weather, strong emotional expression such as laughing or hard crying, airborne chemicals or dusts, menses.
- Symptoms occur or worsen at night, awakening the patient.

Recurrent episodes of coughing and wheezing are almost always due to asthma in both children and adults. Asthma is frequently underdiagnosed, especially in children who wheeze when they have a respiratory infection. These children are often diagnosed with bronchitis, bronchiolitis, or pneumonia even though their symptoms are more consistent with a diagnosis of asthma. Any child who has frequent coughing or respiratory infections such as pneumonia or bronchitis should be evaluated for asthma.¹¹

A careful medical history, physical examination, pulmonary function tests, and additional tests are needed to provide the information needed to be sure the diagnosis is correct. It is important to be sure that the symptoms the patient is experiencing are not due to another disease process. Figure 2 lists a variety of conditions that can mimic the symptoms of asthma.

No single test or measurement is adequate to diagnose asthma. It is the patient's pattern of symptoms, along with their medical history and exclusion of other possible diagnoses that lead to the diagnosis. Keep in mind that asthma can present with signs and symptoms that vary widely from patient to patient as well as within the same patient over time.

**Figure 2:
Conditions That Can Mimic Asthma**

<i>Infants & Children</i>	<i>Adults</i>
<ul style="list-style-type: none"> • Allergic rhinitis and sinusitis • Foreign body in trachea or bronchus • Vocal cord dysfunction • Vascular ring or laryngeal web • Laryngotracheomalacia, tracheal stenosis, or bronchostenosis • Enlarged lymph nodes or tumor • Viral bronchiolitis or obliterative bronchiolitis • Cystic fibrosis • Bronchopulmonary dysplasia • Heart disease • Aspiration from swallowing mechanism dysfunction or gastroesophageal reflux 	<ul style="list-style-type: none"> • Chronic bronchitis or emphysema • Congestive heart failure • Pulmonary embolism • Laryngeal dysfunction • Obstruction of the airway (tumors) • Pulmonary infiltration with eosinophilia • Cough due to drugs (ACE inhibitors) • Vocal cord dysfunction

Adapted from NIH Publication 97-4051, page 22

What are the treatment options?

The good news is that even though asthma cannot be cured, it can almost always be controlled. There are a number of medicines that are used to control asthma that come in the form of sprays, pills, powders, liquids, and injections.

Anti-inflammatory agents (corticosteroids, cromolyn sodium, nedocromil, and other anti-inflammatory agents) are used to reduce the bronchial inflammation and have a preventative action. Leukotriene modifiers (zafirlukast, monlelukast, and zileuton) are a recent addition to anti-inflammatory therapy and work by

blocking the action of leukotrienes, chemicals involved in airway inflammation.

Bronchodilators are also used to relax bronchial smooth muscle. They include beta-adrenergic agonists, methylxanthines, and anticholinergics. These medicines help to make the airways less reactive.

Anti-inflammatory agents, including leukotriene modifiers, **prevent** asthma attacks from starting. They reduce swelling and mucus.

Bronchodilators help **stop** asthma attacks after they have started and can help prevent expected attacks, such as from exercise.

Treating asthma also involves a fair amount of patient education. Patients and families need to understand their disease process, the medications they take, how to use a peak flow meter to monitor their asthma, how to avoid asthma triggers, and how to treat acute exacerbations (asthma episodes).



Asthma Medications

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

- Long-term control medications are taken daily on a long-term basis to prevent asthma attacks. They include anti-inflammatory agents, long-acting bronchodilators, and leukotriene modifiers.
- Quick-relief medications are used to stop asthma attacks after they have started or to prevent expected attacks, such as from exercise. Quick-relief medications include short-acting inhaled beta₂-agonists (albuterol, bitolterol, pirbuterol, terbutaline), anticholinergics (ipratropium bromide), and systemic corticosteroids (methylprednisolone, prednisolone, prednisone).
- The systemic corticosteroids have a slow onset of action (>4 hours), but they help prevent progression of the exacerbation, speed recovery, and prevent relapses.

All medications have potential side-effects, including those that are used to manage asthma. It is estimated that more than 60% of asthma patients suffer from medication side effects, causing many patients to either skip doses or take less medication than

prescribed.¹² It is important that health care professionals ask about medication side-effects and attempt, if possible, to manage them. Perhaps side-effects can be managed with a new medication, a different dosage, by rinsing and gargling after inhaled medication, or by using other comfort measures. If the taste of the medication is objectionable, the patient could rinse and gargle with mouthwash or follow their plain water rinse and gargle with a flavored beverage. If nausea from an oral medication (i.e., theophylline) is a problem, taking the medication with food rather than on an empty stomach can help. If the patient experiences rapid heart rate, tremors, anxiousness, and nausea with a beta₂ agonist, the feeling will often pass in 15-20 minutes. Reassure the patient that the side-effects will go away as their body adjusts to the medicine. Mild side effects often go away after a few days.

In addition to side-effects, health care professionals need to be alert for patients who self-medicate. Patients need to understand the importance of taking their medications as ordered and consulting their doctor about over-the-counter products.

Long-Term Control Medications

Corticosteroids (inhaled)

Corticosteroids are indicated for long-term prevention of symptoms and suppression, control, and reversal of inflammation. They reduce the need for oral corticosteroids, which have more side-effects. Corticosteroids include: beclomethasone dipropionate (Vanceril, Beclovent), budesonide (Pulmicort), flunisolide (Aerobid), fluticasone propionate (Flovent), and triamcinolone acetonide (Azmacort).

Potential side-effects are cough, dysphonia (voice impairment), and oral thrush. In high doses, systemic effects may occur.

Therapeutic issues:

- Spacer/holding chambers and mouth rinsing/gargling after inhalation decrease local side effects and systemic absorption.
- Preparations are not absolutely interchangeable on a mcg or per puff basis. New delivery devices may provide greater delivery to airways, affecting the dose needed.
- Dexamethasone is not included because it is highly absorbed and has long-term suppressive side effects.

Systemic Corticosteroids

Systemic corticosteroids are used in a short-term “burst” (3-10 days) to gain control of asthma symptoms. They are sometimes used for long-term prevention of symptoms in severe persistent asthma and for the suppression, control, and reversal of inflammation.

Potential side-effects from short-term use are reversible abnormalities in glucose metabolism, increased appetite, fluid retention, weight gain, mood alteration, hypertension, peptic ulcer, and rarely aseptic necrosis of the femur. With long-term use side-effects may include: adrenal axis suppression, growth suppression, dermal thinning, hypertension, diabetes, Cushing’s syndrome, cataracts, muscle weakness, and rarely impaired immune function. Some coexisting conditions such as herpes, varicella, tuberculosis, hypertension, peptic ulcer, and *Strongyloides* (a parasite) may be worsened by systemic corticosteroids.

Therapeutic issues:

- The lowest effective dose should be used. For long-term use, alternate-day a.m. dosing produces the least toxicity. If daily doses are needed, there may be improved efficacy without increasing adrenal suppression if taken at 3 p.m. rather than in the morning.

Cromolyn Sodium and Nedocromil

Cromolyn sodium and nedocromil work by blocking the early and late reactions to allergens and by inhibiting the acute response to exercise, cold and dry air, and SO₂. These medications are used for long-term prevention of symptoms and may modify inflammation. They are also used as a preventative treatment prior to exercise or exposure to an allergen. These medications cannot stop an asthma episode; they only prevent them from happening.

Potential side-effects: 15-20% of patients complain of an unpleasant taste from nedocromil.

Therapeutic issues:

- Therapeutic response often occurs within 2 weeks, but a 4-6 week trial may be needed to determine maximum benefit.
- Dose of cromolyn MDI (1 mg/puff) may be inadequate to affect airway hyperresponsiveness. Nebulizer delivery (20 mg/ampule) may be preferred for some patients.
- Safety is the primary advantage of these agents.
- If a beta₂ agonist is used along with cromolyn, take the beta₂ agonist first.

Long-Acting Beta₂-Agonists

Long-acting beta₂-agonists, such as salmeterol (Serevent) and formoterol (Foradil), cause bronchodilation, increase mucociliary clearance, and decrease mast cell mediator release and vascular permeability. They are used for long-term prevention of symptoms, especially nocturnal symptoms, when added to anti-inflammatory therapy. They can also be used to prevent exercise-induced bronchospasm. Sameterol should not be used to treat acute symptoms or exacerbations!

Side-effects include tachycardia, arrhythmia, headache, tremors, hypokalemia, hyperglycemia, muscle cramps and clinically significant prolongation of the QT_C interval in overdose.

Therapeutic issues:

- Use caution in patients with impaired hepatic function, cardiovascular disorders (including coronary insufficiency, cardiac arrhythmias, and hypertension), convulsive disorders, or thyrotoxicosis.
- Should not be used instead of anti-inflammatory therapy.
- May control symptoms better when added to standard doses of inhaled corticosteroid, rather than just increasing the corticosteroid dosage.

Oral Albuterol, sustained release

Inhaled long-acting beta₂-agonists are preferred because they are longer acting and have fewer side effects.

Combination Inhalers

Combination inhalers, such as Advair® are becoming more and more common. These inhalers combine a corticosteroid plus a long-acting bronchodilator for long-term control of asthma symptoms. Advair® combines fluticasone propionate with salmeterol. These inhalers are used to prevent asthma symptoms and are contraindicated for acute bronchospasm, status asthmaticus, or the immediate prevention of exercise induced bronchospasm.

Methylxanthines

Methylxanthines are given for long-term control and prevention of asthma symptoms, especially for nighttime control. Methylxanthines such as theophylline act by relaxing the bronchial smooth muscle, helping the diaphragm to contract, and increasing clearance of mucus from the airways.

Side-effects can include insomnia, gastric upset, aggravation of an ulcer or gastric reflux, increased hyperactivity in some children, and difficulty urinating in elderly males with an enlarged prostate. With too much medicine, toxic symptoms can develop such as tachycardia, nausea and vomiting, tachyarrhythmias (SVT), central nervous system stimulation, headache, seizures, hematemesis, hyperglycemia, and hypokalemia.

Therapeutic issues:

- Need to follow drug levels to be sure that concentrations of the drug are within the therapeutic (and not toxic) range.
- There are a lot of things that can affect the serum concentration of theophylline (diet, febrile viral illness, hypoxia, cor pulmonale, decompensated congestive heart failure, cirrhosis, age, certain medications, smoking, etc.).
- Not generally recommended for exacerbations. There is minimal evidence for any added benefit to optimal doses of inhaled beta₂-agonists.

Leukotriene Modifiers

Leukotriene modifiers are indicated for long-term control and prevention of symptoms in mild persistent asthma for patients 12 years of age and older. Medications include zafirlukast and zileuton tablets.

Potential side-effects may include elevation of liver enzymes, reversible hepatitis and hyperbilirubinemia.

Therapeutic issues:

- Take on an empty stomach (1 hour before or 2 hours after meals).
- Can inhibit the metabolism of warfarin, terfenadine, and/or theophylline (need to monitor levels of these drugs).

Quick Relief Medications

Short-Acting Inhaled Beta₂-Agonists

These drugs are the mainstay of the quick relief medications and to prevent exercise-induced bronchospasm. These medications act on the bronchial smooth muscle to relax it. Includes: albuterol (Proventil, Ventolin), bitolterol (Tornalate), pirbuterol (Maxair), and terbutaline.

Side-effects include tachycardia, skeletal muscle tremor, hypokalemia, increased lactic acid, headache, and hyperglycemia. The inhaled route usually

produces fewer systemic side-effects. Patients with preexisting cardiovascular disease (especially if elderly) may have adverse cardiovascular reactions with inhaled beta₂ agonist therapy.

Therapeutic issues:

- The inhaled route works quicker, has fewer adverse effects, and works better than systemic routes.
- Isoproterenol, metaproterenol, isoetharine, and epinephrine are not recommended because they can cause excessive cardiac stimulation. Albuterol liquid is not recommended.
- Regularly scheduled daily use is not generally recommended.
- Increasing use or lack of expected effect indicates inadequate control of asthma. Patients who use more than one canister per month may be over-relying on this medication.
- Patients who frequently use beta₂-agonist medication should either initiate or intensify anti-inflammatory medication.
- There is no convincing evidence that routine use of an inhaled beta₂-agonist prior to each dose of inhaled corticosteroid increases intrapulmonary delivery of the inhaled corticosteroid or reduces dosage requirement.¹³

Anticholinergics

Anticholinergic (ipratropium bromide) medication is indicated for relief of acute bronchospasm. It acts by reducing the intrinsic vagal tone in the airways and may block bronchoconstriction due to irritants or to reflux esophagitis. Anticholinergics may also decrease mucus.

Side-effects include a dry mouth and drying of respiratory secretions, increased wheezing in some patients, and blurred vision if accidentally sprayed into the eyes.

Therapeutic issues:

- Reverses only cholinergically mediated bronchospasm. Does not block exercise-induced bronchospasm.
- Might add effect to the beta₂-agonist, but has a slower onset of action.
- An alternative for patients with intolerance to beta₂-agonists.
- Is the treatment of choice for bronchospasm due to beta-blocker medication.

Systemic Corticosteroids

Systemic corticosteroids are given for moderate to severe asthma episodes to prevent the episode from

getting worse, reverse inflammation, speed recovery, and prevent relapse. Includes methylprednisolone, prednisolone, and prednisone.

Potential side-effects from short-term use are reversible abnormalities in glucose metabolism, increased appetite, fluid retention, weight gain, mood alteration, hypertension, peptic ulcer, and rarely aseptic necrosis of the femur.

Therapeutic issues:

- Short-term therapy should continue until the patient achieves 80% PEF (peak expiratory flow) of their personal best or symptoms resolve. This usually takes about 3-10 days.
- There is no evidence that tapering the dose following improvement will prevent relapse.

Management of Asthma

General recommendations for the management of asthma are based on how severe the asthma symptoms are. Figure 3 reviews the various “steps” of asthma severity and the recommended medications at each step.

Figure 3: Managing Asthma in Adults and Children Older than 5 Years of Age

1 Step One: Mild Intermittent

Symptoms:

- Symptoms occur 2 times a week or less
- No symptoms and normal PEF between exacerbations
- Exacerbations brief (hours to a few days); intensity varies

Nighttime symptoms 2 times per month or less

Lung Function:

- FEV₁ or PEF are 80% or more of predicted value
- PEF variability <20%

General Treatment Guidelines (Step One)

Long-term Control:

- No daily medication needed.

Quick relief:

- Inhaled beta₂-agonists as needed for symptoms.

Asthma

©TCHP Education Consortium, 2007

Page 9

- Intensity of treatment will depend on severity of exacerbation.

Use of short-acting inhaled beta₂-agonists more than 2 times a week may indicate the need to initiate long-term control therapy.

2 Step Two: Mild Persistent

Symptoms:

- Symptoms >2 times a week but <1 time a day
 - Exacerbations may affect activity
- Nighttime symptoms >2 times per month

Lung Function:

- FEV₁ or PEF are 80% or more of predicted value
- PEF variability 20-30%

General Treatment Guidelines (Step Two)

Long-term Control:

- Anti-inflammatory: either inhaled corticosteroid (low dose) or cromolyn or nedocromil (children usually begin with a trial of cromolyn or nedocromil).
- Sustained-release theophylline to serum concentration of 5-15 mcg/ml is an alternative, but not preferred, therapy.
- Zafirlukast or zileuton may be considered for patients over 12 years of age, although their position in therapy is not fully established.

Quick relief:

- Short-acting bronchodilator: inhaled beta₂-agonists as needed for symptoms.
- Intensity of treatment will depend on severity of exacerbation.
- Use of short-acting inhaled beta₂-agonists on a daily basis, or increasing use, indicates the need for additional long-term control therapy.

3 Step Three: Moderate Persistent

Symptoms:

- Daily symptoms
- Daily use of inhaled short-acting beta₂ -agonist
- Exacerbations affect activity
- Exacerbations occur 2 times a week or more often; may last days
- Nighttime symptoms >1 time a week

Lung Function:

- FEV₁ or PEF >60% and <80% predicted
- PEF variability >30%

General Treatment Guidelines (Step 3)

Long-term Control:

- Daily medications: Anti-inflammatory (medium dose inhaled corticosteroid) OR inhaled corticosteroid (low-medium dose and add a long-acting bronchodilator, especially for nighttime symptoms; either long-acting inhaled beta₂-agonist, [preferred], sustained-release theophylline, or long-acting beta₂-agonist tablets).
- If needed, add to the anti-inflammatory a long-acting bronchodilator (either long-acting inhaled beta₂-agonist [preferred] or sustained-release theophylline, or long-acting beta₂-agonist tablets)

Quick relief:

- Inhaled beta₂-agonists as needed for symptoms.
- Intensity of treatment will depend on severity of exacerbation.
- Use of short-acting inhaled beta₂-agonists on a daily basis, or increasing use, indicates the need for additional long-term control therapy.

4 Step Four: Severe Persistent

Symptoms:

- Continual symptoms
- Limited physical activity
- Frequent exacerbations
- Nighttime symptoms frequent

Lung Function:

- FEV₁ or PEF are 60% or less of predicted value
- PEF variability >30%

General Treatment Guidelines (Step 4)

Long-term Control:

- Daily medications: Anti-inflammatory (high dose inhaled corticosteroid) AND long-acting bronchodilator (either long-acting inhaled beta₂-agonist [preferred] or sustained-release theophylline, or long-acting beta₂-agonist tablets) AND corticosteroid tablets or syrup long-term (try to reduce repeatedly the systemic corticosteroids while still maintaining control with high dose inhaled steroids)

Quick relief:

- Inhaled beta₂-agonists as needed for symptoms.
- Intensity of treatment will depend on severity of exacerbation.

Asthma

©TCHP Education Consortium, 2007

Page 10

- Use of short-acting inhaled beta₂-agonists on a daily basis, or increasing use, indicates the need for additional long-term control therapy.

*Clinical features listed are before treatment. Only one feature of severity is needed to place a patient in a given category. Place patients in the most severe grade in which any feature occurs. Patients at any grade level can have mild, moderate, or severe exacerbations. An individual's classification can change over time.

Adapted from: 1997 National Heart, Lung, and Blood Institute panel Report 2, page 83-85.

Children less than 5 years of age are classified as step 1-4 by their symptoms and lung function in the same way as adults and older children are, but the treatment guidelines are different. Recommendations for infants and children less than 5 years of age are shown in figure 4.

Figure 4: Managing Asthma in Infants and Children Less Than 5 Years of Age

1 Step One: Mild Intermittent

Long-term Control:

No daily medication needed.

Quick Relief:

- Bronchodilator as needed for symptoms 2 times per week or less often. Intensity of treatment will depend upon severity of exacerbation. Either: inhaled short-acting beta₂-agonist by nebulizer or MDI (metered dose inhaler) with face mask and spacer/holding chamber OR oral beta₂-agonist for symptoms.
- With viral respiratory infection:
 - Bronchodilator every 4-6 hours up to 24 hours (longer with physician consult) but, in general, repeat no more than once every 6 weeks.

Consider systemic corticosteroid if current exacerbation is severe OR the patient has history of previous severe exacerbations.

2 Step Two: Mild Persistent

Long-term Control:

- Daily anti-inflammatory medication. Either cromolyn (nebulizer is preferred; or MDI) or nedocromil (MDI only) OR low-dose inhaled

corticosteroid with spacer/holding chamber and face mask. Infants and young children usually begin with a trial of cromolyn or nedocromil.

Quick Relief:

Bronchodilator as needed (see step 1)

3 Step Three: Moderate Persistent

Long-term Control:

- Daily anti-inflammatory medication. Either a medium-dose inhaled corticosteroid with spacer/holding chamber and face mask OR, once control is established: medium-dose inhaled corticosteroid and nedocromil OR medium-dose inhaled corticosteroid and long-acting bronchodilator (theophylline).

Quick Relief:

Bronchodilator as needed (see step 1) up to three times per day

4 Step Four: Severe Persistent

Long-term Control:

- Daily anti-inflammatory medication. High-dose inhaled corticosteroid with spacer/holding chamber and face mask. If needed, add systemic corticosteroids 2 mg/kg/day and reduce to lowest daily or alternate-day dose that stabilizes symptoms.

Quick Relief:

Bronchodilator as needed (see step 1) up to three times per day.

Adapted from: 1997 National Heart, Lung, and Blood Institute panel Report 2, page 96.

Keep in mind that the “step” approach presents general guidelines to assist with clinical decisionmaking. Clinicians should tailor the medication plan to the individual patient. The goal is to gain control of the asthma symptoms as soon as possible, then to decrease treatment to the lowest medication level that maintains control. A “rescue” course of systemic corticosteroids (prednisolone) may be needed at any time or step. Consultation with an asthma specialist is recommended for anyone with severe persistent asthma (step 4), if there are difficulties achieving or maintaining control of the asthma, the patient has a life-threatening

Asthma

©TCHP Education Consortium, 2007

Page 11

exacerbation, immunotherapy is being considered, or for moderate asthma in children under 5. Treatment should be reviewed every one to six months to see if a gradual stepwise reduction in treatment is possible.



Treating an Acute Asthma Exacerbation

Asthma attacks can be very scary for patients and their families. Figure 5 summarizes the signs and symptoms that indicate an exacerbation of asthma.

PaO₂ (on air)	Normal *	>60 mm Hg *	<60 mm Hg; possible cyanosis
PCO₂	< 42 mm Hg *	<42 mm Hg *	>42 mm Hg *
SaO₂ (on air) at sea level	>95% *	91-95%	<91%
*test not usually necessary Note: The presence of several parameters, but not necessarily all, indicates the general classification of the exacerbation. Many of these parameters have not been systematically studied, so they serve only as general guides. <i>Source: 1997 National Heart, Lung, and Blood Institute panel Report 2, page 109.</i>			

Figure 5: Signs and Symptoms of an Asthma Exacerbation

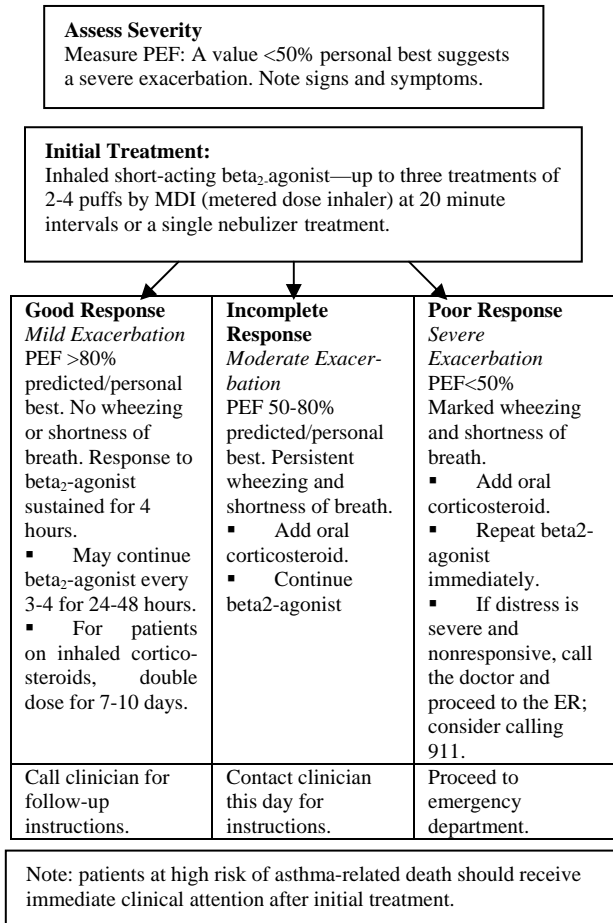
Symptoms	Mild	Moderate	Severe
Breathlessness	While walking	While talking (infant has a softer, shorter cry)	While at rest (infant-stops feeding)
Position	Can lie down	Prefers sitting	Sits upright
Talks in	Sentences	Phrases	Words
Alertness	May be agitated	Usually agitated	Usually agitated
Resp. rate	Increased	Increased	Increased; often >30/min
Accessory muscle use (supra-sternal retractions)	Usually not	Commonly	Usually
Wheeze	Moderate, often only on end expiration	Loud; throughout exhalation	Usually loud; throughout inhalation and exhalation
Pulse/min	<100	100-120	>120
Pulsus paradoxus	Absent <10mm Hg	May be present 10-25 mm Hg	Often present >25 mm Hg (adult), 20-40 mm Hg (child)
Figure 5 (continued)			
Symptoms	Mild	Moderate	Severe
PEF (% predicted or personal best)	>80%	50-80% or response lasts < 2 hours	<50%

Signs of an imminent respiratory arrest include: drowsiness or confused state, paradoxical movement of chest and abdomen with respiration (they move opposite from one another rather than together), no wheezing is audible, bradycardia, and absence of pulsus paradoxus (likely due to respiratory muscle fatigue).

Home Treatment

For most patients, the clinician will give instructions for managing asthma exacerbations at home. By beginning treatment at home, delays are prevented, exacerbations are less likely to become severe, and it also adds to the patient’s sense of control over their asthma. The amount of care given at home will vary from patient to patient based on the patient’s (or parent’s) abilities and past experiences, as well as on the availability of emergency care. It is understood that home treatment includes prompt communication between the patient and clinician about any serious deterioration in their symptoms or peak flow, decreased responsiveness to inhaled beta₂-agonists, or decreased duration of effect.

Figure 6: General Guidelines for Home Management of Asthma (Adapted from: 1997 National Heart, Lung, and Blood Institute panel Report 2, page 108)



Care in the Emergency Room

Care in the hospital and Emergency Department (ED) is more intensive than home treatment. The patient will be evaluated by history, physical examination, PEF (peak expiratory flow) or FEV₁ (forced expiratory volume in one second), oxygen saturation, and other tests as indicated. In general, if the PEF or FEV₁ is 50% or better, they will give the patient a beta₂-agonist by MDI or nebulizer, up to three doses in the first hour; oxygen, if needed, to achieve an O₂ saturation of ≥90%; and oral systemic corticosteroids if there is no immediate response or if the patient recently took oral systemic corticosteroids.

If the PEF or FEV₁ is <50% (severe exacerbation), the patient will generally receive an anticholinergic along with the beta₂-agonist by nebulization every 20 minutes or continuously for 1 hour, oxygen to achieve an O₂ saturation of ≥90%, and an oral

systemic corticosteroid. For this patient, as well as the patient described in the previous paragraph, they will continue to be re-assessed and treated until they either have a good response and are discharged home or are admitted to the hospital for follow-up care and observation. Patients who are discharged home will be instructed to continue with their inhaled beta₂-agonist and oral corticosteroid and to consult their doctor for follow-up care.

If the patient appears to be on the verge of a respiratory arrest (or in one), they will be intubated and placed on mechanical ventilation with 100% O₂, given a nebulized beta₂-agonist and anticholinergic and an intravenous corticosteroid. This patient will be admitted to the hospital intensive care unit (ICU).

* Adapted from the 1997 National Heart, Lung, and Blood Institute Panel Report 2, pages 108 and 112.

Many studies have demonstrated that 2 grams of magnesium sulfate given IV bolus over 20 minutes can stop severe bronchospasm.

Managing Special Situations in Asthma

The Young and the Breathless

A number of studies have looked at delayed maturation and reduced linear growth prior to puberty in children with asthma. It is thought to be caused by use of corticosteroids (especially systemic) or by uncontrolled asthma itself. Regardless of the cause of the growth suppression, most studies show that the delays do not appear to compromise the attainment of final predicted adult heights.¹⁴

There have been cases of children with severe persistent asthma on immunosuppressive doses of systemic corticosteroids who have died from varicella (chicken pox) infection. Because of this, it is recommended that patients who have not had the disease be immunized. The vaccine should not be administered to those receiving immunosuppressive doses of systemic corticosteroids (2mg/kg or more of prednisone equivalent or 20 mg/day of prednisone for more than one month). The corticosteroids should be discontinued for at least one month before the vaccine is given. Children who have completed a short prednisone course can receive varicella immunization without delay.^{15, 16} Children and adults who have been exposed to varicella infection who have not been immunized and are on immunosuppressive doses of corticosteroids should receive zoster immunoglobulin and therapy with oral

acyclovir. If they should develop chicken pox, give intravenous acyclovir and perhaps zoster immunoglobulin.

In addition to the varicella vaccine, children with asthma should receive all recommended childhood vaccines on schedule whenever possible. Children with asthma who acquire a vaccine-preventable disease may suffer from exacerbation of their asthma or more serious complications. Annual influenza vaccination is recommended for all patients with persistent asthma. A new vaccine (Respigam®) may be used to prevent respiratory syncytial virus (RSV) infection.

Children who are in school need to have a written plan for handling exacerbations (including whether the child should carry their inhalers with them during school hours). The plan should also address long-term control medications, prevention of exercise-induced bronchospasm (EIB) during physical education and sports, and identification of factors that may worsen the child's asthma so that the child can reduce or eliminate the triggers from their school environment. Some children may need to have a nebulizer available at the school.

Adolescents (and younger children, if appropriate) should be directly involved in their asthma management. Adolescents, in particular, have more difficulty adhering to their plan of care and may fail to recognize the danger of poorly controlled asthma. Adolescents may not accept that they have a chronic illness or may see the care plan as infringing on their independence.

Old Wheezers

Because obstructive lung disease is common among the elderly, careful evaluation must be done to determine the cause and extent of the airflow obstruction. A trial of systemic corticosteroids will help to determine if the airflow obstruction is reversible, and to what extent. The elderly frequently have other medical conditions which may be aggravated by asthma medications. There is also a potential for increased adverse drug interactions and adjustments to the medication plan may be necessary.

- Because airway response to bronchodilators may change with age and older patients (especially those with pre-existing ischemic heart disease) tend to be more sensitive to the side-effects of beta₂ agonists [tremor and tachycardia], it might be beneficial to use an anticholinergic along with the beta₂ agonist.

- Theophylline clears more slowly in the elderly, is more likely to cause life-threatening events with chronic overdose, and has a greater potential for drug interactions (especially with antibiotics and H₂-histamine antagonists such as cimetidine). Both theophylline and epinephrine may worsen underlying heart conditions.
- Systemic corticosteroids may cause confusion, agitation, and changes in glucose metabolism.
- Because the elderly are at risk for bone demineralization and corticosteroids may be associated with bone density loss, treatment with calcium supplements, vitamin D, and, when appropriate, estrogen replacement, is recommended.
- Nonsteroidal anti-inflammatory agents (NSAIDs), which are often used in the elderly for arthritis, nonselective beta blockers for hypertension, and beta-blockers that are used in some eye drops for glaucoma all may aggravate asthma.

The Pregnant

If asthma is poorly controlled during pregnancy, increased perinatal mortality, prematurity, and low birth weight may result. Some of the medications used to treat asthma may pose a risk to the fetus. The physician should carefully review the medications and make changes as needed.

All Stressed-out with No Place to Go

There is emerging evidence that stress can not only help to precipitate an asthma exacerbation, but may also be a risk factor for developing asthma.¹⁷ Psychosocial factors that are associated with poor outcomes include: conflict between patients, families, and the medical staff; depressive symptoms; poor asthma self-care; behavioral and emotional problems; and disregarding asthma symptoms.

The Surgical Patient

Patients with asthma should be carefully reviewed prior to surgery because they are at risk for acute bronchoconstriction triggered by intubation, hypoxemia, possible hypercapnia, impaired cough effectiveness, atelectasis, respiratory infection, and latex exposure during and after surgery. The evaluation should review current symptoms, medications, and measurement of pulmonary function. If it is possible, attempt to improve lung function to their predicted values or their "personal best" level (see section on Peak Expiratory Flow). A short course of corticosteroids may be necessary to optimize lung function. Patients who have received

systemic corticosteroids in the last 6 months will need to have intravenous hydrocortisone every 8 hours during the surgical period to a rapidly reduced dose within 24 hours after surgery.

Exercise Makes Me Wheeze

Exercise induced bronchospasm (EIB) should be expected in all asthma patients to some degree. Exercise may be the only precipitant of asthma in some patients. Symptoms of EIB include cough, shortness of breath, chest pain or tightness, wheezing, or endurance problems during exercise. Symptoms usually occur during or just minutes after vigorous activity, peaking in 5-10 minutes after resting, and resolving in 20-30 minutes. This is not to say that exercise should be avoided. On the contrary, exercise is important for the health maintenance of all patients. The difference is that if you have EIB, you need to plan ahead.

EIB is treated by using short-acting beta₂ agonists just before exercising. This will usually help prevent EIB for 2-3 hours and is effective in more than 80% of patients. For a longer duration of action Sameterol may be used (10-12 hours). Cromolyn and nedocromil may also be effective for preventing EIB if taken right before exercise. For some patients, a lengthy warm-up before exercise may eliminate the need for repeated medications if the patient can tolerate continuous exercise with minimal symptoms. Long-term therapy with anti-inflammatory medication may reduce airway responsiveness and reduce the frequency and severity of EIB.

The Four “Wheezons”

Some patients only experience asthma symptoms when exposed to certain molds and pollens. Such seasonal asthma, if predictable, can be treated by instituting daily long-term anti-inflammatory therapy prior to the anticipated onset of symptoms and carried through the end of the problematic season.

Coughing, Coughing, Coughing

Cough variant asthma is seen most often in young children. The primary symptom is coughing that frequently occurs at night. Once the diagnosis is established, it should be treated according to the stepwise approach to long-term management of asthma.



Patient Education

A recent study indicates that only one in three patients uses even half of the prescribed amount of asthma medication daily.¹⁸ Similarly, a number of studies

have documented incorrect MDI technique in the majority of patients and that only 40% of physicians correctly performed four or more of the seven steps recommended for MDI inhalation technique.¹⁹

One study of patients with COPD participating in a lung health study described the phenomenon of inhaler “dumping.” The study found that while 87% of patients reported compliance with prescribed inhaler use and 85% had a canister weight consistent with compliance, nearly 18% were found to “dump” their inhaler in the hours before their appointment, to bring the canister weight down. The reasons for non-compliance are complex, however, studies do indicate that adult asthma education can be effective in reducing readmissions and hospital days, as well as improving patient understanding, control of asthma symptoms, and MDI technique.²⁰

The Bottom Line is:

Patients may not use medications as prescribed, some will even try to cover up their non-compliance, and many patients do not use their inhaler correctly.

Aerosol Delivery Devices

The management of asthma often includes the use of aerosolized medication (either liquid or powder) that is delivered directly to the airways by breathing it in. Inhaled medications increase the therapeutic effects of the medication at the site it is needed, with fewer systemic side-effects than with oral, injected, or infused medications.²¹

Currently available devices for delivery of aerosolized medications include metered-dose inhalers (MDIs), spacer or holding chambers for use with MDIs, breath-actuated inhalers, dry powder inhalers, and small-volume nebulizers. The effectiveness of the aerosol delivery device is directly related to the particle size of the aerosolized medication. Only particles of 1 to 5 μm in size are “inhalable” and get deposited in the small airways of the lower respiratory tract.²¹ Only about 10% of the medication actually gets to the lung; as much as 85% gets deposited in the mouth, throat, and large airways. The medicine in the mouth and throat will eventually be swallowed, increasing the systemic concentration (and side-effects) of the medicine.

Use of a spacer/holding chamber will decrease the amount of medication deposited in the mouth and throat to about 5% (the remaining 80% stays in the spacer device). Use of a spacer/holding chamber may also improve lung deposition to 15% of the dose. A spacer/holding chamber is useful for all patients, particularly for those on inhaled steroids, and for younger children and older adults who may have difficulty coordinating their inhalation with actuation of the MDI. If necessary, a soft, pliable mask can be applied to the end of the spacer/holding chamber if the patient is not able to use the mouthpiece.

Figure 7 reviews the proper technique for using an inhaler. These steps should be reviewed very carefully with patient and family since proper technique is essential for the treatment to be effective.

Figure 7: Steps for Using an Inhaler*

<i>Inhaler technique should be demonstrated at every visit</i>	
1.	Remove the cap and hold the inhaler upright.
2.	Shake the inhaler. Attach the inhaler to the spacer/holding chamber (if applicable).
3.	Tilt your head back slightly and exhale slowly.
4.	Position the inhaler in one of the following ways: <ul style="list-style-type: none"> • Open mouth method: position inhaler 1 to 2 inches from your open mouth • With a spacer/holding chamber: Put the mouthpiece of the spacer/holding chamber in your mouth and close your lips around it. • "Regular" method: Place the mouthpiece of the inhaler in your mouth and close your lips around it (do not use for corticosteroids). • For inhaled dry powder capsules: Close your lips tightly around the mouthpiece of the inhaler and inhale rapidly.
5.	Press down on the inhaler to release the medication as you start to inhale slowly.
6.	Inhale slowly over 3 to 5 seconds.
7.	Hold your breath for 10 seconds to allow the medication time to reach deeply into your lungs.
8.	Wait one minute and repeat the puff as directed. Waiting between puffs may help the second puff to penetrate your lungs better.

Patients should be taught to avoid common inhaler mistakes by following these inhaler tips*:

- Breathe out *before* pressing the inhaler. Exhaling the air in your lungs allows you to be able to take a deep breath.
- Inhale *slowly*.
- Breathe in through your mouth, not your nose.
- Press down on your inhaler at the *start* of inhalation (within the first second of inhalation).

- Keep inhaling as you press down the inhaler.
- Press your inhaler only *once* while you are inhaling (one breath for each puff).
- Make sure you breathe in evenly and deeply.
- It is a good idea to rinse out your mouth and/or gargle after using your inhaler, particularly if you are using an inhaled steroid (beclomethasone dipropionate, budesonide, flunisolide, fluticasone propionate, triamcinolone acetonide) or a dry powder inhaler.

**Adapted from the Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma. National Asthma Education and Prevention Program, National Heart, Lung, and Blood Institute, 1997.*

With dry powder inhalers (Turbuhaler®, Diskhaler®, Rotahaler®, and Spinhaler®), it is important to close the mouth tightly around the mouthpiece and inhale rapidly. All dry powder inhalers require a deep and forceful inspiration. Children as young as 4 years have successfully used dry powder inhalers, but effects are more consistent in those over 5 years of age.

For children less than 5 years of age, an MDI and spacer/holding chamber with a face mask can be used. Or, a nebulizer can be used to deliver medications.

The nebulizer is the delivery method of choice for patients of any age who cannot use an MDI with spacer/holding chamber or spacer and face mask because they cannot follow the proper technique (e.g., during exacerbations). The nebulizer is also the delivery method of choice for cromolyn in children and for high-dose beta₂-agonists and anticholinergics in moderate to severe exacerbations in all patients.²² Despite convincing evidence that using an MDI with a holding chamber is effective and less expensive to use than a nebulizer to treat acute asthma, many institutions continue to use the nebulizer as the primary delivery method.²³

As with the MDI, proper technique in using the nebulizer is essential to its effectiveness. With proper nebulizer use that results in maximal airway deposition of medication, a mouthpiece is used rather than a mask (or, even worse, holding the tubing in front of the child's nose). Inhalation should be slow with occasional deep breaths. For young children and other patients unable to use the mouthpiece, a tightly fitting face mask is used. Try to keep the child calm during the treatment since crying can significantly reduce the amount of medication delivered to the

airways.²⁴ Efficiency of delivery falls considerably as the mask is moved from the face. Just a 2 cm move away from the face can reduce deposition by as much as 85%.²⁵

In addition to the proper technique for using aerosol delivery devices and the importance of taking medications as prescribed, patients also need to learn how to clean and care for their equipment. For MDIs and spacer/ holding chamber devices, they should be periodically taken apart, washed and allowed to dry thoroughly before reassembling. Nebulizers should be cleaned according to manufacturer instructions.

Using a Peak Flow Meter

A peak flow meter (a.k.a., peak expiratory flow [PEF]) is a device that gives the patient feedback about their asthma in their home setting. Patients 5 years and older are usually able to use a peak flow meter. There is a three-color “stoplight system” (red, yellow, and green) that helps the patient determine if they are on the verge of an asthma attack. Some patients are “poor perceivers” and do not know their asthma is getting worse until it is severe. A peak flow meter can be very helpful for these patients. Patients with moderate to severe persistent asthma may also benefit from tracking their PEF.

PEF measurements should be taken on awakening in the morning, before taking medicine. The best reading out of three should be recorded in their asthma diary. The PEF can also be checked before and after taking a short-acting inhaled quick relief medication, or routinely between the hours of noon and 2:00 p.m. If the PEF increases 20% or more with a quick relief medication, the patient should call their doctor to see if additional medicine is needed to control their asthma better.

Patients need to establish and occasionally re-evaluate their “personal best” on the PEF. The patient’s personal best is the highest PEF number they can achieve over a 2-3 week period of time when their asthma is under good control.

To get the PEF number, the patient blows as hard and as fast as they can into the peak flow meter to find the greatest amount of air that they were able to exhale. The results of the test will give a number. Once the patient’s personal best is established, PEF readings will be classified into zones like a traffic light (red, yellow, and green). The zone will tell the patient what to do when their PEF number changes.



The red zone (50% or less of the patient’s personal best) indicates a severe attack. The patient is likely to be breathless and may have trouble talking. The accessory muscles (neck, intercostal, and abdominal) might be tight from trying to assist with breathing. The lips and fingernails might appear gray or bluish in color. The patient should take their asthma medicine as prescribed (quick relief medicine) and either call their doctor or the emergency room immediately or get to the emergency room right away.



The yellow zone (50-80% of the patient’s personal best) indicates a moderate attack. The patient may feel a tightness in the chest, start coughing and spitting up mucus, have a restless feeling and trouble sleeping. The patient may wheeze or make a whistling sound with breathing. They should take their quick relief medication as prescribed and call their doctor. The yellow zone could indicate the need to change or increase daily medications.



The green zone (80% or more of the patient’s personal best) indicates good control. No asthma symptoms are present. The patient should continue to take their medication as usual.

Identifying and Avoiding Triggers

Asthma episodes are often triggered. Finding asthma triggers isn’t always easy, but if triggers can be identified, it might be possible to reduce exposure to those triggers, helping to avoid asthma episodes. Here are some things that may trigger an asthma episode:

- Allergic reactions to things like pollens, molds, feathers, animals, house dust mites, cockroaches, and some foods
- Vigorous exercise
- Sleep (nocturnal asthma)
- Hot or cold air
- Infections such as colds, influenza, and other respiratory illnesses
- Household products with strong odors or fumes such as perfume, paint, hair spray, and cleaners
- Drugs such as aspirin, ibuprofen, and some heart medications
- Occupational dusts and vapors such as from plastics, grains, metals, and wood
- Air pollutants including cigarette and wood smoke, ozone, sulfur dioxide, and auto exhaust
- Emotional stress and excitement

Controlling exposure to triggers outdoors is difficult. The patient may need to avoid outdoor air pollution, mold spores, and pollen. Anytime that air pollution and pollen levels are high, it's advisable to remain indoors.

At home a number of things can be done to reduce asthma triggers. Modifications to the bedroom or sleeping area are especially important since many people with asthma have more trouble with symptoms at night.

Indoor air can be modified by using an air conditioner. This will allow the windows to remain closed, keeping out some pollen and mold spores and will lower indoor humidity. Low humidity helps control mold and dust mites. Indoor temperature should be kept at a comfortable level. Some people with asthma can't tolerate a big change in temperature, especially when moving from warm to cold air. An air filter and/or vacuum cleaner designed to remove dust mites may or may not help in reducing allergy symptoms.

Cigarette smoking is another trigger that must be avoided. If you have asthma and smoke, you need to quit. If there is someone with asthma in your home, you and all others must not smoke in the home or around the person with asthma. Wood stoves and fireplaces should be avoided.

Pets and other animals can cause asthma symptoms through their dander (tiny scales or particles that fall off hair, feathers, or skin) and saliva. All pets that trigger asthma symptoms should be removed from the home. It may take months to completely clear pet allergen from the home because it remains in the house dust. If the pet remains in the home, it should stay out of the bedroom of the person with asthma. Weekly pet baths may help cut down the amount of pet saliva and dander.

Cockroaches can cause asthma symptoms, too. Keep your home free of cockroaches by storing food in sealable containers, keeping crumbs, dirty dishes and other sources of food waste cleaned up, fixing leaks and eliminating standing water, and removing clutter where roaches can hide. If you must use a pesticide, consider that baits are less likely to harm your lungs than a spray or fogger.

Mold spores and pollen float in the air. Pollen grains can cause hay fever symptoms. Indoor molds can be a problem when humidity is high—especially

in bathrooms, kitchens, and basements. Give these areas good air circulation and clean them often.

You may want to use a dehumidifier in the basement; empty the water and clean it often to prevent mildew. Painting with mold-inhibiting paint may be helpful. Vent the clothes dryer to the outside to lower basement humidity.

Molds also form in houseplants and dry flowers. If left undisturbed, their effect is minimal but you may need to eliminate them from your home. Avoid heavy vegetation around and over the house—it encourages dampness and mold growth. Keep the yard free of autumn leaves as much as possible. Wet leaves are a good source of mold. Mold can be abundant in grass, especially during wet periods and may be stirred up during the process of mowing.

Keep the house and car windows closed, especially at night. Minimize early morning activity between the hours of 5-10 a.m. These are the hours pollen is most usually emitted. Stay indoors if the pollen or mold spore count is high and on windy days. Avoid hanging sheets and clothing outside where they may collect pollen and mold spores.

Dust mites are everywhere dust is. Following these rules will help control dust mites*:

1. Vacuuming the mattress once a week is helpful. You can also put the mattress, box spring, and pillows in allergen-proof covers and tape over the length of the zipper. If the pillow is washed weekly, it may not need a cover. Choose Dacron pillows, wash weekly or replace yearly.
2. Wash all bedding weekly in hot water (>130° F.). Removing the bedspread at night might help.
3. Don't lie down or sleep on upholstered furniture.
4. Remove carpeting from the bedroom. If this is not an option, vacuum weekly (the person with asthma should not do the vacuuming or cleaning). If you must vacuum or clean, wear a dust mask and leave the room for at least an hour after cleaning.
5. Dust with a damp cloth weekly. Do not use spray cleaners in the bedroom and do not clean when the person with asthma is present in the room. Avoid brooms and vigorous sweeping actions that might stir up dust.
6. Use window coverings such as shades or plastic curtains that are easy to wash. Avoid mini-blinds and dry-clean only drapes. Clean window coverings and throw rugs twice a month.

7. Remove upholstered furniture, stuffed animals (unless they can be washed), bookshelves, and anything under the bed. Wash bed toys and blankets weekly.
8. Closets should hold only needed clothing. Remove out-of-season clothing and store elsewhere. Needed clothing may need to be stored in a plastic bag (not a dry cleaning bag).
9. Reduce humidity in the home to less than 50%; consider a dehumidifier.
10. Air cleaning devices may be helpful in reducing some indoor air pollutants. Ask your doctor for advice about air cleaning devices. If you decide to use one, make sure it removes particles efficiently over an extended period of time and does not produce ozone.

*Adapted from *Home Control of Allergies and Asthma* by the American Lung Association, 8/00 and Healthpartners patient education literature: *Hints on Reducing Dust Mite and Animal Allergies* and *How to Avoid Mold and Pollen*.

Summary

Asthma is not just a big problem, but a big opportunity for health care professionals to improve outcomes through patient education. All health care professionals need to understand the basics of what asthma is, how it is managed, and what patients need to know to manage their own disease. Hopefully this home study program leaves you better prepared to deliver excellent care to your patients with asthma.

References

1. American Lung Association (1999). Childhood asthma: An overview. Available online at: www.lungusa.org/asthma.
2. Xu, B. (Oct. 2000). Perinatal factors tied to asthma in childhood. *Journal of Asthma*, 37: 589-594.
3. National Heart, Lung, and Blood Institute (Jan. 1999). Asthma statistics, pages 1 and 2. Available through NIH online at: www.nhlbi.nih.gov.
4. American Lung Association (1999). Asthma in children fact sheet, page 1. Online at: www.lungusa.org/asthma.
5. AHRQ Research on caring for children with asthma, page 1. Translating research into practice fact sheet. February 2000. AHRQ Publication No. 00-P025. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/research/chilasth.htm>.
6. American Lung Association (Jan. 2001). Trends in asthma morbidity and mortality, page 4. Available online at: www.lungusa.org/data/asthma.
7. *Ibid.*, page 3.
8. *Ibid.*, page 6.
9. *Ibid.*, page 1
10. *Ibid.*, page 2.
11. American Lung Association (1999). Childhood asthma: An overview, page 4. Online at: www.lungusa.org/asthma.
12. Doctor's Guide (1999). Asthma study reveals patients skip medication to avoid side effects. Available online at: www.docguide.com.
13. National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. Expert Panel Report 2. Guidelines for diagnosis and management of asthma. Bethesda, MD. National Institutes of Health, 1997. Publication No. 97-4051, page 71.
14. National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. Expert Panel Report 2. Guidelines for diagnosis and management of asthma. Bethesda, MD. National Institutes of Health, 1997. Publication No. 97-4051, page 72.
15. American Academy of Pediatrics Committee on infectious diseases. Recommendations for the use of live attenuated varicella virus. *Pediatrics* 1995; 5:791-6.
16. Centers for Disease control and Prevention. General recommendations on immunization. *Morbidity and Mortality Weekly Report* 1994; Jan. 28; 43(RR-1): 1-38.
17. National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. Expert Panel Report 2. Guidelines for diagnosis and management of asthma. Bethesda, MD. National Institutes of Health, 1997. Publication No. 97-4051, page 101.
18. George, R., Light, R., Matthay, M., and Matthay, R., editors (2000). *Chest medicine: Essentials of pulmonary and critical care medicine*, 4th ed., Lippincott Williams and Wilkins, Philadelphia, PA, page 143.
19. *Ibid.*
20. *Ibid.*
21. Hayden, M., ed. (Sept., 1998). *Asthma care education*. Published through Meniscus, an educational institute of Glaxo-Wellcome, Inc., pg. 63. Website: www.meniscus.com.
22. *Ibid.*
23. National Heart, Lung, and Blood Institute. National Asthma Education and Prevention Program. Expert Panel Report 2. Guidelines for

diagnosis and management of asthma. Bethesda, MD. National Institutes of Health, 1997. Publication No. 97-4051, page 69.

24. Kerscsmar, C. (April 2000). Aerosol treatment of acute asthma: And the winner is... *Journal of Pediatrics*, page 430.
25. *Ibid.*, page 429.
26. *Ibid.*, page 429

Recommended Reading

1. Brozene S, Russell SS. (1999). *Core Curriculum for Medical-Surgical Nursing*, 2nd ed. Academy of Medical-Surgical Nurses, Janetti NJ.
2. Phipps WJ, Sands JK, Marek JF, eds. (1999). *Medical-Surgical Nursing: Concepts & Clinical Practice*, 6th ed. St. Louis: Mosby, Inc.
3. Seidel HM, Ball JW, Dains JE et al, eds. (2002) *Mosby's Guide to Physical Examination*, 5th ed. St. Louis: Mosby, Inc.
4. Stillwell, S. (2002). *Mosby's Critical Care Nursing Reference*. 3rd ed. St. Louis, Mo: Mosby/Elsevier.
5. Smeltzer SC, Bare BG, eds. (2002) *Brunner & Suddarth's Textbook of Medical-Surgical Nursing*, 10th ed. Philadelphia: Lippincott William and Wilkins.
6. Wiegand, D.J.L. & Carlson, K.K. (eds.) (2005). *AACN Procedure Manual for Critical Care*. 5th ed. Philadelphia: Elsevier.
7. www.ispub.com: Intravenous Magnesium Sulfate As An Adjunct In The Treatment Of Severe Asthmatic Patients Non-Responding To Conventional Therapy
8. www.medscape.com: Magnesium Sulfate in the Treatment of Asthma

Directions for Submitting Your Post Test for Contact Hours

To obtain a certificate of completion for this home study program, please complete the post-test and evaluation on the next few pages. The date on your certificate of completion will be the date that your home study is received. **Any materials received with a postmark after the expiration will be discarded.**

HealthEast, HCMC, & MVAMC Employees

If you are an employee of HealthEast, HCMC, or MVAMC, you may send the post-test and evaluation to TCHP for processing. Your post-test will be returned to you through your hospital. It cannot be mailed to your home.

Paid Participants

If you are not an employee of one of the TCHP hospitals, please send the post-test and evaluation to TCHP with a check for \$12.00. Please make check payable to **TCHP Education Consortium** and mail to:

**TCHP Education Consortium
Capitol Office Building
525 Park Street, Suite 120
St. Paul, MN 55103**

Your post-test will be returned to you with the certificate of completion.

Asthma Post-Test

Please print all information clearly and sign the verification statement:

Name _____
(please print legal name above)

Birth date (required)

Format: 01/03/1999

M	M	D	D	Y	Y	Y	Y

For HealthEast, HCCM, or MVAMC, employees only:

Hospital _____ Unit _____

Personal verification of successful completion of this educational activity (required):

I verify that I have read this home study and have completed the post-test and evaluation.

Signature

1. What is the underlying cause of asthma in most, if not all, patients?
 - a) Allergies
 - b) Mucus plugs
 - c) Airway inflammation
 - d) Hypertrophied smooth muscle
- 2) Which of the following is NOT a symptom of asthma?
 - a) Cough
 - b) Runny nose
 - c) Wheezing
 - d) Shortness of breath

Identify the following medications as “Q” for quick relief, “L” for long-term, or “B” if it is used for both quick relief and long-term control.

- 3) ___ Beclomethasone
- 4) ___ Cromolyn sodium
- 5) ___ Theophylline
- 6) ___ Albuterol
- 7) ___ Sameterol
- 8) ___ Terbutaline
- 9) ___ Nedocromil
- 10) ___ Methylprednisolone
- 11) ___ Ipratropium bromide

- 12) ___ Zafirlukast
- 13) True or false? Exercise induced bronchospasm should be expected in all asthma patients to some degree.
- 14) True or false? Inhaler technique should be demonstrated at every clinic visit.
- 15) When should patients check their peak expiratory flow at home?
 - a) In the morning before taking any medicine.
 - b) Between noon and 2 p.m.
 - c) Before and after taking an inhaled quick relief medicine.
 - d) To establish their “personal best” number
 - e) All of the above
- 16) Which of the following is NOT a condition that can mimic asthma?
 - a) A piece of hotdog lodged in the trachea
 - b) Pulmonary fibrosis
 - c) Congestive heart failure
 - d) Cystic fibrosis
- 17) True or false? All inhalers require a slow, steady inhalation over 3-5 seconds.
- 18) True or false? Most patients with asthma are instructed on how to manage asthma attacks at home.

Expiration date: The last day that post tests will be accepted for this edition is **December 31, 2017**—your envelope must be postmarked on or before that day.

Evaluation: Asthma

Please complete the evaluation form below by placing an “X” in the box that best fits your evaluation of this educational activity. Completion of this form is required to successfully complete the activity and be awarded contact hours.

At the end of this home study program, I am able to:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Describe the signs and symptoms of asthma.					
2. Identify tests that are used to help in the diagnosis of asthma.					
3. List 3 or more medications used to treat asthma.					
4. Describe how to treat an acute exacerbation of asthma.					
5. Identify important topics for patient education for the asthma patient.					
6. The teaching / learning resources were effective. <i>If not, please comment:</i>					

The following were disclosed in writing prior to, or at the start of, this educational activity (please refer to the first 2 pages of the booklet).		
	Yes	No
7. Notice of requirements for successful completion, including purpose and objectives		
8. Conflict of interest		
9. Disclosure of relevant financial relationships and mechanism to identify and resolve conflicts of interest		
10. Sponsorship or commercial support		
11. Non-endorsement of products		
12. Off-label use		
13. Expiration Date for Awarding Contact Hours		
14. Did you, as a participant, notice any bias in this educational activity that was not previously disclosed? <i>If yes, please describe the nature of the bias:</i>		

15. How long did it take you to read this home study and complete the post test and evaluation:
 _____ hours and _____ minutes.

16. Did you feel that the number of contact hours offered for this educational activity was appropriate for the amount of time you spent on it?

___ Yes

___ No, more contact hours should have been offered

___ No, fewer contact hours should have been offered.

Expiration date: December 31, 2017
