



# Making a Difference in the Management of Asthma: A Guide for Respiratory Therapists



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National Asthma Education  
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## Preface

*In recent years, respiratory therapists (RTs) employed in hospitals, emergency departments, home care settings, and clinics have expressed the need for more information about assessing asthma patients, improving patient adherence to treatment through education, managing an asthma exacerbation, developing a care plan, monitoring asthma control using peak flow measures and/or symptoms, and reducing asthma triggers. This guide has been prepared in an effort to respond to these expressed needs. It builds upon the four basic components of effective asthma management as outlined in the National Asthma Education and Prevention Program's (NAEPP's) Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma (EPR-2) and subsequent update of the guidelines, Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma—Update on Selected Topics 2002 (EPR—Update 2002). This guide demonstrates how to apply the principles of the four basic components of asthma care to real-life practice.*

*The guide can serve as an easy and practical reference for the RT; it presents information in a way that will make it easier to share with patients. Those wishing more detailed or technical information on asthma management may refer to the EPR-2 and EPR—Update 2002 on the National Heart, Lung, and Blood Institute's (NHLBI) Web site at [www.nhlbi.nih.gov](http://www.nhlbi.nih.gov). Publications from the NAEPP can be ordered through the NHLBI Health Information Center, P.O. Box 30105, Bethesda, MD 20824-0105. Most publications are also available through the Internet at <http://www.nhlbi.nih.gov>.*

Sincerely yours,



*Claude Lenfant, M.D.  
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## Letter From the American Association for Respiratory Care

Dear Colleagues:

There is no doubt that all respiratory therapists (RTs) should continue providing front-line respiratory treatment to persons with asthma, but we also need to expand our role by participating in ongoing detection, education, and management activities that lead to better overall control of this disease. Although great advances have been realized in our understanding and treatment of asthma over the past 15 years, it is disturbing to note that the prevalence of asthma has increased by 75 percent and that emergency room visits for exacerbation of asthma are unacceptably high—about 1.8 million visits annually. There is still much work to be done, and RTs can play an important role.

Knowledge about asthma is critical but, alone, it is not enough to make a difference in patient outcomes. Even the availability of a wide range of medications known to effectively control asthma is not enough to make a difference. Patients need—in addition—a “partner in care.” This is a health care provider who understands the clinical practice recommendations of the National Asthma Education and Prevention Program (NAEPP) Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma (EPR-2) (1997), and Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma—Update on Selected Topics 2002 (EPR—Update 2002). A partner in care should have the background and training to educate patients and patients’ caregivers about asthma management and

to teach them the necessary skills for self-management of their disease. RTs are well suited to be partners in asthma care. We can make a difference!

The American Association for Respiratory Care (AARC) is committed to assisting RTs to move beyond pure respiratory treatment of patients with asthma and, as members of multidisciplinary health care teams, to play a more active role in their full management and care. AARC also encourages RTs to take a leadership position in initiating and implementing comprehensive asthma disease management programs. *Making a Difference in the Management of Asthma: A Guide for Respiratory Therapists* will provide valuable assistance in achieving both goals.

I challenge all of you to not only read this guide, but also to bring the concepts to life in your practices. RTs can make a difference in asthma management if they apply the principles of this guide. It is based upon the latest scientific findings and clinical practice recommendations for asthma. Please put it to work.

Sincerely,



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## Introduction

Asthma is controllable when managed properly through a patient-provider partnership. The National Asthma Education and Prevention Program (NAEPP) developed this guide to help you, the respiratory therapist (RT), deepen your knowledge of the asthma disease processes, improve the care you provide to asthma patients, and help you build relationships with other providers as a valued member of the asthma-care team. This handbook also offers guidance in organizing, implementing, and evaluating asthma disease-management programs that could improve the health of patients with asthma.

As RTs, you have learned to assess patients' clinical status, measure lung function and other physiological variables, administer treatments, and monitor patients' response to those treatments as part of the health care team that develops and monitors asthma care. In addition, you have learned to communicate with patients, tailoring information to their needs and helping them develop the skills they need to take better care of themselves.

The ultimate success of any effort to optimally manage asthma rests upon the success of patients in self-managing their condition. Thus, the impact of your ability to convey information, teach skills, inspire adherence to the treatment plan, and work with the health care team to make appropriate recommendations regarding adjustments to treatment is substantial. It will influence how well patients and families form collaborative relationships with health care providers and assume ultimate responsibility for their own well-being.

This guide contains two parts. Part I reviews the knowledge base necessary for providing optimal care to patients with asthma based on the NAEPP *Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma* (1997 and subsequent *Update on Selected Topics—2002*). Part II outlines the programmatic considerations necessary for establishing asthma care within the context of a comprehensive disease-management program, which is one option for delivering care that has a great deal of interest. The intent of this guide is to prepare you to deliver high-quality, cost-effective asthma management to patients of all ages and in different health care settings.



## Part I.

# Providing Optimal Management of Asthma

### What Is Asthma?

Asthma affects approximately 20 million Americans. About 12 million people reported having an asthma attack in the year 2001; each year 1.8 million of them go to emergency departments (EDs) because of asthma attacks. Approximately 5,000 sufferers die each year as a result of the disease. Yet many patients do not really understand what asthma is, even after they have received the diagnosis. The following is a simple, brief definition of asthma that you can share with your patients:

*Asthma is a chronic disease in which the airways of your lungs become inflamed. This means the airways are swollen and sensitive; they are easily provoked and tend to hyperrespond to a variety of things. The swelling can be controlled with medicine and by staying away from those things, called “triggers,” that provoke your airways—such as smoke or allergens like dust mites, animal dander, and pollens. When airways react to triggers they become narrow and blocked, often producing mucus, making it hard to breathe. This may cause symptoms, for example, coughing, wheezing, chest tightness, and shortness of breath. Worsening symptoms can result in an asthma attack, or episode. With proper control, most people with asthma can live normal, active lives—free of troublesome symptoms and asthma attacks, all or most of the time.*

Asthma results from complex interactions among a variety of inflammatory cells, mediators, and the cells and tissues in the airways (see figure 1).

First, stimuli activate the release of inflammatory mediators from mast cells, macrophages, eosinophils, and other inflammatory cells within the airways. These stimuli may include indoor and outdoor allergens, irritants, viral respiratory infections, cold air, and exercise.

Next, the inflammatory mediators signal other inflammatory cells to migrate into the airways and to become active. This airway inflammation leads to airflow limitation by increased smooth-muscle contraction, swelling, and mucus secretion. Airway inflammation also leads to hyperresponsiveness of the airway.

All these factors, in turn, result in the narrowing, or obstruction, of the airway. This obstruction, which can develop gradually or abruptly, causes the symptoms of coughing, wheezing, chest tightness, shortness of breath, and decreased endurance.

Reducing airway inflammation can reduce airway hyperresponsiveness, asthma symptoms, and the need for frequent use of bronchodilators—in other words, can control asthma. Asthma patients can greatly reduce airway inflammation by decreasing or eliminating exposure to the allergens, irritants, or other stimuli that provoke asthma episodes and by taking anti-inflammatory medication daily.

Although there is greater understanding of the biological mechanisms by which asthma occurs,

we still do not know exactly what causes asthma. Atopy, the genetic predisposition for the development of an Immunoglobulin E (IgE)-mediated response to common aeroallergens, is the strongest identifiable predisposing factor for developing asthma. Other factors associated with the development of asthma include parental history of asthma, or physician-diagnosed atopic dermatitis, or two of the following: physician-diagnosed allergic rhinitis, wheezing apart from colds, peripheral blood eosinophilia.

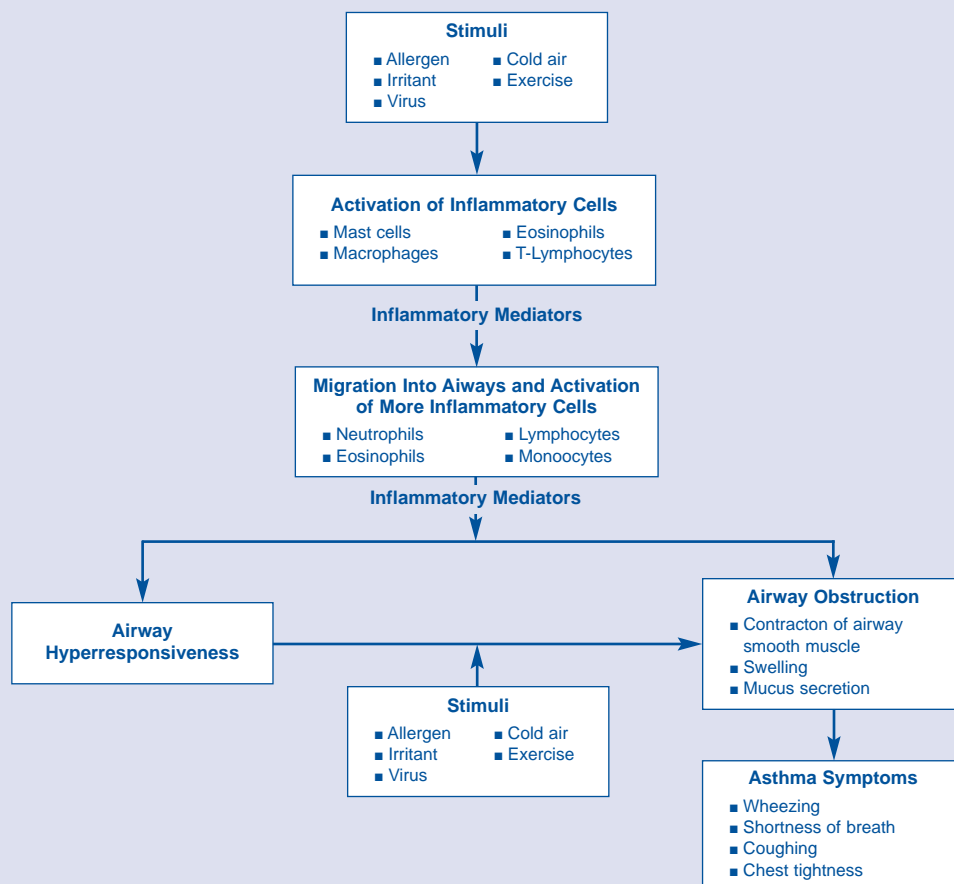
## Basic Components of Effective Asthma Care

Asthma requires active management over time. The condition of a patient's asthma will change depending upon the environment, level of activity, management practices, and other factors. Thus, even when patients have their asthma under control, monitoring and continued treatment are necessary to maintain this control.

To ensure long-term control of asthma, your encounters with asthma patients should be organized around the four components of asthma management, as recommended in the NAEPP *Expert Panel Report 2: Guidelines for the*

Figure 1

### Relationships Among Airway Inflammation, Airway Hyperresponsiveness, Airway Obstruction, and Asthma Symptoms



*Diagnosis and Management of Asthma* (EPR-2) and subsequent update *Expert Panel Report—Update on Selected Topics 2002* (EPR—Update 2002). The four components are listed below and then explained in greater detail:

- Assessment and Monitoring
- Control of Factors Contributing to Asthma Severity
- Pharmacologic Therapy: Managing Asthma Long Term
- Patient Education for a Partnership in Asthma Care

## Component 1. Assessment and Monitoring

### Initial Assessment and Diagnosis of Asthma

Information necessary for establishing the diagnosis of asthma includes a detailed patient history, a thorough physical exam, and evaluation of pulmonary-function testing (spirometry) to document the reversibility of airflow obstruction.

Information in a patient’s medical history should address the key indicators for considering a diagnosis of asthma, including onset or worsening of asthma-related symptoms from potential triggers (see figure 2).

Figure 2

**Key Indicators for Considering a Diagnosis of Asthma**

Consider asthma and performing spirometry if any of these indicators are present.\* These indicators are not diagnostic by themselves, but the presence of multiple key indicators increases the probability of a diagnosis of asthma. Spirometry is needed to establish a diagnosis of asthma.

- Wheezing—high-pitched whistling sounds when breathing out—especially in children. (Lack of wheezing and a normal chest examination do not exclude asthma.)
- History of any of the following:
  - Cough, worse particularly at night
  - Recurrent wheeze
  - Recurrent difficulty in breathing
  - Recurrent chest tightness
- Reversible airflow limitation and diurnal variation as measured by using a peak flow meter, for example:
  - Peak expiratory flow (PEF) varies 20 percent or more from PEF measurement on arising in the morning (before taking a short-acting inhaled beta<sub>2</sub>-agonist) to PEF measurement in the early afternoon (after taking a short-acting inhaled beta<sub>2</sub>-agonist).
- Symptoms occur or worsen in the presence of:
  - Exercise
  - Viral infection
  - Animals with fur or feathers
  - House-dust mites (in mattresses, pillows, upholstered furniture, carpets)
  - Mold
  - Smoke (tobacco, wood)
  - Pollen
  - Changes in weather
  - Strong emotional expression (laughing or crying hard)
  - Airborne chemicals or dusts
  - Menses
- Symptoms occur or worsen at night, awakening the patient.

\*Eczema, hay fever, or a family history of asthma or atopic diseases are often associated with asthma, but they are not key indicators.

Spirometry provides an objective measure of lung function and is important for making a diagnosis, assessing the severity of asthma, and developing and using a written asthma management plan.

To confirm an asthma diagnosis, the clinician should determine that:

- There is a history or presence of episodic symptoms of airflow obstruction as indicated by asthma symptoms.
- Airflow obstruction is at least partially reversible, as measured by spirometry before and after inhaling a short-acting bronchodilator:
  - *Establish airflow obstruction:* The amount of air forcefully exhaled in the first second from a full inspiration (forced expiratory volume, FEV<sub>1</sub>) is less than 80 percent of the predicted amount; and the ratio of FEV<sub>1</sub> to the total volume of forcibly exhaled air (forced vital capacity, FVC) is less than 65 percent of that predicted—or below the lower limit of normal.
  - *Establish reversibility:* FEV<sub>1</sub> increases by at least 12 percent and by at least 200 milliliters after using a short-acting inhaled beta<sub>2</sub>-agonist.
- Alternative diagnoses are excluded.

In infants and children younger than 5 years of age, spirometry is not possible. However, a trial of asthma medications may aid in the eventual diagnosis of asthma in younger children suspected of having this disease. Unfortunately, children with asthma are often mislabeled as having bronchiolitis, bronchitis, or pneumonia, and many do not receive appropriate therapy.

### Periodic Assessment and Monitoring

It is recommended that periodic assessments and ongoing monitoring of asthma be provided to determine if the goals of asthma therapy are being met. The goals of therapy set the foundation for the patient's treatment plan, and by monitoring how well the patient is achieving these goals, physicians



Spirometry provides an objective measure of lung function and is important for making a diagnosis.

can make modifications to their clinical approach. The goals of therapy include:

- Minimal or no chronic and troublesome symptoms, day or night
- Normal or near normal pulmonary function
- No limitations on activities; no school/work missed due to asthma
- Minimal or no recurrent exacerbations of asthma; minimal or no need for ED visits or hospitalizations
- Optimal medications with minimal or no adverse side-effects
- Satisfaction with asthma care.

RTs can assist physicians in monitoring each of these goals during followup visits to determine whether the patient is meeting them and as a means to help guide treatment decisions. The following are steps you can take in monitoring each of the goals of therapy.



■ *Steps for monitoring occurrence of chronic and troublesome symptoms:*

1. Assess symptoms and clinical signs of asthma at each health care visit, including daytime and nighttime symptoms in the past 2 weeks and symptoms while exercising.
2. Review with every patient how to recognize symptoms that indicate inadequate control and what actions to take when symptoms worsen.
3. Educate each patient with asthma about his or her asthma action plan, including daily monitoring of signs and symptoms and how to measure peak expiratory flow.

■ *Steps for monitoring maintenance of normal or near normal pulmonary function:*

1. Ask patients to demonstrate the use of their peak flow meter at every visit, and use the reading as part of the clinical assessment.
2. Perform spirometry testing (1) at the initial assessment, (2) after treatment has stabilized symptoms and peak flow, and (3) at least every 1 to 2 years when asthma is stable, more often when asthma is unstable, or therapy is being altered.

■ *Step for monitoring maintenance of activity levels:* Survey patients at every visit regarding sleep disturbances, reduction in usual activities, and missed work or school due to asthma.

■ *Steps for identifying onset of exacerbations of asthma:*

1. Teach patients, especially those with moderate or severe persistent asthma, how to use the peak flow meter to help monitor and manage their asthma. Use each patient's own personal best peak flow as the standard against which to compare peak flow measurements and as the basis of his or her action plan. A drop in peak flow to less than

50 percent of personal best indicates a severe exacerbation.

2. Teach patients how to use an asthma diary, which includes peak flow or symptom scores as a way to track changes in peak flow or in the frequency, type, or intensity of symptoms.
3. Question patients and review any records of self-monitoring to detect exacerbations.

■ *Steps for reviewing medications:*

1. Ask patients to review for you what medications they are taking, what time of day they take them, how often, and whether there are any side effects, such as shakiness, nervousness, bad taste, sore throat, or cough.
2. Review inhaler technique, the level of usage of the as-needed short-acting inhaled beta<sub>2</sub>-agonist, and the frequency of oral corticosteroid therapy.
3. Be aware that a drop in peak flow below 80 percent of personal best or the need for



There is no need to limit physical activity if asthma is controlled.

more frequent rescue medication may indicate a need for additional long-term-control medication.

- *Step for monitoring overuse of short-acting inhaled beta<sub>2</sub>-agonists:* Ask patients at every visit about their frequency of using short-acting inhaled beta<sub>2</sub>-agonists for quick relief from asthma symptoms. For patients with intermittent asthma, use of short-acting inhaled beta<sub>2</sub>-agonists more than two times a week may indicate the need to initiate long-term-control therapy; for patients with persistent asthma, daily use, or increasing use, may indicate the need to increase long-term-control therapy.
- *Steps for ensuring patient-provider communications and patient satisfaction with care:*
  1. Encourage open discussion of concerns and expectations of therapy. Ask if the patient experiences difficulty following the asthma management plan. Work together to identify ways to overcome barriers to adherence.
  2. Question patients about their level of satisfaction with asthma control and satisfaction with the quality of care.

## Component 2. Control of Factors Contributing to Asthma Severity

A variety of stimuli can increase airway inflammation and induce acute asthma episodes. Eliminating or reducing exposure to these stimuli—also called triggers—has proved to be effective in decreasing the need for asthma medications and in reducing symptoms. Environmental stimuli that can make asthma worse include airborne allergens, airway irritants, infections, and cold air; nonenvironmental stimuli include exercise and strong emotional expressions, such as laughing, crying, and yelling. You can help by encouraging patients to work with their physicians to identify what makes their asthma worse.

The following is a description of what is typically included in the physician's assessment.

### ■ Allergens

The majority of persons with asthma have an allergic or IgE-mediated component to their asthma. For many, exposure to allergens is the primary cause of airway inflammation, hyper-responsiveness, and narrowing.

The diagnosis of allergy requires taking a thorough history and then using skin tests or in vitro methods to assess sensitivity to the allergen(s). The outdoor molds and pollens that commonly bring on allergic symptoms are usually seasonal. However, exposure to the most common indoor allergens—house dust mites, cockroach feces, molds, and animal dander—occurs year-round.

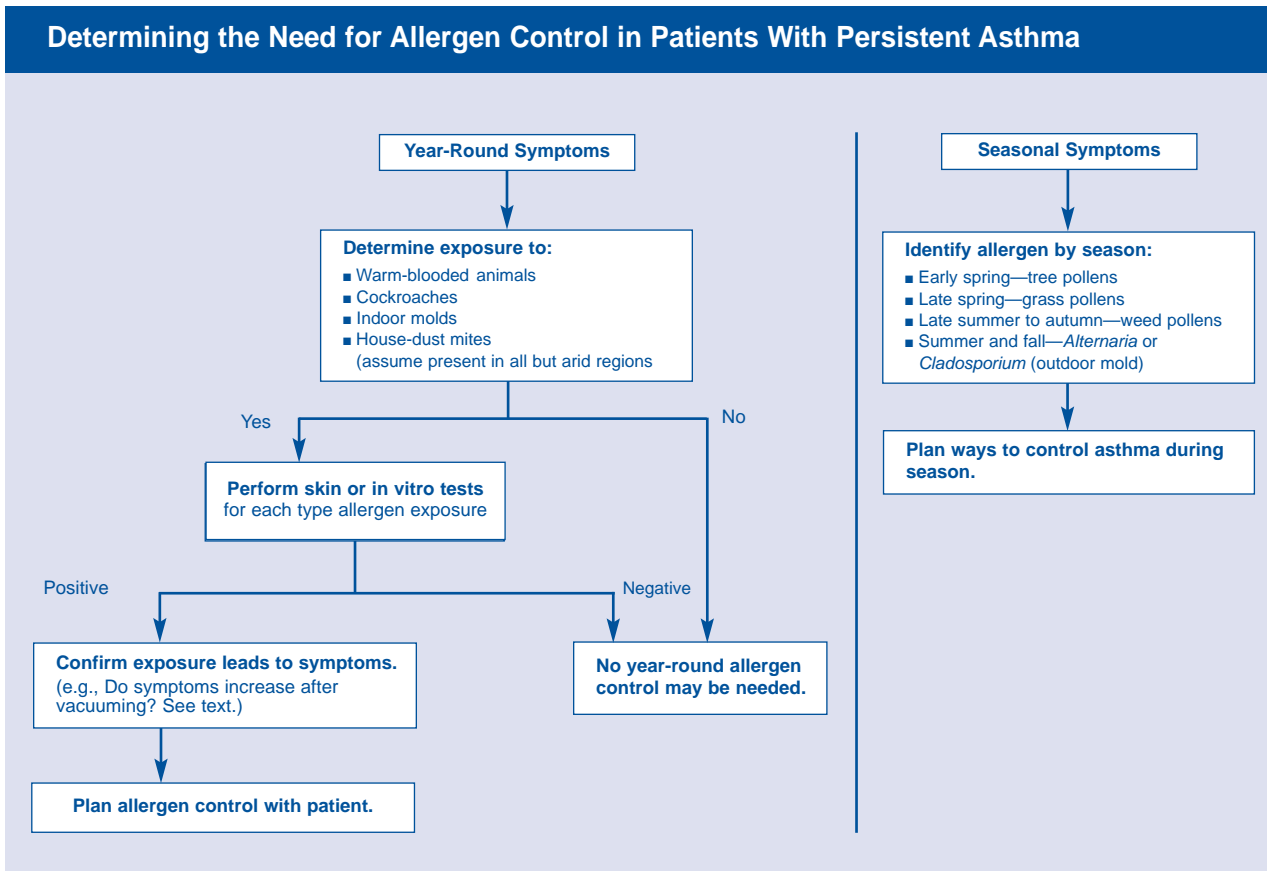


Animal dander from dogs, cats, and other furry pets can make asthma worse.

There are three main treatments for allergies, and each should be coupled with patient education. These are listed in the order in which they should be tried: (1) reducing the exposure to the offending allergens, (2) medications, and (3) immunotherapy.

Figure 3 summarizes the physician assessment of the need for allergen control in individual patients.

Figure 3



■ Irritants

Patients should minimize exposure to irritants, especially those that patients know induce acute asthma episodes. Indoor irritants include tobacco smoke, emissions from wood-burning stoves, strong odors and sprays (for example, perfume, hair spray, cooking odors, paint fumes, and insecticides), and airborne irritants from occupational exposure. Outdoor irritants include air pollutants, particularly ozone, nitrogen dioxide, and sulfur dioxide.

■ Other factors

Factors other than allergens and irritants that can influence asthma



Strongly advise patients and others around them to stop smoking.

severity include rhinitis and sinusitis, gastroesophageal reflux (GERD), viral respiratory infections, and sensitivity to aspirin and to foods that contain sulfites.

In summary, the most important actions you can take to help patients control factors contributing to asthma severity is to encourage them to work with their physicians to identify factors that trigger their asthma and to help educate patients about how to reduce their exposures to these factors.

Figure 4 outlines control measures for factors that contribute to asthma severity.

- Urge patients and their families to attempt one or two control measures at a time, starting with the least expensive and/or the most practical or effective.

- Ask about the presence of smokers in every household and advise smokers to quit. Recommend to the smoker directly that he or she stop smoking for the patient’s health, as well as for his/her own health. Ask the person to set a quit date and refer to quit-smoking materials and programs.

Figure 4

Control Measures for Factors Contributing to Asthma Severity	
Factors Contributing to Asthma Severity	Control Measures: Instructions to Patients
Allergens	See patient handout, “How To Control Things That Make Your Asthma Worse,” available in the publication, <i>Facts About Controlling Your Asthma</i> , posted on the Web at <a href="http://www.nhlbi.nih.gov/health/public/lung/asthma">www.nhlbi.nih.gov/health/public/lung/asthma</a> .
Tobacco smoke	Strongly advise patient and others living in the home to stop smoking. Discuss ways to reduce exposure to other sources of tobacco smoke, such as from daycare providers and the workplace.
Rhinitis	Intranasal steroids. Antihistamine/decongestant combinations may also be used.
Sinusitis	Medical measures to promote drainage. Antibiotic therapy is appropriate when complicating acute bacterial infection is present.
Gastroesophageal reflux	No eating within 3 hours of bedtime, elevate head of bed 6 to 8 inches, and take appropriate medication.
Sulfite sensitivity	No eating of shrimp, dried fruit, processed potatoes. No drinking of beer or wine.
Medication interactions	No beta-blockers (including ophthalmological preparation). Aspirin and other nonsteroidal anti-inflammatory medication. Inform adult patients with severe persistent asthma, nasal polyps, or a history of aspirin sensitivity about the risk of severe and even fatal episodes from using these drugs. Usually safe alternatives are acetaminophen or salsalate.
Occupational exposures	Discuss with asthma patients the importance of avoidance, ventilation, respiratory protection, and a tobacco smoke-free environment. If occupationally induced asthma, recommend complete cessation of exposure to initiating agent. Obtain permission from patient before contacting management or onsite health professionals about workplace exposure.
Viral respiratory infections	Annual influenza vaccinations should be given to patients with persistent asthma.

### Component 3. Pharmacologic Therapy: Managing Asthma Long Term

Each patient diagnosed with asthma has a classification according to level of severity to help inform clinicians about the type, dose, and frequency of medication to recommend. All patients with asthma need a quick-relief medication (for example, a short-acting inhaled beta<sub>2</sub>-agonist) to provide prompt reversal of acute airflow obstruction and quick relief from accompanying bronchoconstriction. In addition, patients with persistent asthma will need daily long-term-control medications to

achieve and maintain control of chronic asthma symptoms. The most effective long-term-control medications for asthma are those that reduce inflammation. Inhaled corticosteroids are the most effective anti-inflammatory medication currently available.

Physicians prescribe medications for patients in accordance with the severity of their asthma. Patients are classified into one of four levels of asthma severity, as determined by assessment of chronic or recurrent asthma symptoms and lung function (see figure 5). Different recommendations

Figure 5

Classification of Asthma Severity			
Clinical Features Before Treatment*			
	Symptoms**	Nighttime Symptoms	Lung Function
<b>STEP 4</b> <b>Severe</b> <b>Persistent</b>	<ul style="list-style-type: none"> <li>■ Continual symptoms</li> <li>■ Limited physical activity</li> <li>■ Frequent exacerbations</li> </ul>	Frequent	<ul style="list-style-type: none"> <li>■ FEV<sub>1</sub> or PEF ≤60% predicted</li> <li>■ PEF variability &gt;30%</li> </ul>
<b>STEP 3</b> <b>Moderate</b> <b>Persistent</b>	<ul style="list-style-type: none"> <li>■ Daily symptoms</li> <li>■ Daily use of inhaled short-acting beta<sub>2</sub>-agonist</li> <li>■ Exacerbations affect activity</li> <li>■ Exacerbations ≥2 times a week; may last days</li> </ul>	>1 time a week	<ul style="list-style-type: none"> <li>■ FEV<sub>1</sub> or PEF &gt;60%–&lt;80% predicted</li> <li>■ PEF variability &gt;30%</li> </ul>
<b>STEP 2</b> <b>Mild</b> <b>Persistent</b>	<ul style="list-style-type: none"> <li>■ Symptoms &gt;2 times a week but &lt;1 time a day</li> <li>■ Exacerbations may affect activity</li> </ul>	>2 times a month	<ul style="list-style-type: none"> <li>■ FEV<sub>1</sub> or PEF ≥80% predicted</li> <li>■ PEF variability 20–30%</li> </ul>
<b>STEP 1</b> <b>Mild</b> <b>Intermittent</b>	<ul style="list-style-type: none"> <li>■ Symptoms ≤2 times a week</li> <li>■ Asymptomatic and normal PEF between exacerbations</li> <li>■ Exacerbations brief (from a few hours to a few days); intensity may vary</li> </ul>	≤2 times a month	<ul style="list-style-type: none"> <li>■ FEV<sub>1</sub> or PEF ≥80% predicted</li> <li>■ PEF variability &lt;20%</li> </ul>

\* The presence of one of the features of severity is sufficient to place a patient in that category. An individual should be assigned to the most severe grade in which any feature occurs. The characteristics noted in this figure are general and may overlap because asthma is highly variable. Furthermore, an individual's classification may change over time.

\*\* Patients at any level of severity can have mild, moderate, or severe exacerbations. Some patients with intermittent asthma experience severe and life-threatening exacerbations separated by long periods of normal lung function and no symptoms.

of pharmacotherapy—sometimes called medication “steps”—correspond with each level of severity. Medication needs are greater among individuals with more severe asthma. Also, there is a slight variance in the pharmacotherapy recommendations for adults and children 5 years of age and older versus infants and children younger than age 5. The medication steps that correspond to the two age groups are indicated in figures 6 and 7.

Ultimately, the physician’s judgment of an individual patient’s needs and circumstances, along with the patient’s classification of severity, will determine the step at which to initiate therapy and choice of medication. There are two appropriate approaches to gaining control of asthma:

- Start treatment at the step appropriate to the severity of the patient’s asthma at the time of evaluation. If this does not achieve control, gradually step up therapy until control is achieved and maintained. (See charts for



Patient education should begin at the time of diagnosis.

Stepwise Approach for Managing Asthma, figures 6 and 7.)

Or

- At the onset, give therapy at a higher level to achieve rapid control and, once control is achieved and sustained, cautiously step down to the minimum therapy necessary to maintain control.

Infants and young children who consistently require treatment for symptoms more than twice per week or experience severe exacerbations less than 6 weeks apart may require daily inhaled anti-inflammatory medication as a long-term asthma therapy. In addition, long-term-control medications should be considered in infants and young children who have had more than three episodes of wheezing in the past year that lasted more than 1 day and affected sleep and who have risk factors for the development of asthma (parental history of asthma or physician-diagnosed atopic dermatitis, or two of the following: physician-diagnosed allergic rhinitis, wheezing apart from colds, peripheral blood eosinophilia). Use of long-term-control medications in infants and young children will need careful monitoring. The child’s ability to use medication delivery devices should help to determine which type to use. Be aware that the dose the child receives can vary considerably among delivery devices.

#### **Component 4. Patient Education for a Partnership in Asthma Care**

Patient education should begin at the time of diagnosis and be an integral part of every step of asthma care. It is essential that all members of the designated health care team provide education. The principal clinician should lend credibility to key educational messages by introducing them to patients and negotiating verbal or written agreements for followup action. All members of the

*(continue on page 17)*

Figure 6

Stepwise Approach for Managing Asthma in Adults and Children Older Than 5 Years of Age: Treatment			
Classify Severity: Clinical Features Before Treatment or Adequate Control			Medications Required To Maintain Long-Term Control
	Symptoms/Day Symptoms/Night	PEF or FEV <sub>1</sub> PEF Variability	Daily Medications
<b>Step 4</b> <b>Severe Persistent</b>	Continual Frequent	≤60% >30%	<ul style="list-style-type: none"> <li>■ Preferred treatment:               <ul style="list-style-type: none"> <li>• High-dose inhaled corticosteroids</li> <li>AND</li> <li>• Long-acting inhaled beta<sub>2</sub>-agonists</li> </ul> </li> <li>AND, if needed,</li> <li>• Corticosteroid tablets or syrup long term (2 mg/kg/day, generally do not exceed 60 mg per day). (Make repeat attempts to reduce systemic corticosteroids and maintain control with high-dose inhaled corticosteroids.)</li> </ul>
<b>Step 3</b> <b>Moderate Persistent</b>	Daily >1 night/week	>60% – <80% >30%	<ul style="list-style-type: none"> <li>■ Preferred treatment:               <ul style="list-style-type: none"> <li>• Low-to-medium dose inhaled corticosteroids and long-acting inhaled beta<sub>2</sub>-agonists.</li> </ul> </li> <li>■ Alternative treatment (listed alphabetically):               <ul style="list-style-type: none"> <li>• Increase inhaled corticosteroids within medium-dose range</li> <li>OR</li> <li>• Low-to-medium dose inhaled corticosteroids and either leukotriene modifier or theophylline.</li> </ul> </li> </ul> <hr style="border-top: 1px dashed black;"/> <p>If needed (particularly in patients with recurring severe exacerbations):</p> <ul style="list-style-type: none"> <li>■ Preferred treatment:               <ul style="list-style-type: none"> <li>• Increase inhaled corticosteroids within medium-dose range and add long-acting inhaled beta<sub>2</sub>-agonists.</li> </ul> </li> <li>■ Alternative treatment:               <ul style="list-style-type: none"> <li>• Increase inhaled corticosteroids within medium-dose range and add either leukotriene modifier or theophylline.</li> </ul> </li> </ul>
<b>Step 2</b> <b>Mild Persistent</b>	>2/week but <1x/day >2 nights/month	≥80% 20–30%	<ul style="list-style-type: none"> <li>■ Preferred treatment:               <ul style="list-style-type: none"> <li>• Low-dose inhaled corticosteroids.</li> </ul> </li> <li>■ Alternative treatment (listed alphabetically):               <ul style="list-style-type: none"> <li>cromolyn, leukotriene modifier, nedocromil,</li> <li>OR sustained release theophylline to serum concentration of 5–15 mcg/mL</li> </ul> </li> </ul>
<b>Step 1</b> <b>Mild Intermittent</b>	≤2 days/week ≤2 nights/month	≥80% <20%	<ul style="list-style-type: none"> <li>■ No daily medication needed.</li> <li>■ Severe exacerbations may occur, separated by long periods of normal lung function and no symptoms. A course of systemic corticosteroids is recommended.</li> </ul>

Figure 6 (continued)

## Stepwise Approach for Managing Asthma in Adults and Children Older Than 5 Years of Age: Treatment

### Quick Relief All patients

- Short-acting bronchodilator: 2–4 puffs **short-acting inhaled beta<sub>2</sub>-agonists** as needed for symptoms.
- Intensity of treatment will depend on severity of exacerbation; up to 3 treatments at 20-minute intervals or a single nebulizer treatment as needed. Course of systemic corticosteroids may be needed.
- Use of short-acting beta<sub>2</sub>-agonists >2 times a week in intermittent asthma (daily, or increasing use in persistent asthma) may indicate the need to initiate (increase) long-term-control therapy.



### Step down

Review treatment every 1 to 6 months; a gradual stepwise reduction in treatment may be possible.



### Step up

If control is not maintained, consider step up. First, review patient medication technique, adherence, and environmental control.

### Goals of Therapy: Asthma Control

- Minimal or no chronic symptoms day or night
- Minimal or no exacerbations
- No limitations on activities; no school/work missed
- Maintain (near) normal pulmonary function
- Minimal use of short-acting inhaled beta<sub>2</sub>-agonist
- Minimal or no adverse effects from medications

### Note

- The stepwise approach is meant to assist, not replace, the clinical decisionmaking required to meet individual patient needs.
- Classify severity: assign patient to most severe step in which any feature occurs (PEF is percent of personal best; FEV<sub>1</sub> is percent predicted).
- Gain control as quickly as possible (consider a short course of systemic corticosteroids); then step down to the least medication necessary to maintain control.
- Minimize use of short-acting inhaled beta<sub>2</sub>-agonists. Over-reliance on short-acting inhaled beta<sub>2</sub>-agonists (e.g., use of short-acting inhaled beta<sub>2</sub>-agonists every day, increasing use or lack of expected effect, or use of approximately one canister a month even if not using it every day) indicates inadequate control of asthma and the need to initiate or intensify long-term-control therapy.
- Provide education on self-management and controlling environmental factors that make asthma worse (e.g., allergens and irritants).
- Refer to an asthma specialist if there are difficulties controlling asthma or if step 4 care is required. Referral may be considered if step 3 care is required.



Figure 7

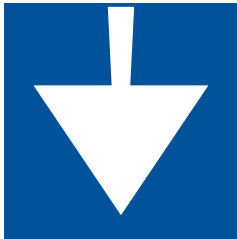
Stepwise Approach for Managing Infants and Young Children (5 Years of Age and Younger) With Acute or Chronic Asthma Symptoms		
Classify Severity: Clinical Features Before Treatment or Adequate Control		Medications Required To Maintain Long-Term Control
<u>Symptoms/Day</u> <u>Symptoms/Night</u>		Daily Medications
<b>Step 4</b> Severe Persistent	Continual Frequent	<ul style="list-style-type: none"> <li>■ Preferred treatment:                             <ul style="list-style-type: none"> <li>• High-dose inhaled corticosteroids</li> <li>AND</li> <li>• Long-acting inhaled beta<sub>2</sub>-agonists</li> <li>AND, if needed,</li> <li>• Corticosteroid tablets or syrup long term (2 mg/kg/day, generally do not exceed 60 mg per day). (Make repeat attempts to reduce systemic corticosteroids and maintain control with high-dose inhaled corticosteroids.)</li> </ul> </li> </ul>
<b>Step 3</b> Moderate Persistent	Daily >1 night/week	<ul style="list-style-type: none"> <li>■ Preferred treatment:                             <ul style="list-style-type: none"> <li>• Low-dose inhaled corticosteroids and long-acting inhaled beta<sub>2</sub>-agonists</li> <li>OR</li> <li>• Medium-dose inhaled corticosteroids.</li> </ul> </li> <li>■ Alternative treatment:                             <ul style="list-style-type: none"> <li>• Low-dose inhaled corticosteroids and either leukotriene receptor antagonist or theophylline.</li> </ul> </li> </ul> <hr style="border-top: 1px dashed black;"/> <p>If needed (particularly in patients with recurring severe exacerbations):</p> <ul style="list-style-type: none"> <li>■ Preferred treatment:                             <ul style="list-style-type: none"> <li>• Medium-dose inhaled corticosteroids and long-acting beta<sub>2</sub>-agonists.</li> </ul> </li> <li>■ Alternative treatment:                             <ul style="list-style-type: none"> <li>• Medium-dose inhaled corticosteroids and either leukotriene receptor antagonist or theophylline.</li> </ul> </li> </ul>
<b>Step 2</b> Mild Persistent	>2/week but <1x/day >2 nights/month	<ul style="list-style-type: none"> <li>■ Preferred treatment:                             <ul style="list-style-type: none"> <li>• Low-dose inhaled corticosteroids (with nebulizer or MDI with holding chamber with or without face mask or DPI).</li> </ul> </li> <li>■ Alternative treatment (listed alphabetically):                             <ul style="list-style-type: none"> <li>• Cromolyn (nebulizer is preferred or MDI with holding chamber)</li> <li>OR leukotriene receptor antagonist.</li> </ul> </li> </ul>
<b>Step 1</b> Mild Intermittent	≤2 days/week ≤2 nights/month	<ul style="list-style-type: none"> <li>■ No daily medication needed.</li> </ul>

Figure 7 (continued)

## Stepwise Approach for Managing Infants and Young Children (5 Years of Age and Younger) With Acute or Chronic Asthma Symptoms

### Quick Relief All patients

- Bronchodilator as needed for symptoms. Intensity of treatment will depend upon severity of exacerbation.
  - Preferred treatment: Short-acting inhaled beta<sub>2</sub>-agonists by nebulizer or face mask and space/holding chamber
  - Alternative treatment: Oral beta<sub>2</sub>-agonists
- With viral respiratory infection
  - Bronchodilator q 4–6 hours up to 24 hours (longer with physician consult); in general, repeat no more than once every 6 weeks
  - Consider systemic corticosteroid if exacerbation is severe or patient has history of previous severe exacerbations
- Use of short-acting beta<sub>2</sub>-agonists >2 times a week in intermittent asthma (daily or increasing use in persistent asthma) may indicate the need to initiate (increase) long-term-control therapy.



### Step down

Review treatment every 1 to 6 months; a gradual stepwise reduction in treatment may be possible.



### Step up

If control is not maintained, consider step up. First, review patient medication technique, adherence, and environmental control.

### Goals of Therapy: Asthma Control

- Minimal or no chronic symptoms day or night
- Minimal or no exacerbations
- No limitations on activities; no school/parent's work missed
- Minimal use of short-acting inhaled beta<sub>2</sub>-agonist
- Minimal or no adverse effects from medications

### Note

- The stepwise approach is intended to assist, not replace, the clinical decisionmaking required to meet individual patient needs.
- Classify severity: assign patient to most severe step in which any feature occurs.
- There are very few studies on asthma therapy for infants.
- Gain control as quickly as possible (a course of short systemic corticosteroids may be required); then step down to the least medication necessary to maintain control.
- Minimize use of short-acting inhaled beta<sub>2</sub>-agonists. Over-reliance on short-acting inhaled beta<sub>2</sub>-agonists (e.g., use of short-acting inhaled beta<sub>2</sub>-agonists every day, increasing use or lack of expected effect, or use of approximately one canister a month even if not using it every day) indicates inadequate control of asthma and the need to initiate or intensify long-term-control therapy.
- Provide parent education on asthma management and controlling environmental factors that make asthma worse (e.g., allergies and irritants).
- Consultation with an asthma specialist is recommended for patients with moderate or severe persistent asthma. Consider consultation for patients with mild persistent asthma.

health care team should reinforce and expand upon these messages and agreements. Key educational messages include the following (see figure 8):

- Basic facts about asthma
- Roles of medications
- Skills: correct use of aerosol delivery devices, use of peak flow meter and/or symptom diary for self-monitoring
- Environmental control measures
- When and how to take rescue actions

The following lists useful techniques to enhance your education efforts and to ensure better patient adherence to followup action steps to which the patient has agreed:

- Encourage an active partnership and review an individualized written asthma action plan with each patient, including an action plan for preventing, recognizing, and treating exacerbations. Action plans are especially important for



Vacuuming may help reduce allergens.

patients with moderate or severe persistent asthma and patients with a history of severe exacerbations.

- Ask patients to demonstrate the use of a metered-dose inhaler (MDI) or dry powdered inhaler (DPI), spacer, nebulizer (as appropriate), and peak flow meter. When indicated, demon-

Figure 8

### Key Educational Messages for Patients

*Check off or document that the following key messages have been covered:*

#### Basic Facts About Asthma

- The contrast between asthmatic and normal airways
- What happens to the airways in an asthma attack

#### Roles of Medications

- How medications work
  - Long-term control: medications that prevent symptoms, often by reducing inflammation
  - Quick relief: short-acting bronchodilator relaxes muscles around airways
- Stress the importance of long-term-control medications and not to expect quick relief from them.

#### Skills

- Inhaler use (patient demonstrate)
- Spacer/holding chamber use
- Symptom monitoring, peak flow monitoring, and recognizing early signs of deterioration

#### Environmental Control Measures

- Identifying and avoiding environmental precipitants or exposures

#### When and How To Take Rescue Actions

- Responding to changes in asthma severity (daily self-management plan and action plan)

strate to the patient/family the correct technique to enhance their understanding.

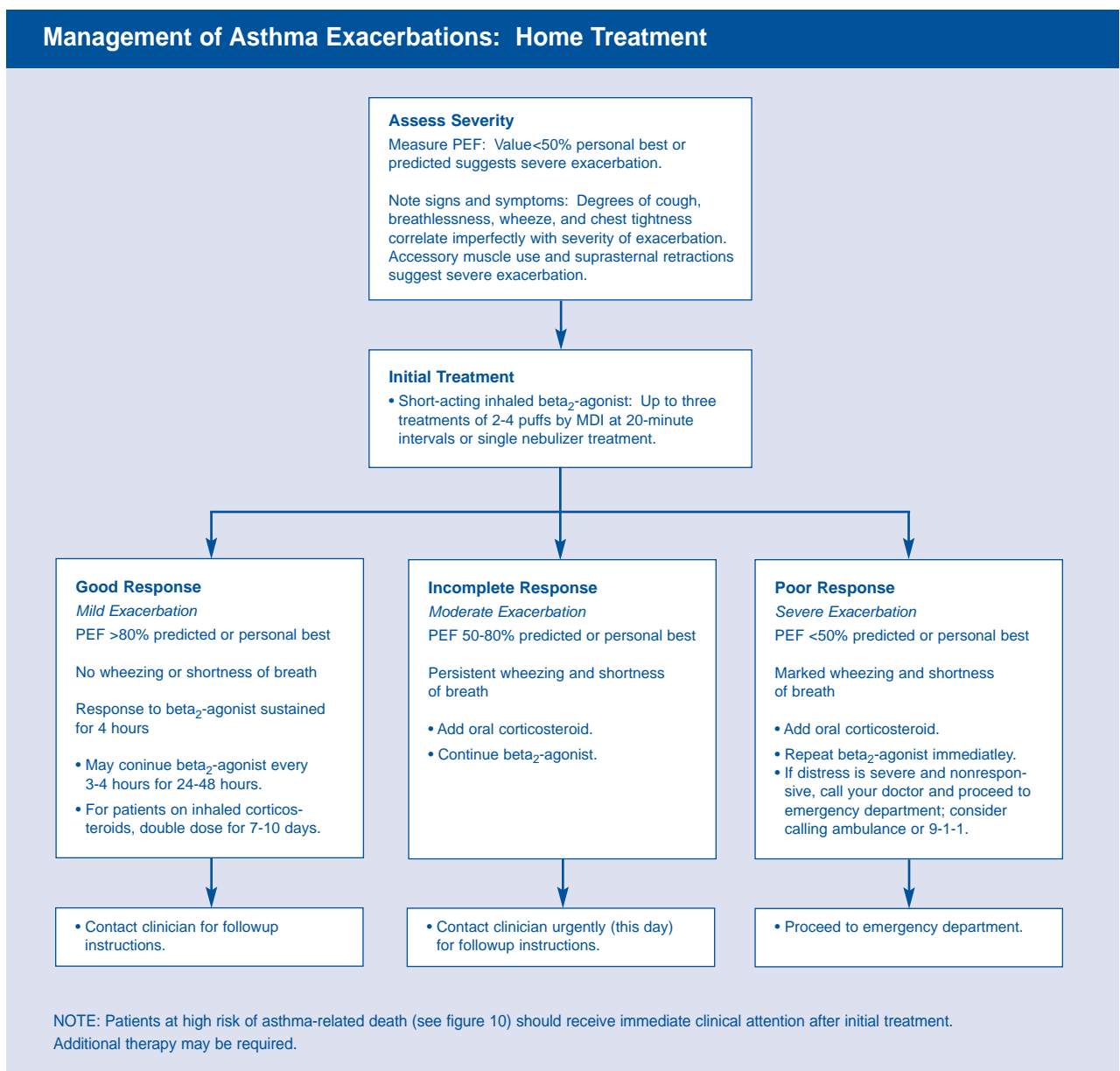
- Identify and address obstacles and concerns. Ask patients about problems they think they might have in performing the recommended action(s).

- Encourage or enlist family involvement. Fit the daily medication regimen into the patient's and family's routine.

- Followup at each visit by reviewing the performance of the agreed-upon actions and adjusting plans as necessary.

- Assess the influence of the patient's cultural beliefs and practices that might affect asthma care. Incorporate beliefs and practices that support the care plan and do not harm the overall health of the patient.

Figure 9



## Managing Exacerbations of Asthma

Asthma exacerbations are acute or subacute episodes of progressively worsening shortness of breath, cough, wheezing, and chest tightness or some combination of these symptoms. Exacerbations are characterized by decreases in expiratory airflow that can be documented and quantified by simple measurement of lung function (spirometry or peak expiratory flow [PEF]). These objective measures more reliably indicate the severity of an exacerbation than do the subjective measures of reported symptoms.

### Home Treatment

Starting treatment at home for asthma exacerbations allows for “early” treatment. Early treatment is the best strategy for management of an asthma exacerbation. Basic tenets of early treatment include the following:

- Preparing a written action plan to guide patient self-management, especially for patients with moderate-to-severe persistent asthma and any patient with a history of severe exacerbations.
- Recognizing signs of worsening asthma (including worsening PEF) and signs that indicate the need to call the doctor or seek emergency care.
- Initiating prompt use of short-acting inhaled beta<sub>2</sub>-agonists (2 to 4 puffs every 20 minutes for 1 hour) and, for moderate-to-severe exacerbations, the addition of oral steroids.
- Monitoring response to medication.
- Removing or withdrawing the patient from allergens or irritants that precipitated the exacerbation.

Early treatment for asthma exacerbation actually begins with education and preparation of patients on their written asthma action plans. Action plans are based upon a general systematic approach for

managing exacerbations as shown in figure 9. However, action plans should provide instructions tailored to meet an individual patient’s needs. Concepts of particular importance for you to review with patients relative to the action plan include the following:

- Having necessary medication and equipment for assessing and treating exacerbations at home, especially for patients at high risk of asthma-related death (see figure 10).

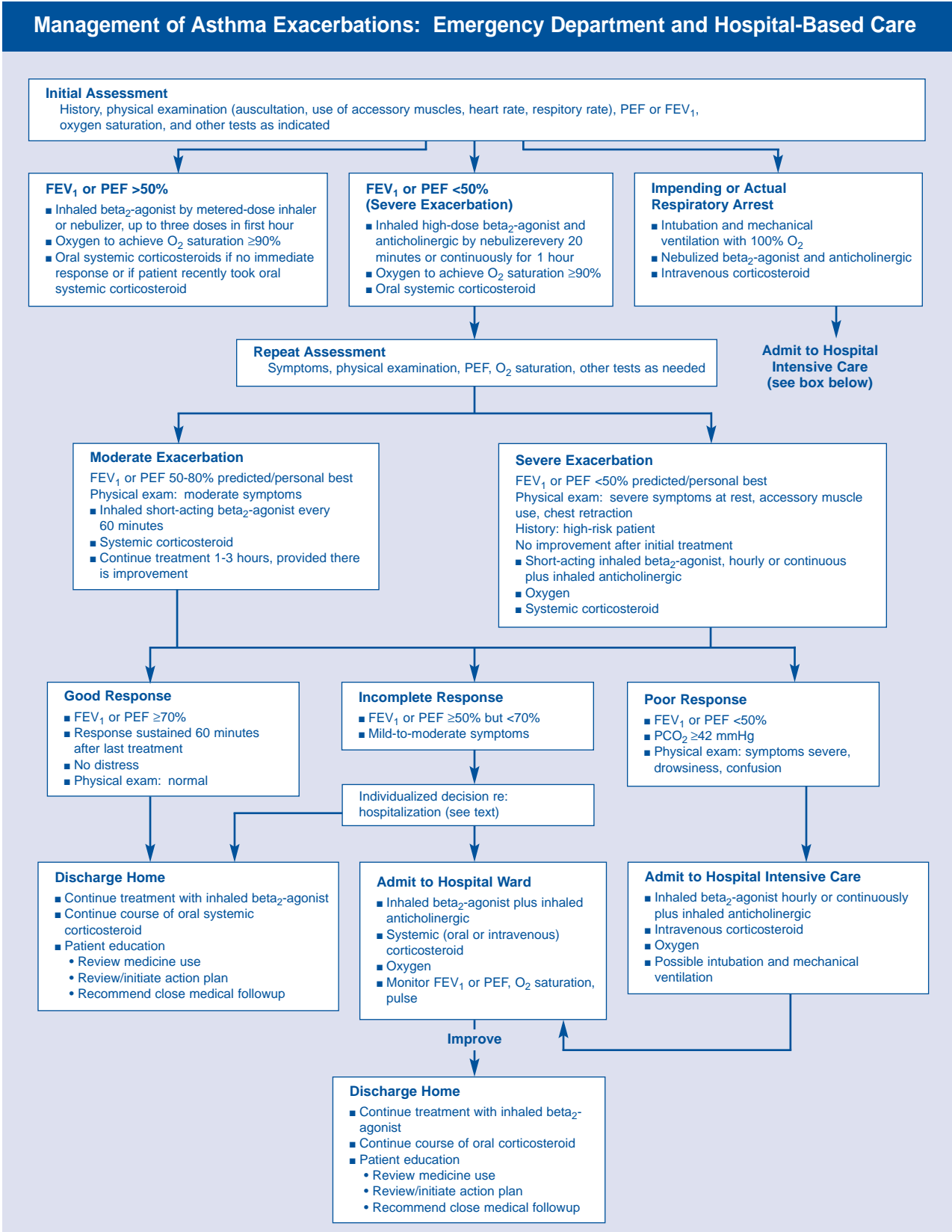
Figure 10

### Risk Factors for Death From Asthma

- Past history of sudden severe exacerbations
- Prior intubation for asthma
- Prior admission for asthma to an intensive care unit
- Two or more hospitalizations for asthma in the past year
- Three or more emergency care visits for asthma in the past year
- Hospitalization or an emergency care visit for asthma within the past month
- Use of >2 canisters per month of short-acting inhaled beta<sub>2</sub>-agonist
- Current use of systemic corticosteroids or recent withdrawal from systemic corticosteroids
- Difficulty perceiving airflow obstruction or its severity
- Comorbidity, as from cardiovascular diseases or chronic obstructive pulmonary disease
- Serious psychiatric disease or psychosocial problems
- Low socioeconomic status and urban residence
- Illicit drug use
- Sensitivity to *Alternaria*

Sources: Kallenbach et al., 1993; Rodrigo and Rodrigo, 1993; Suissa et al., 1994; Greenberger et al., 1993; O'Hollaren et al., 1991

Figure 11



- Monitoring symptoms to recognize early signs of deterioration.
- Monitoring peak flow to assess the severity of an exacerbation and response to medication.
- Adjusting medications in response to particular signs, symptoms, and peak flow measurements.
- Recognizing when to seek medical help, for example, if (1) an asthma exacerbation is severe, (2) therapy does not give rapid, sustained improvement, or (3) there is further deterioration.
- Seeking followup care after an exacerbation to assess overall asthma control.

Some advantages of starting early treatment at home are that doing so avoids treatment delays, prevents exacerbations from becoming severe, and adds to the patient's overall self-confidence in being able to manage his or her asthma. The extent to which care should be provided in the home depends on the patient's (or parents') abilities and experience and on the availability of emergency care.

## Emergency and Hospital Management

Once the patient is in the ED, it is important that the staff closely monitor the patient for signs of deterioration. During this time the patient likely will receive frequent treatments and assessment of lung function (see figure 11).

Upon arrival, the attending clinician should assess the patient's peak flow or FEV<sub>1</sub> and administer medications accordingly without delay. After therapy is initiated, a brief, focused history and physical examination pertinent to the exacerbation should be obtained, followed by a more detailed history, physical examination, and lab studies as warranted.

Treatment should include oxygen by nasal cannula or mask, whichever the patient tolerates better to maintain an oxygen saturation level (SaO<sub>2</sub>) greater than 90 percent (greater than 95 percent in pregnant



A metered dose inhaler with face mask and holding chamber is one way to administer therapy to young children.

women and in patients with coexistent heart disease). The ED staff should also give the patient short-acting inhaled beta<sub>2</sub>-agonists (repetitive or continuous). They may safely give three treatments of short-acting beta<sub>2</sub>-agonists as close together as every 20 minutes as initial therapy, or a single nebulizer treatment. After that, the frequency of treatments will vary according to airflow obstruction response, associated symptoms, and the occurrence of side effects (see figure 12).

To promote additional bronchodilation, the ED staff may consider administering anticholinergics, in addition to beta<sub>2</sub>-agonists. Patients with moderate-to-severe exacerbations should receive systemic corticosteroids.

ED interventions should *not* generally include the following:

- Methylxanthines
- Antibiotics (except for comorbid conditions)
- Aggressive hydration for older children and adults
- Chest physical therapy
- Mucolytics
- Sedation

Figure 12

Dosages of Drugs for Asthma Exacerbations in Emergency Medical Care or Hospital			
MEDICATIONS	DOSAGES		
	Adult Dose	Child Dose*	Comments
<b>Short-Acting Inhaled Beta<sub>2</sub>-Agonists</b>			
<b>Albuterol</b>			
Nebulizer solution (5.0 mg/mL, 2.5 mg/3 mL, 1.25 mg/3 mL, 0.63 mg/3 mL)	2.5–5 mg every 20 minutes for 3 doses, then 2.5–10 mg every 1–4 hours as needed, or 10–15 mg/hour continu- ously	0.15 mg/kg (minimum dose 2.5 mg) every 20 minutes for 3 doses, then 0.15–0.3 mg/kg up to 10 mg every 1–4 hours as needed, or 0.5 mg/kg/hour by continu- ous nebulization	Only selective beta <sub>2</sub> -ago- nists are recommended. For optimal delivery, dilute aerosols to minimum of 3 mL at gas flow of 6–8 L/min.
MDI (90 mcg/puff)	4–8 puffs every 20 minutes up to 4 hours, then every 1–4 hours as needed	4–8 puffs every 20 minutes for 3 doses, then every 1–4 hours inhalation maneuver. Use spacer/holding chamber	As effective as nebulized therapy if patient is able to coordinate.
<b>Bitolterol</b>			
Nebulizer solution (2 mg/mL)	See albuterol dose	See albuterol dose; thought to be half as potent as albuterol on a mg basis	Has not been studied in severe asthma exacerbations. Do not mix with other drugs.
MDI (370 mcg/puff)	See albuterol dose	See albuterol dose	Has not been studied in severe asthma exacerbations.
<b>Levalbuterol (R-albuterol)</b>			
Nebulizer solution (0.63 mg/3 mL, 1.25 mg/3 mL)	1.25–2.5 mg every 20 min- utes for 3 doses, then 1.25–5 mg every 1–4 hours as needed, or 5–7.5 mg/hour continuously	0.075 mg/kg (minimum dose 1.25 mg) every 20 minutes for 3 doses, then 0.075–0.15 mg/kg up to 5 mg every 1–4 hours as needed, or 0.25 mg/kg/hour by continuous nebulization	0.63 mg of levalbuterol is equivalent to 1.25 mg of racemic albuterol for both efficacy and side effects.
<b>Pirbuterol</b>			
MDI (200 mcg/puff)	See albuterol dose	See albuterol dose; thought to be half as potent as albuterol on a mg basis	Has not been studied in severe asthma exacerbations.



Figure 12 (continued)

<b>Systemic (Injected) Beta<sub>2</sub>-Agonists</b>			
Epinephrine 1:1000 (1 mg/mL)	0.3–0.5 mg every 20 minutes for 3 doses sq	0.01 mg/kg up to 0.3–0.5 mg every 20 minutes for 3 doses sq	No proven advantage of systemic therapy over aerosol.
Terbutaline (1 mg/mL)	0.25 mg every 20 minutes for 3 doses sq	0.01 mg/kg every 20 minutes for 3 doses, then every 2–6 hours as needed sq	No proven advantage of systemic therapy over aerosol.
<b>Anticholinergics</b>			
Ipratropium bromide			
Nebulizer solution (0.25 mg/mL)	0.5 mg every 30 minutes for 3 doses then every 2–4 hours as needed	0.25 mg every 20 minutes for 3 doses, then every 2–4 hours	May mix in same nebulizer with albuterol. Should not be used as first-line therapy; should be added to beta <sub>2</sub> -agonist therapy.
MDI (18 mcg/puff)	4–8 puffs as needed	4–8 puffs as needed	Dose delivered from MDI is low and has not been studied in asthma exacerbations.
Ipratropium with albuterol			
Nebulizer solution (Each 3 mL vial contains 0.5 mg ipratropium bromide and 2.5 mg albuterol.)	3 mL every 30 minutes for 3 doses, then every 2–4 hours as needed	1.5 mL every 20 minutes for 3 doses, then every 2–4 hours	Contains EDTA to prevent discoloration. This additive does not induce bronchospasm.
MDI (Each puff contains 18 mcg ipratropium bromide and 90 mcg of albuterol.)	4–8 puffs as needed	4–8 puffs as needed	
<b>Systemic Corticosteroids</b>			
Dosages and comments apply to all three corticosteroids			
Prednisone  Methylprednisolone  Prednisolone	120–180 mg/day in 3 or 4 divided doses for 48 hours, then 60–80 mg/day until PEF reaches 70% of predicted or personal best	1 mg/kg every 6 hours for 48 hours, then 1–2 mg/kg/day (maximum = 60 mg/day) in 2 divided doses until PEF 70% of predicted or personal best	For outpatient “burst” use 40–60 mg in single or 2 divided doses for adults (children: 1–2 mg/kg/day, maximum 60 mg/day) for 3–10 days.

\* Children ≤ 12 years of age

**Note**

No advantage has been found for higher dose corticosteroids in severe asthma exacerbations, nor is there any advantage for intravenous administration over oral therapy provided gastrointestinal transit time or absorption is not impaired. The usual regimen is to continue the frequent multiple daily dose until the patient achieves an FEV<sub>1</sub> or PEF of 50 percent of predicted or personal best and then lower the dose to twice daily. This usually occurs within 48 hours. Therapy following a hospitalization or ED visit may last from 3–10 days. If patients are then started on inhaled corticosteroids, studies indicate there is no need to taper the systemic corticosteroid dose. If the followup systemic corticosteroid therapy is to be given once daily, one study indicates that it may be more clinically effective to give the dose in the afternoon at 3 p.m., with no increase in adrenal suppression (Beam et al., 1992).

## Measuring Outcomes

Effective asthma management should result in demonstrated improvement in the patient's condition. Patient outcomes, although centered on the patient, are likely to affect families as well.

*Patient- and family-centered outcomes* include such indicators as symptom measures, lung function, functional status, health-related quality of life, and patient satisfaction with health care. Self-management skills largely influence patient outcomes and include medication adherence and taking action to avoid asthma exacerbation. *Resource utilization measures* also may help assess patient outcomes; these measures include number of hospital admissions, hospital days, prescriptions filled, and ED and urgent care visits due to asthma.

Measuring outcomes has relevance for the specific care of individual patients and for overall impact on groups of patients, such as participants in asthma disease-management programs or enrollees of a health maintenance organization. In all instances, data are identified, gathered, and analyzed to address predetermined outcome measures. The data source may be individual patient charts or specially designed databases. A primary purpose of data collection is to monitor the well-being of patients and make adjustments to individual care plans, as indicated. An equally important purpose of data is to assess the quality of health care services being provided over time to an identifiable group of patients, such as those receiving care from a health care program or organization.

The following information reviews outcome measures that can be used to monitor individual patient outcomes and/or assess the impact of services provided on outcomes of groups of patients.



People with asthma can enjoy regular activity.

## Patient- and Family-Centered Outcomes

### Symptom Measures

Questionnaires and direct interviews are the usual methods of collecting symptom data, which include frequency, duration, and intensity of wheezing, dyspnea, coughing, chest tightness, sputum production, and nighttime awakenings. One useful method is to combine temporal measurements of several important symptoms into a multidimensional index. The basis of this index is the concept of a symptom-free or episode-free day. Patients recall the number of days over a period of 1 to 2 weeks in which they have had no symptoms. Limiting the time frame to no more than 2 weeks reduces recall bias. An alternative method for collecting data is to ask patients to record this information in a diary.

Questions used to evaluate symptom control include the following: Does the patient awaken more than once or twice a month with coughing or shortness of breath? Do symptoms occur more than once or twice a week with duration of more than 1 hour? The answer "yes" to either question may indicate inadequate control of asthma and the need for the clinician to make adjustments to therapy. Even with optimal therapy, however, patients with severe asthma may not be able to attain the goals for symptom control listed above.

### Lung Function

Measures of lung function focus specifically on the extent of airflow obstruction. Objective pulmonary function measures include those derived in the clinical setting from FEV<sub>1</sub>, FVC, and PEF. The clinician uses spirometry to measure FEV<sub>1</sub> and FVC at initial assessment to

evaluate patient response while making changes in therapy that stabilize symptoms and daily PEF, and after the patient is stabilized. For routine followup, spirometry measures should be taken at least every 1 to 2 years when asthma is stable—more often when asthma is unstable. The clinician should assess PEF, as measured by a peak flow meter, during each office visit to compare a current measure to the patient’s personal best. The patient determines his or her personal best by taking a daily reading over a period of 2 to 3 weeks when the asthma is under good control and then selecting the highest number. Remind patients to use the same peak flow meter at home and during office visits for accurate comparisons. Personal-best readings do change over time. Therefore, it is important to reestablish this reading periodically.

Information obtained from lung function testing does not necessarily correlate with the patient’s or the health care provider’s perception of the severity of the patient’s condition. Peak flow measurements often detect airflow obstruction in patients who may not even be aware of symptoms. Therefore, peak flow monitoring can be a useful tool for tracking patient outcomes over time.

Questions used to help patients monitor asthma using peak flow measures include the following: Is peak flow reduced by at least 20 percent from predicted or personal best at any point? Is peak flow reduced by 15 percent after 6 minutes of rigorous exercise? Is morning-to-evening variability greater than 20 percent? The answer “yes” to any of these questions suggests inadequate control of asthma, and further assessments of pulmonary function and other outcome measures will be necessary.

### **Functional Status**

Functional status relates to limitations imposed by asthma on normal levels of activity. The number of schooldays or workdays missed due to asthma is a frequently used indicator of these limitations. You should encourage patients to report this information at each visit to their clinicians, making sure they

report data only for the period since their last visit to avoid including missed days already captured.

The following questions are used to assess functional status: Can the patient maintain his or her normal or desired activity levels? Does the patient perceive any limitation in his or her physical or social activity because of asthma? Can the patient exercise vigorously without coughing or shortness of breath?

### **Quality of Life**

Health-related quality of life refers to the degree that disease impairment affects the social, physical, and mental well-being of the individual, according to his or her own assessment. In addition to assessing symptom control and functional status, quality-of-life questionnaires examine anxieties and fears that patients experience due to asthma. Questions used to assess quality of life include the following: Does the patient or family report social or psychological stress as a consequence of asthma or asthma therapy? Do the patient and family have the knowledge, skills, and confidence to control asthma?

Quality-of-life questionnaires offer a standardized set of questions designed so that the resulting scores create a univariant measure to compare with subsequent measures over time. However, collecting and analyzing data related to quality of life often requires additional clinic/office time with patients as well as other resources. Therefore, quality-of-life questionnaires are more often used in research studies than in routine clinical care.

### **Self-Management Skills**

Self-management skills are at the core of patient education. We know that patients who follow their medication regimen and who respond quickly and appropriately to worsening symptoms have better outcomes. It is also important for the patient to control exposure to known environmental risks.

Medication adherence represents the degree to which patients follow a prescribed regimen. Since

pharmacotherapy is critical for asthma management, it is essential that patients understand and are able to articulate the difference between long-term-control medications and quick-relief medications and are able to demonstrate proper use of inhaled medications. Patients should know what medications they should be taking, how often to take them, and whether they are causing side effects. Most of this information comes from self-reports as documented in the patient's chart. This reinforces the importance of discussing the medication regimen at each patient visit. Gaining access to other potential medication data, e.g., pharmacies' (or Medicaid's or Medicare's) databases on prescription fulfillment by individual patients can be difficult, and access is usually reserved for specified studies. Medication adherence is an indirect measure of patient outcomes, and the source of data is largely the patient's chart.

Patients with an asthma action plan will have an outline of steps to take when their asthma symptoms are worsening. The plan will give specific information on how to recognize when asthma symptoms are worsening, to adjust medications accordingly, and to seek medical care when appropriate. The existence of such a plan—with documentation in the patient's record that he or she understands how to follow the plan—becomes another important indirect measure of patient outcomes. Therefore, it is important to review the asthma action plan at each patient visit.

It is also important for patients to know what factors make their asthma worse so they can take steps to eliminate or reduce their exposure to these things. Questionnaires, such as the sample shown in figure 13, can help patients identify their individual asthma triggers. Patients can then be instructed about what actions to take to reduce exposure to specific triggers and asked periodically about how they are implementing these actions over time.

## **Patient Satisfaction**

Patient satisfaction with care refers to important aspects of the relationship between the patient and provider, as well as to factors such as cost, waiting time, continuity of care, and time required to make an appointment. Patient satisfaction with care may or may not correlate with the technical quality of care, that is, the appropriateness of diagnosis and treatment. Therefore, a patient's opinion should not be used as a proxy measure of these aspects of care but as an independent dimension of quality of care. The absence of satisfaction with care is associated with reduced adherence to the treatment plan.

Self-administered surveys and interviews are the usual sources of data on patient satisfaction. Patients may not feel free to express dissatisfaction with their care. Therefore, patient satisfaction measures are most valid when obtained by individuals not providing care to the patients.

## **Resource Utilization**

Health resource utilization provides valuable information because it usually parallels an increase or reduction in the cost of asthma care. The assumption is that well-controlled asthma will result in less use of health resources, particularly expensive emergency and hospital care. Patient interviews (self-reports), claims data, and hospital admission records are the major sources of data relative to health care utilization. Of these, hospital admissions records provide the most accurate measure. However, because patients may receive care at several institutions, collecting these data can be difficult. Self-reported data are easiest to collect but depend on patient recall, which is not always accurate. Claims-based outcomes include only paid events and, as such, may underestimate true utilization.

Figure 13

Patient Self-Assessment Form for Environmental and Other Factors That Can Make Asthma Worse	
Patient Name: _____	Date: _____
Do you cough, wheeze, have chest tightness, or feel short of breath year-round? (If no, go to next question) . . . . . No___ Yes___	
If yes:	
■ Are there <b>pets</b> or animals in your home, school, or daycare? . . . . .	No___ Yes___
■ Is there moisture or <b>dampness</b> in any room of your home?. . . . .	No___ Yes___
■ Have you seen <b>mold</b> or smelled musty odors any place in your home?. . . . .	No___ Yes___
■ Have you seen <b>cockroaches</b> in your home?. . . . .	No___ Yes___
■ Do you use a <b>humidifier</b> or swamp cooler in your home? . . . . .	No___ Yes___
Does your coughing, wheezing, chest tightness, or shortness of breath get worse at certain times of the year? (If no, go to next question) . . . . . No___ Yes___	
If yes:	
Do your symptoms get worse in the:	
■ Early spring? (Trees) . . . . .	No___ Yes___
■ Late spring? (Grasses) . . . . .	No___ Yes___
■ Late summer to autumn? (Weeds) . . . . .	No___ Yes___
■ Summer and fall? ( <i>Alternaria</i> , <i>Cladosporium</i> ). . . . .	No___ Yes___
Do you <b>smoke</b> ? . . . . .	No___ Yes___
Does anyone smoke at home, work, or daycare? . . . . .	No___ Yes___
Is a <b>wood-burning stove or fireplace</b> used in your home? . . . . .	No___ Yes___
Are <b>kerosene, oil, or gas stoves or heaters</b> used without vents in your home? . . . . .	No___ Yes___
Are you exposed to <b>fumes or odors</b> from cleaning agents, sprays, or other chemicals? . . . . .	No___ Yes___
Do you cough or wheeze during the week, but not on weekends when away from <b>work or school</b> ? . . . . .	No___ Yes___
Do your eyes and nose get irritated soon after you get to work or school? . . . . .	No___ Yes___
Do your coworkers or classmates have symptoms like yours? . . . . .	No___ Yes___

**Figure 13 (continued)**

Are isocyanates, plant or animal products, smoke, gases, or fumes used where you work? . . . . .	No ___	Yes ___
Is it cold, hot, dusty, or humid where you work? . . . . .	No ___	Yes ___
Do you have a <b>stuffy nose</b> or postnasal drip, either at certain times of the year or year-round? . . . . .	No ___	Yes ___
Do you sneeze often or have itchy watery eyes? . . . . .	No ___	Yes ___
Do you have <b>heartburn</b> ? . . . . .	No ___	Yes ___
Does food sometimes come up into your throat? . . . . .	No ___	Yes ___
Have you had coughing, wheezing, or shortness of breath at night in the past 4 weeks? . . . . .	No ___	Yes ___
Does your infant vomit then cough or have wheezy cough at night? . . . . .	No ___	Yes ___
Are these symptoms worse after feeding? . . . . .	No ___	Yes ___
Have you had wheezing, coughing, or shortness of breath <b>after eating</b> shrimp, dried fruit, or canned or processed potatoes? . . . . .	No ___	Yes ___
After drinking beer or wine? . . . . .	No ___	Yes ___
Are you taking any prescription medicines or over-the-counter <b>medicines</b> ? . . . . .	No ___	Yes ___
If yes, which ones? _____ _____		
Do you use eye drops? . . . . .	No ___	Yes ___
Do you use any medicines that contain beta-blockers (e.g., blood pressure medicine)? . . . . .	No ___	Yes ___
Do you ever take aspirin or other nonsteroidal anti-inflammatory drugs (like ibuprofen)? . . . . .	No ___	Yes ___
Have you ever had coughing, wheezing, chest tightness, or shortness of breath after taking any medication? . . . . .	No ___	Yes ___
Do you cough, wheeze, have chest tightness, or feel short of breath during or after <b>exercising</b> ? . . . . .	No ___	Yes ___

## Part II.

# Establishing an Asthma Disease-Management Program

Asthma disease management is a comprehensive and coordinated system for providing health care services to achieve long-term control of asthma, not just episodic care in response to asthma exacerbation. Asthma disease-management programs generally use a population-based approach that seeks to identify patients at high risk for undesirable asthma outcomes and to intervene by modifying that risk. Programs combine the use of the most current treatment practices with a case-management approach and a self-care component. Case management provides individualized patient education and skills building, close monitoring of patient treatment, advocacy, and referral to other needed services. An effective disease-management program should result in patient wellness and autonomy and a reduction in the unnecessary use of health care resources and attendant costs.

Appendix A provides a compendium of examples that show how RTs have taken an active role in the planning, delivery, and evaluation of asthma disease-management programs being offered in a variety of health care settings. RTs have the basic skills to contribute to the development and operation of such programs.

Information in the following section of this guide is intended to better prepare RTs for their role on an asthma disease-management team. Indeed, the activities described can be applied to a spectrum of asthma programs, whether or not they meet the specific definition of disease management.

## What Is an Asthma Disease-Management Program?

A well-conceptualized asthma disease-management program incorporates all four components of effective asthma care presented in the EPR-2 and subsequent updates that are described in Part I of this guide. Simply put, a disease-management program seeks to improve patient outcomes through delivering quality asthma care in a cost-effective manner. Its implementation reaches across the continuum of the health care system—from providers to facilities to payers—and includes community resources as well.

With today's limited budgets and scarce medical resources, health care administrators and decision-makers are seeking tools and methods for improving decisions related to the allocation of health service dollars. Therefore, the integration of **costs** with **outcomes**, which underlies disease-management programs may be a useful approach.

Ideally, improvements in patient health outcomes will offset the costs of implementing new health care services. RTs are becoming increasingly involved in the planning, implementation, and evaluation of asthma disease-management programs in a variety of settings, as described in Appendix A. Effective participation by RTs requires a grasp of certain basic information. The following information should be helpful in laying a foundation for better understanding the cost-outcome equation that underlies disease-management programs.

## Costs

From a cost-of-illness approach, costs can be separated into the categories of direct and indirect expenditures. *Direct expenditures* are those associated with medical treatments, for example, physician-related services, hospital care (both inpatient and outpatient), emergency care, and medications. These costs are also referred to as resource utilization measures.

On the other hand, *indirect expenditures* refer to nonmedical costs consequential to a disease, for example, time lost from work or school, transportation expenses, childcare expenses when an individual receives medical care, and lost productivity or wages relative to premature death from lack of care. These indirect costs can also be referred to as social impact measures.

## Outcomes

Outcome data can serve as a useful tool in evaluating asthma disease-management programs.

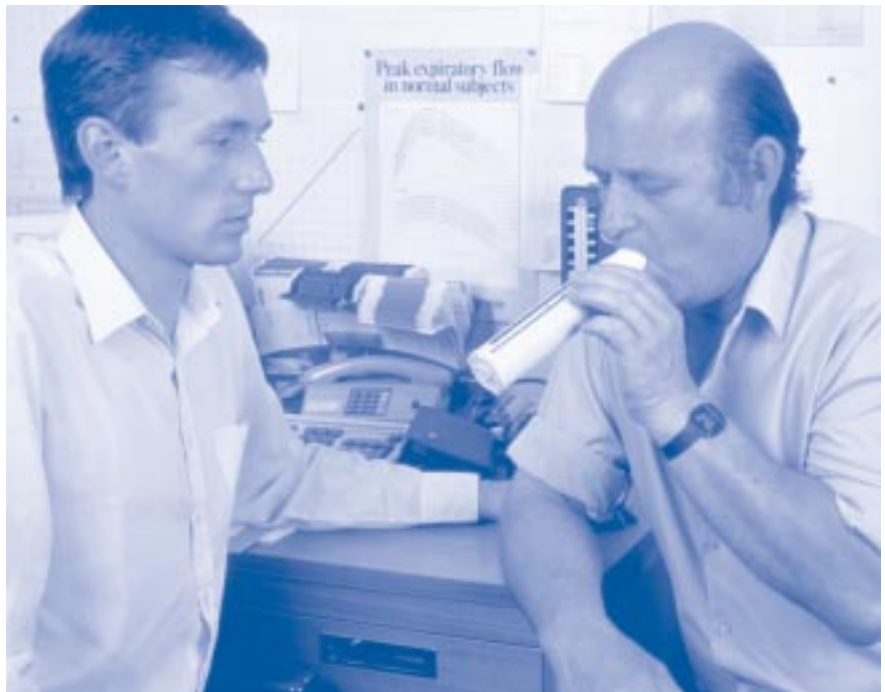
Decisionmakers will want to understand the results of a program in terms of *measurable* outcomes. Outcomes fall into two major classifications: *resource utilization measures* or *patient- and family-centered measures*. See “Measuring Outcomes” for a more complete discussion.

Examples of resource utilization measures include frequency and duration of hospital admissions, frequency of emergency department visits, and unscheduled office visits. Measures also may include routine ambulatory care visits and prescription fulfillment. A possible measure for medication adherence is a

patient’s prescription refill pattern for anti-inflammatory and short-acting beta<sub>2</sub>-agonist medications or a ratio of the two.

In general, resource utilization measures are obtainable from existing databases, for example, hospital Management of Information Systems (MIS) databases, employer data, and insurance and Medicaid claims databases. However, because the sources of these data may be multiple and dispersed, an alternative and perhaps more efficient approach to obtaining these measures is by collecting patient-reported information using recall methods (for example, questionnaires or surveys). While measurement error and bias are not uncommon in self-reported data, the accuracy of such data can be maximized by taking precautions such as limiting the time frame for symptom recall to no more than 2 weeks. Although there are problems with self-reported data, do not disregard them, for they are appropriate—and often the only—data for many important outcomes.

Examples of patient- and family-centered outcomes include symptom measures, measures of lung func-



Peak flow measurements provide useful data for monitoring patient lung function.



tion, measures of functional status, measures of self-management skills, health-related quality of life, and patient satisfaction with health care. Spirometry and peak flow measurement are the acceptable methods for obtaining objective measures of lung function. In general, patient- and family-centered measures are obtainable from the patient's chart. A variety of questionnaires, many having been validated and published in the scientific literature, are the principal method of collecting information on the functional-status, quality-of-life, and patient-satisfaction outcomes. Responses to questionnaires can be entered into a database.

Patient satisfaction, also obtainable from questionnaires, appears to correlate with physician behavior and communication skills, and can substantially affect patient adherence to the prescribed treatment regimen. Satisfaction is increased when (1) providers are perceived as friendly and accepting; (2) providers offer to share with patients the information gathered during the history-taking, physical examination, and testing; (3) providers meet patients' expectations for visits; and (4) patients feel that providers really listen to their concerns. Patient self-management behaviors, particularly medication adherence and monitoring for and managing asthma exacerbations, greatly influence most patient- and family-centered outcomes.

## Cornerstones of an Asthma Disease-Management Program

Cornerstones of a disease-management program include professional education, patient/family education and management strategies, and health care system supports. Ideally, a disease-management program will examine the processes of delivering asthma care as a means of identifying opportunities for change within the health care system that will lead to improved quality of care.

## Professional Education

Quality asthma care requires physicians and other health care providers to be well informed. They need to be knowledgeable about diagnosis and the latest treatment recommendations. This requires clinicians to understand and keep up with information on pathophysiology, diagnosis, and treatment, and to practice in concert with that knowledge. They should be familiar with outcomes assessment and the various tools available for measuring different aspects of quality of care, for example, patient symptoms, lung function, functional status, quality of life, and patient satisfaction with care. Equally important, health care providers must learn how to communicate effectively with patients.

As a member of the asthma health care team, RTs can facilitate and contribute to professional education in the following ways:

- Circulate pertinent scientific articles to all professionals on the team.
- Provide tools to help with patient assessment, encounter documentation, and education.
- Design interactive, problem-based seminars with case studies.
- Host a seminar; invite your team physician to speak.
- Custom design a list of drugs based on your organization's formulary; provide recommended dose and frequency of each, according to the EPR-2 and updates.
- Post summaries on specific sections of the EPR-2 and updates, for example, the severity classifications.
- Generate reports about patient status and progress to share with others on the asthma-care team; coordinate and communicate with other providers in the chain of care.
- Develop a list of quality patient education materials and references.

## Patient/Family Education and Management Strategies

Quality asthma care requires patients and their caregivers to be well educated in asthma basics and to be active participants in their asthma care. They need to have an understanding of what asthma is, what the symptoms are, and what triggers can make asthma symptoms worse. Patients and their caregivers must understand the difference between quick-relief and long-term-control medications and the appropriate use of each, as well as proper technique for using an inhaler, spacer, and peak flow meter. Patients should develop asthma self-monitoring skills, especially for recognizing early signs of deterioration that can lead to exacerbation. Armed with this information, patients and their caregivers should feel motivated and have the confidence for taking control of asthma and adhering to the prescribed medical and educational advice as outlined in their asthma management plan.

As members of the asthma health care team, RTs can facilitate and contribute to patient/family education and management in the following ways:

- Focus on the patient as a person, not on his or her asthma, in order to best tailor information to individual needs.
- Carefully review the written asthma action plan at each encounter; provide explicit instructions on when to call the doctor and/or proceed to the emergency department.
- Coach the patient to perform peak flow measurements and assist him or her in documenting personal best value.
- Demonstrate how to keep a good asthma diary.
- Teach proper techniques for handling, cleaning, and storing medicine.
- Review the patient's (and caregiver's, if appropriate) techniques for using an inhaler at each encounter.



Bird feathers may trigger worsening asthma symptoms.

- Explain and demonstrate the proper use and care of air compressors, nebulizers, peak flow meters and inhalation devices.
- Remind and encourage patients to keep appointments.
- Conduct telephone assessments between in-person visits.
- Generate reports about patient status and progress to others on the asthma care team; coordinate and communicate with other providers in the chain of care.

## System Supports

Assuring quality care in a cost-efficient manner may require taking steps to streamline or redesign processes in an existing system for delivery of health services. As part of the ongoing implementation and evaluation of the broader disease-management program, RTs should look for

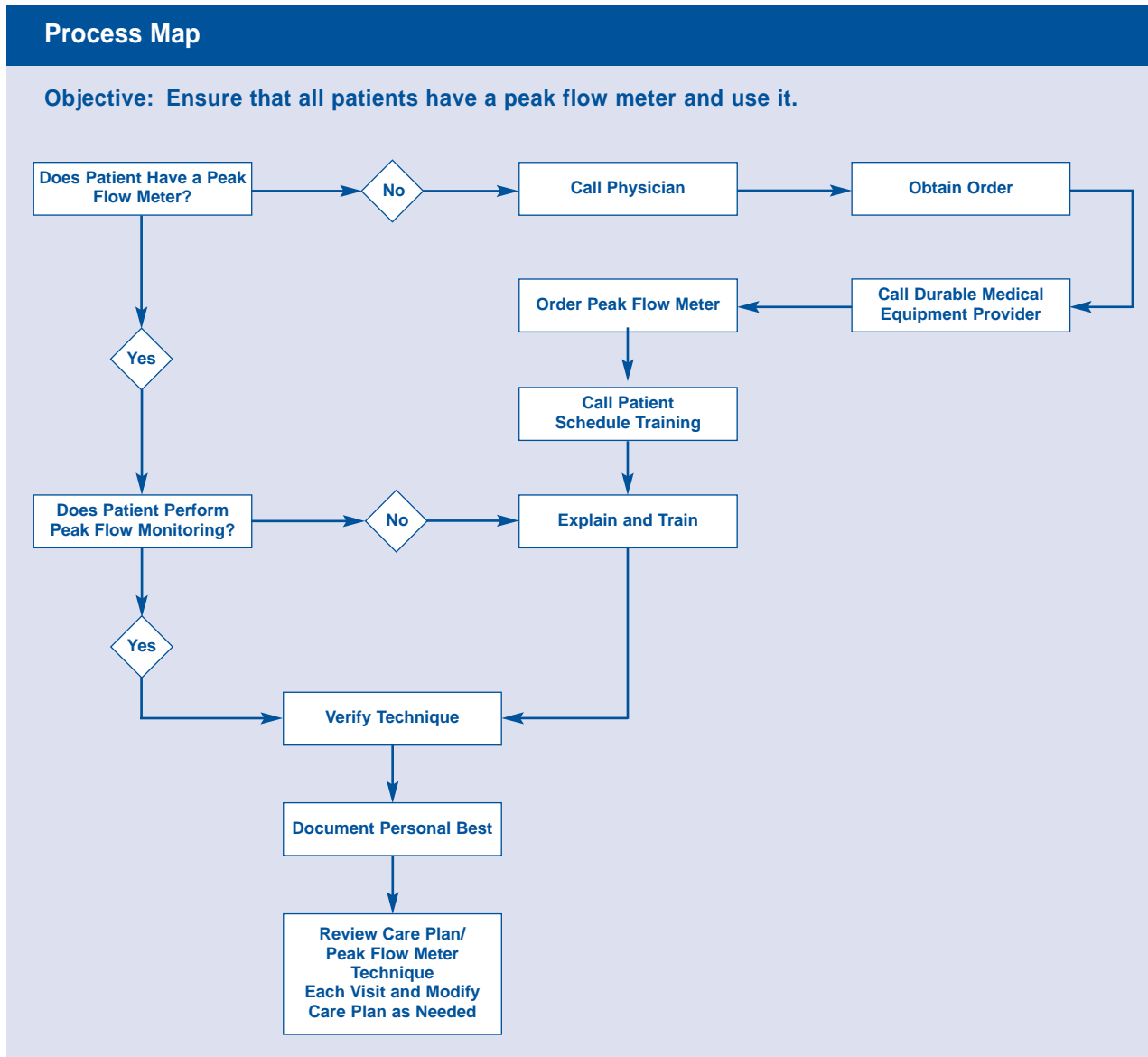
opportunities for quality improvement. Quality improvements generally result in better resource utilization and patient outcomes.

One approach for improving outcomes is through benchmarking, that is, by identifying organizations that have achieved the best results, then adopting their outcomes as your benchmarks and applying lessons learned from their endeavors to enhance the probability of achieving your own goals. The Health Plan Employees Data and Information Set (HEDIS) 2000 defines and tracks an asthma

medication measure that can be useful for benchmarking. In order to make meaningful comparisons of your program results with the benchmarks, you must be careful to measure the same variables in the same way, so as to accurately replicate the benchmark indicators.

Another method for streamlining health care delivery systems and improving quality of care is to examine and refine processes through mapping. See figure 14 for an illustrative example. Each box represents a step in the chain of events for achiev-

Figure 14



ing the stated objective. In this case the objective is to ensure that all patients have a peak flow meter and know how to use it. The map shows who is responsible for performing each step along the way in achieving this objective. The premise is that each step must be satisfactorily completed before the next step is taken. A step is automatically considered complete when the next responsible person in line to take action accepts that it is.

As members of the asthma health care team, RTs can facilitate and contribute to enhancing system supports for quality asthma care in the following ways:

- Identify opportunities for quality improvement and follow through with action.
- Assist in gathering relevant data to assess desired program outcomes; watch for new and useful data and data sources that contribute to evaluation of the overall program.
- Communicate with decisionmakers about asthma program status—successes, obstacles, solutions for overcoming obstacles, and so forth; prepare periodic reports or presentations that summarize findings.
- Foster a multidisciplinary team approach to patient care, thereby expanding buy-in and leveraging limited resources.
- Make things happen; accept responsibility for following through on the team’s agreed-upon activities.
- Network to establish connections with a variety of community asthma resources.

## Planning an Asthma Disease-Management Program

To create a program, RTs should build upon the principles of disease-management programs as described above. A number of RTs have done so, either by designing their own programs or becom-

ing partners with other care providers—for example, hospitals, managed care organizations (MCOs) and private physicians’ offices. (See Appendix A.)

The blueprint for a disease-management program is the program plan. The plan should include a description of the services you will provide; the personnel you will need; the action steps you will take to implement, monitor, and evaluate the program; and the overall rationale for implementing the program. You may wish to assemble a multidisciplinary team, including a physician, pharmacist, nurse, and social worker, to help develop the program plan. A program plan will include information on the following elements: background (statement of purpose); program design (goals and objectives, personnel requirements, logistic issues); implementation strategies; administrative, legal, and liability issues; evaluation plan for addressing outcomes; and budget. In developing a description for each element, you should consider certain key questions and issues.

### Background

#### Statement of Purpose

What is the need and/or justification for your program? What health care issues does it address? Who is the target audience? What can you expect to accomplish? What is the basis of your intervention design, and what documentation can you offer on the likelihood of success?

In describing your program, you will want to address any special needs of the target population you will be serving. For example, providing a disease-management program in rural areas can present challenges that may influence the cost, points of access, and reimbursement for delivery of health care services. More specifically, low population density makes it difficult to bring health services to persons with special needs, such as those who have asthma. About one-quarter of America’s uninsured children live in rural settings, where patients often

must travel considerable distances to obtain health care. You will want to show how your disease-management program offers solutions to these challenges in rural settings.

## Program Design

### Goals and Objectives

What is your long-term vision for program impact? What are your program objectives in measurable terms? What degree of change can you realistically aim for? What are the key data indicators you will use to measure outcomes? Are these indicators easy to collect or access from existing databases? What level of activity (for example, frequency and duration of patient encounters) do you propose to offer?

### Personnel Requirements

What disciplines will comprise your core team? Have you established the credentials for members of the team? Have you clearly spelled out in the job descriptions the responsibilities for each member? Personnel for a comprehensive program may include:

- A disease case manager, e.g., an RT, nurse, or social worker
- Office support personnel (receptionists, schedulers, and secretaries)
- A database administrator, analysts, and information systems personnel
- Financial accounting and data processing employees
- A medical director
- An office manager for physical-plant issues, ordering, and receiving supplies

A physician who has demonstrated a commitment to the care of patients with asthma should provide the medical direction for your program. Access to an asthma specialist for consultation, if not serving as the medical director, is important.

### Logistic Issues

Have you determined the location and hours of operation for the program? Do you have adequate office space, equipment, and supplies? Have you developed a referral stream to establish your client base?

Your professional partners in all likelihood have solid contacts with other professionals who see patients with asthma. These physicians should be the primary source of referrals for your asthma disease-management program, and you should approach them carefully to ensure long-term commitment to the program. The physicians you introduce to your program will need information about how your program coordinates with the medical care they provide and assurance that you will communicate with them frequently about your encounters with their patients.

As your program gets underway, the need for the cooperation and availability of various clinical services will arise. The relationships that you establish with other service providers will prove invaluable to the success of your program. In some situations, reaching patients can be “built in.” For example, if your program operates as part of a pulmonary clinic or ED of a large teaching hospital, you have contact with an identifiable patient base. However, if you operate as an independent entity, as a business, a practice-based program, or a community-based program, you may need to employ recruiting techniques to attract participants. Avenues for recruitment must be consistent with HIPPA (Health Information Privacy Protection Act) regulations. Some potential recruitment sources include:

- Physician referrals accrued by the efforts of your medical director
- Public service announcements
- Paid advertising
- Medical meetings, conventions, or trade shows

- Word-of-mouth referrals by patients already enrolled in your program
- Strategic alliances with MCOs, physician practice groups, or hospitals

### Implementation Strategies

What are the basic strategies you plan to use—partnering with local physicians for buy-in and endorsement, patient and caregiver education, patient skill building, professional education, links to community resources, or other tactics? What are the supporting strategies, or action steps, you plan to use—patient incentives for participation, lunchtime seminars for providers, home visits to patients and/or caregivers, referral to specialists, feedback reports to primary care providers, or other support strategies? Do you have a rollout strategy and timeline?

### Administrative, Legal, and Liability Issues

Have you consulted with representatives from the fields of law and insurance to ensure that your program complies with all necessary regulations

and to minimize your risk of liability? Have you checked the National Committee for Quality Assurance (NCQA) and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) regulations that may apply to you? Have you identified durable medical equipment (DME) providers you could partner with to facilitate prescribing and fulfilling the medical equipment needs of your patients? Have you included a pharmacist in your planning group to help identify resources that facilitate availability of certain drugs to patients in your program? Have you arranged for ongoing medical supervision of the program by a physician? Have you established a relationship with a Clinical Laboratory Improvement Amendments (CLIA)-certified laboratory to conduct the evaluations you will need on program participants from time to time?

The NCQA is a private, not-for-profit organization that assesses and reports on the quality of MCOs. In its HEDIS 2000 data set, the NCQA developed an asthma measure for use of appropriate asthma medications for people with asthma. The measure evaluates whether patients with persistent asthma are being prescribed medication deemed acceptable in the EPR-2 and updates as primary therapy for long-term control of asthma. The JCAHO is the predominant standards-setting and accrediting body for health care in the United States, covering all sites where health care is delivered.

In the area of asthma disease management, one of your most important partners may be a DME provider with whom you can make special arrangements for pricing, expediting insurance claims, and delivery that includes training the patient to use the products safely. Be sure to avoid conflicts of interest when making such arrangements.

### Evaluation Plan: Outcomes

Have you selected data collection instruments, including intake forms to record demographics and patient history, surveys, and pretests and posttests?



Ongoing care is essential for optimal asthma management.

Have you identified your outcome measures? Do you have a method for collecting data and tracking activities? Have you determined content and format for progress and feedback reports for those with financial and clinical interest in the program? Have you developed a system for ongoing program monitoring and making any necessary modifications to the program?

## **Budget**

Have you conducted an analysis of what the program will cost and what potential benefits will offset the cost? Have you determined what services are reimbursable and how you will otherwise cover the costs?

## **Evaluating Program Impact**

Program evaluation begins at the initial program-planning stage and extends over the life of the program. Now, with an increased emphasis on accountability and the need for choosing among budget alternatives, it is essential to evaluate your program and provide feedback to stakeholders. Evaluation tells them what you have done, how much you have done, and how well you have done it. It describes the impact you have had on improving patient outcomes, on managing program resources effectively, and on balancing cost of delivering program services with savings realized from better utilization of health care resources.

The key to good program evaluation is a systematic collection of data related to program activities and outcomes. The program description, or program plan, that you develop will help guide the selection of appropriate data elements. The plan indicates the scope and purpose of the program, and delineates the goals and objectives and measurable outcomes you wish to achieve. The plan also describes the implementation strategies you will use, as well as the specific activities you will implement in support of these strategies.

In choosing the actual data elements for use in monitoring and assessing your program, it is important to consider whether sources for these data already exist and, if so, how accessible they are. In some cases data may not be readily available, and you may need to adopt or develop instruments and methods for collecting them. Before deciding to use a particular outcome measure, consider the time and expense associated with the effort of collecting, collating, and analyzing this measure. Determine the potential of improving asthma-related outcome data routinely being collected before deciding to collect new data.

Also, before undertaking any data collection, it is critical to consider how you will use the data. Planning ahead saves time and resources. Spend time getting only the necessary data and avoid wasting effort and resources on data that will not be useful. Since carefully evaluated results are far more likely to be convincing and to reinforce the value of your program to others, it may be prudent for you to seek the help of someone with statistical expertise.

Once you have collected the necessary data, you must take care in reaching justified conclusions. Steps to take include outlining the findings, determining what they mean and how significant they are, comparing them to the objectives for the program and determining the degree of success you have achieved, and examining all the angles before interpreting results and drawing conclusions. For example, if you set out to reduce pharmacy costs by 20 percent through a disease-management program but instead see a 10-percent increase for treating asthma, what would you conclude? Pharmacy cost is one cost center that increases as adherence to treatment improves. This phenomenon is easy to explain because patients who are motivated to comply with their treatment plan will use more prescription medications. However, expensive hospitalizations may decrease due to improved medications, resulting in considerable savings. Thus, it is important to emphasize the overall cost

reduction that can result from an integrated disease-management program.

Monitoring ongoing program activities provides a way to determine what strategies are most successful and what adjustments you must make during implementation in order to address obstacles and achieve your goals.

Finally, be sure to share the evaluation findings and the “lessons” you have learned with others. You should use the data you collect to facilitate improved patient care, design more effective materials, improve operational processes, and justify the continuation of the program. You should routinely assemble reports and disseminate them in a form that is easy to interpret and review and that is relevant to all participants in the asthma disease-management program.



## Selected Resources

Eggleston P, Buckley T, Breysse P, Wills-Karp M, et al. The environment and asthma in U.S. inner cities. *Environ Health Perspect* 1999;107:S439–50.

Kallstrom T, Lewarski J. Home care. *Respir Care Clin N Am* 2000 Mar;6(1):75–85

Kercsmar C, Myers T. Clinical pathways in treatment of asthma. *Curr Opin Allergy Clin Immunol* 2002 Jun;2(3):183–7.

McDowell K, Chatbum R, Myers T, O’Riordan M, Kercsmar C. A cost-saving algorithm for children hospitalized for status asthmaticus. *Arch Pediatr Adolesc Med* 1998 Oct;152(10):977–84

National Asthma Education and Prevention Program (NAEPP). *Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma—Update on Selected Topics* 2002. Bethesda, MD, 2002; NIH publication no. 02–5074. <http://www.nhlbi.nih.gov/guidelines/asthma/index.htm>.

NAEPP. *Clinical Practice Guidelines. Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma*. Bethesda, MD, 1997; NIH publication no. 97–4051. <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf>

NAEPP. *Practical Guide for the Diagnosis and Management of Asthma*. Bethesda, MD, 1997; NIH publication no. 97–4053. <http://www.nhlbi.nih.gov/health/prof/lung/asthma/practgde.htm>.

NAEPP. *Nurses: Partners in Asthma Care*. Bethesda, MD, 1995; NIH publication no. 95–3308. [http://www.nhlbi.nih.gov/health/prof/lung/asthma/nurs\\_gde.htm](http://www.nhlbi.nih.gov/health/prof/lung/asthma/nurs_gde.htm).

NAEPP Task Force on the Cost Effectiveness, Quality of Care, and Financing of Asthma Care. *Report of the NAEPP Task Force*. Bethesda, MD, 1996. [http://www.nhlbi.nih.gov/health/prof/lung/asthma/ast\\_cost.htm](http://www.nhlbi.nih.gov/health/prof/lung/asthma/ast_cost.htm).

National Committee for Quality Assurance. HEDIS (Health Plan Employer Data and Information Set) 2000 Asthma Measure: *Use of Appropriate Medications for People with Asthma (First Year Measure)*. <http://www.ncqa.org>.

National Center for Health Statistics, Centers for Disease Control and Prevention. *National Health Interview Survey 2001*. <http://www.cdc.gov/nchs/nhis/htm>.

Platts-Mills T, Wheatley L. The role of allergy and atopy in asthma. *Curr Opin Pulm Med* 1996; 2:29–34.

Pongracuc J, Evans R. Environmental and socio-economic risk factors in asthma. *Immunol Allergy Clin North Am* 2001;21:413–26.

van der Jagt E. Contemporary issues in the emergency care of children with asthma. *Immunol Allergy Clin North Am* 1998;18:211–40.



# Appendix A:

## Learning From Others' Experiences

Asthma disease management can take various forms, with programs proliferating in hospitals and specialty clinics, operating as businesses, existing as community-based programs, and functioning in public schools. While these programs take place in different settings, the goal is always the same—providing the best care for patients and appropriate education for families and caregivers. Primary care physicians direct most of these programs and emphasize multidisciplinary teamwork. RTs have played an active role with varying degrees of responsibility in facilitating these programs.

There are many examples to draw from to demonstrate asthma disease-management programs; however, this appendix highlights asthma disease-management programs that have had significant input from RTs in their development and operation. It presents case studies that illustrate the role of RTs in developing and implementing disease management programs in a variety of settings. The case studies were prepared by the coordinators and administrators of the programs. As part of the case studies, evaluation data are presented. In most cases, data are derived from retrospective comparisons of preprogram and postprogram data. This provides important evaluation information for program administration. Rigorous evaluation through randomized controlled clinical trials in the future also will be important to compare disease-management approaches with other systems designed to provide comprehensive asthma care.

You will find that the following examples illustrate some of the varied settings in which asthma disease management flourishes, as well as demonstrate the range of responsibilities that RTs have taken in program implementation. It is hoped that these examples will inspire you to work with others to initiate and design a program that fits your setting and fully utilizes your skills.

## Appendix A–1. An Outpatient Clinic-Based Program

### Baylor Asthma and Pulmonary Rehabilitation Center, Baylor University Medical Center, Dallas, TX

#### Background

Baylor University has been running an outpatient clinic-based asthma program since the late 1980s. Concerned that patients with asthma were frequently being admitted as inpatients, Baylor physicians decided that a program operated in the outpatient setting held the potential to minimize hospitalizations and improve overall quality of life for their patients with asthma. A professional consultant recommended that the hospital conduct a community survey to determine the components of such a program, and 50 local residents with asthma were interviewed in one-on-one sessions to identify program components. These interviews revealed the following major themes: (1) the focus of the program should be allergies and asthma; (2) the staff should be interdisciplinary; (3) the program should include information regarding the psychosocial effects of the disease and its impact on quality of life; and (4) the program should emphasize patient self-management techniques.

With these goals in mind, the coordinator of the pulmonary rehabilitation program developed a business plan for the new center based on data regarding the number of ED visits and hospital admissions for patients with a primary diagnosis of asthma. Asthma prevalence in the Dallas area and local demographics were other considerations. Working closely with the program's original medical director (an allergist), the coordinator developed a plan to meet the four objectives.

The asthma program began seeing patients in 1988. Two years later, the program merged with the pulmonary rehabilitation program and was called the Baylor Asthma and Pulmonary Rehabilitation

Center. In 1996 the Center moved from the main hospital campus to a new 5,200-square-foot facility in a building two blocks away. In 2002, the Center relocated again to a larger facility.

#### Program Design

**Staff.** The Center's staff consists of a physician manager, eight respiratory care specialists (RCSs), two technicians, an office manager, and two clerks. Four of the RCSs are registered nurses (RNs) and four are RTs.

**Role of RTs.** RTs function as RCSs, using physician-approved algorithms to perform diagnostic tests, assess ongoing care, and develop individualized care plans and patient/family education.

**Target Group.** The program serves asthma patients in the Dallas area, including all ethnic groups and an increasing Hispanic population.

**Patient Referral.** The hospital's inpatient asthma care program can refer patients to the outpatient program, especially those patients who may have come into the hospital through the ED, who do not adhere to the prescribed medical regimen, and/or who are not managing their asthma according to the *NAEPP Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma* (EPR-2) and subsequent updates (NAEPP Guidelines). Patients do not need a doctor referral to make an appointment to the outpatient program, but the program provides only short-term care until their asthma is under control.

**Caseload.** The Center sees about 40 new patients each month; total visits number approximately 600 per month. Patients are both male and female and are 7 years of age and older.

**Community Outreach.** In its work with the Dallas Public Schools and other school districts, the Center staff uses Peak Performance USA, a national school asthma awareness and management program initiated by the AARC. The staff is also involved in a community-wide effort to educate

patients and physicians about asthma and asthma medications through the Dallas Asthma Consortium and its primary project, “The Rules of Two,” an easy way to remember when a patient may need more than one kind of medication to control asthma symptoms.

### **Implementation Strategies**

The focus of the care plan is on pharmacology, stressing the use of inhaled anti-inflammatory medication as the primary intervention, since most of the patients who come to this center have moderate or severe persistent asthma. The Center follows the NAEPP Guidelines.

Most patients come to the Center three to four times until their asthma is sufficiently controlled, then they are referred to a primary care provider for ongoing long-term care. The first Center visit includes diagnostic testing, such as spirometry, skin testing for local area allergens, and broncho-provocation testing to establish a diagnosis and assess the severity of the disease. The results of the skin tests serve as the basis for a personalized environmental-control plan. RCSs do not recommend that patients alter their environment until there is objective documentation of actual allergic triggers.

Patient and family education begins on the first visit. The content is based on the results of patient history and subjective information obtained via a questionnaire, along with objective data gathered during the visit. The RCS provides instruction on how to use medications and medication delivery systems but is careful not to overload the patient with too much information at the first visit.

The second visit usually occurs 2 to 4 weeks after the first, depending on how the patient is doing. The RCSs keep in close contact by phone in the interim. The second visit includes a second testing with spirometry. The physician visits with the patient and may adjust the care plan, and the RCS reinforces messages on self-management. The patient receives a three- or four-zone “asthma

action plan,” based on the information regarding peak flows and medications that he or she has recorded in a home diary during the interval between the first and second visits. The patient also receives instructions on how to adjust medications in response to changes in peak flow.

Patients remain Center clients until their asthma symptoms are under control and they demonstrate an understanding of their care plans and their role in making them work.

### **Outcomes**

Outcome measures include use of the Short Form-36 (SF-36) quality-of-life client survey. The patient completes the survey before the first visit, at discharge back to the primary care physician, and at subsequent 6-month and 12-month intervals. Data analysis is ongoing. The asthma questionnaire completed by patients is converted to a computer-generated format that allows for close evaluation of changes in health status secondary to medical interventions.

Positive response to the program has led to the establishment of Baylor Asthma and Pulmonary Rehabilitation Centers across the Baylor Health Care System. The systemwide approach will enable patients across the Dallas area to access the same high-quality care, usually within 12 to 15 minutes from the time they leave home. Payers also like this approach, as indicated by a case manager from a large health maintenance organization (HMO) who reports that she knows what treatment her patients are getting, no matter what the Baylor location.

**Success Factors.** The program recognizes three factors as critical to the Center’s success: a dedicated medical director who is committed to long-term staff development; administrators who are also committed and who understand that development of this type of program is long term and the payoff is not just in dollars; and professional staff who understand clinical focus, patient satisfaction, and marketing strategies.

**Budget**

**Reimbursement.** The Baylor Asthma and Pulmonary Rehabilitation Center is a distinct cost center within the pulmonary services area of Baylor University Medical Center. Reimbursement for services varies, with HMO and preferred provider organization plans accounting for approximately 70 percent, Medicare and Medicaid for 20 percent, and indemnity plans for about 10 percent. However, patients without any means to pay for services are not turned away. The Center follows the guidelines for documentation required by the medical center and regulators, such as the JCAHO.

## Appendix A–2. An Inner-City, Public Hospital-Based Program

### Asthma Center, Jacobi Medical Center, Bronx, NY

#### Background

The Asthma Center is located at Jacobi Medical Center, a 560-bed inner-city public hospital that also serves as a teaching hospital for the Albert Einstein College of Medicine. RTs in this hospital noticed a trend developing as early as 1986: Asthma patients were not receiving timely care in EDs. An RT developed a proposal for managing patients with asthma in the ED, using RTs as the coordinators for patient care. The plan, which was supported by both ED physicians and pulmonologists, went into operation in 1988, when the hospital began staffing an RT in the ED 7 days a week, 24 hours a day. That was the beginning of an extremely active 8-year period that culminated in 1996 with the formation of an asthma center staffed by RTs, nurse practitioners, and physicians.

The ED protocol called for RTs to assume increased responsibility in the clinical management of asthma patients. Although the program was widely supported from the outset, it raised questions about the RTs' scope of practice, particularly with regard to the administration of intravenous medications. Since New York State did not provide licensure for RTs at that time, a brief limitation of therapist practice ensued to allow the State Department of Health (NYSDOH) and the State Education Department to review and resolve the issues. Thus, when NYSDOH sought participants for a workforce demonstration project aimed at exploring the impact of the RT on asthma care in the ED, Jacobi Medical Center RTs applied for the demonstration project. The study conducted on 100 patients in 1992 and 1993 by the Center for Health Policy Studies found that patients treated by an RT had 60.5 percent fewer hospital admissions than did those treated by another health care professional.

These results led Jacobi Medical Center RTs to prepare another grant proposal, focusing on the provision of first line care to patients with asthma and coordination of services by RTs through an asthma center. It received a NYSDOH grant in 1995 to develop an asthma center, with funding through August 1998. The hospital considered this program during its 2-year demonstration period sufficiently successful to continue funding indefinitely, and the program is now being emulated by other area facilities.

#### Program Design

**Staff.** The Jacobi Asthma Center is a collaborative effort involving physicians, nurse practitioners, and RTs. The staff includes a full-time nurse practitioner, who serves as the overall case manager for Asthma Center patients, and a part-time medical director, who provides direction regarding policy and decisionmaking. The medical director also serves as the consulting physician for patient-management issues and provides guidance to a nurse practitioner.

**Role of RTs.** The program's two full-time RTs are responsible for instructing patients in the use of their metered-dose inhalers (MDIs), peak flow meters, spacers, peak flow diaries, and ways to reduce environmental triggers. The RTs also conduct necessary pulmonary function tests, complete the Juniper Asthma Quality of Life Questionnaire, provide basic information about asthma, and team with the nurse practitioner to educate patients regarding their medications and assessment of symptoms.

**Target Group.** The program serves people in the inner-city who have asthma and lack adequate health care coverage, targeting patients who use the emergency room as their primary provider and patients who have frequent hospital admissions.

**Patient Referral.** Patients are referred from the ED. The RT in the ED schedules the patient for the Asthma Center appointment.

**Caseload.** The Jacobi Medical Center receives approximately 8,000 asthma visits to its ED and

approximately 1,000 visits to its Asthma Center each year. The patient population is 59 percent Hispanic, 23 percent African American, 16 percent Caucasian, and 3 percent other races (primarily Asian). Patients are 71 percent female, and the average age is 43. (The minimum age for referral to the Center is 18.)

### **Implementation Strategies**

The intervention includes four sessions. During the 2-hour first session, patients fill out two surveys: The Juniper Asthma Quality of Life Questionnaire explores the impact of asthma on the patient's lifestyle, and a patient-satisfaction survey solicits the patient's opinions of the services provided and the management of his or her disease. The nurse practitioner then conducts a patient assessment and reviews compliance with medication. The RT performs pulmonary function tests and teaches the patient to use the peak flow meter. The RT also addresses the patient's environmental asthma triggers, along with the issues of indoor air pollution and smoking. If the initial assessment indicates that the patient's home environment needs exploration, a home care consultation is scheduled.

Use of medications follows the NAEPP Guidelines. Patients learn that they should notify the Asthma Center whenever they must use their rescue medications or change their regimen due to a change in their symptoms.

The second visit takes place 2 weeks after the first. RTs and nurse practitioners review the peak flow diary with the patient, addressing the issues of environmental triggers and medication usage. The third and fourth visits take place 3 and 6 months after the initial visit. To gauge progress, the patient completes both the Juniper Asthma Quality of Life questionnaire and patient-satisfaction survey again and undergoes repeat pulmonary function testing. Once again the team reviews the peak flow diary, addresses triggers and medication use, and assesses and adjusts medications, as necessary. Physicians remain involved throughout the program, retaining

sole responsibility for reviewing patient care management and interpreting pulmonary function studies.

### **Outcomes**

The Asthma Center regularly tracks outcomes for its patients, based on the Juniper Asthma Quality of Life questionnaire and patient-satisfaction surveys, the number of ED visits, and the number of hospital inpatient days. The Center has collected data on a group of 133 patients who completed the 4-session program and who also (for comparison purposes) had a preprogram history with the facility. Although the sample size is small and a simple evaluation design without a comparison group is used, an analysis of preprogram and postprogram data on the 133 patients treated in the Asthma Center indicates the following results:

- ED visits declined from 449 to 111.
- Hospital patient-days declined from 86 to 10.
- Quality-of-life scores on the 7-point Juniper Asthma Quality of Life questionnaire increased from 2.74 at the initial visit to 3.84 at the 3-month visit and to 4.77 at the 6-month visit.
- Scores on the 50-point patient-satisfaction survey rose from 35 at the initial visit to 38 at the 3-month visit and to 48 at the 6-month visit.

**Success Factors.** The involvement of RTs in the care of asthma patients at Jacobi Medical Center is at the core of a health care partnership that has led to improved outcomes for patients and reduced costs for the institution.

### **Budget**

**Reimbursement.** The Asthma Center currently receives reimbursement for physician visits in conjunction with its educational sessions. The primary insurers are Medicaid (49 percent), Medicare (11 percent), and private insurers (9 percent). Medicaid HMOs make up 1 percent of the mix, and 30 percent of the patients are uninsured.



## Appendix A–3. A Health Plan-Based Program

### Asthma Care Management Program of Kaiser Permanente Northern California

#### Background

The Kaiser Permanente Northern California Health Plan offers a multilevel, multiservice asthma program that grew out of Kaiser’s overall philosophy of preventive medicine.

The Asthma Population Management Program, implemented in 1998, is one of seven chronic condition management programs at Kaiser Permanente Northern California. The program identifies adult members with asthma by computerized administrative data and stratifies them according to risk into three levels of care, each based on differing care needs and objectives. The goal at each level is to implement proactive, planned interventions to maximize health and patient satisfaction and to enhance members’ skills to effectively self-manage their asthma.

**Level 1: Self-Care Support.** Members at this level can self-manage their asthma and can maintain relatively good control of their asthma. Services available to level 1 members include routine care by the primary care team and self-management education and support. The goal is to maintain member confidence, skills, and health status so that a higher level of care is unnecessary.

**Level 2: Care Management.** Level 2 members have suboptimal asthma control and/or are at high risk for asthma-related hospitalization or emergency room visits. These members are eligible for enrollment in the Asthma Care Management Program. (See criteria for eligibility under Target Group in the Program Design section.) The Asthma Care Management Program is a short-term (usually 6 months or less) clinical intervention that offers individual and group encounters to optimize medical management and to help members in the target

group learn self-care skills to effectively self-manage their asthma. When patients demonstrate confidence in their ability to self-manage asthma and their asthma is stabilized, they return to the primary care team for their asthma care.

**Level 3: Intensive Management.** These members have asthma that is extremely difficult to manage due to its severity or is complicated by psychosocial issues, or they have other unstable comorbid conditions. Level 3 care requires vigilant monitoring and extensive care coordination across services. These members require expert management by a specialist (allergist or pulmonologist) and care by a multidisciplinary team based on individual needs. The goal is to closely manage highest risk members.

As their conditions change, improve, or deteriorate over time, members may move among levels. The goal at each level is to optimize clinical care and to enhance effective self-management skills among all asthma patients so that they can be maintained at level 1 care.

Approximately 40 asthma care managers, RTs, nurses, or clinical pharmacists) in the region provide care for high-risk asthma patients at 29 facilities.

#### Program Design

**Staff.** Asthma care managers may be RTs, nurses, or clinical pharmacists. Each asthma care manager has a physician mentor or champion. The asthma care manager works in partnership with the primary care provider and other team members, including a behavioral medicine specialist (a psychologist or social worker), clinical health educators, allergists, and pulmonologists.

**Role of RTs.** As asthma care managers, RTs provide a comprehensive assessment of patients’ asthma, including trigger identification and avoidance measures, asthma severity, and spirometry. They teach and reinforce asthma self-management skills and help members to explore personal

barriers to effective asthma self-management. Asthma care managers assess members' readiness to learn and make lifestyle changes using motivational interviewing techniques and develop an individualized plan of care with each member. They provide ongoing monitoring of symptoms and peak flows to assess asthma control. Following established protocols, asthma care managers provide clinical management and medication adjustment to optimize treatment.

**Target Group.** The Asthma Care Management Program for adults proactively targets members who meet level 2 eligibility requirements. These members are at high risk for poor outcomes due to suboptimal asthma control and/or need of self-care skills. Eligibility criteria include:

- Diagnosis of asthma with complex symptoms
- Poorly controlled asthma despite primary care team care and self-management education
- Identification as high risk on the Quarterly Asthma High Risk List:
  - ED visit with a diagnosis of asthma in the past 6 months
  - Hospital admission with a principal diagnosis of asthma in the past year
  - Need for two or more prescriptions for oral steroids for asthma
  - Twelve or more canisters of beta<sub>2</sub>-agonist in the past year

**Patient Referral.** Members are referred to the Asthma Care Management Program by primary care providers, pharmacists, or on an ED or hospital.

**Caseload.** The suggested caseload is 320 patients for a full-time care manager over a 12-month period, but actual caseloads vary from facility to facility.

## Implementation Strategies

**Asthma Clinic.** The first care management encounter for all asthma members is an asthma clinic, conducted by an asthma specialist in partnership with the asthma care manager. The specialist may be an allergist, pulmonologist, or a primary care physician or nurse practitioner with expertise in asthma. Here the member receives clinical evaluation and treatment, spirometry, confirmation of diagnosis, assessment of asthma severity, basic asthma self-management survival skills, including environmental control, a written asthma self-management plan, and determination of the level of followup needs.

**Asthma Class.** Adult care management enrollees are next encouraged to attend the “Breathe Easier” asthma class. The curriculum was formally evaluated as a randomized clinical trial in Northern California, and results were positive health outcomes, as well as reduced office visits, in adults with asthma. The program is designed to teach members with asthma how to self-manage their asthma by providing a variety of learning experiences that enhance self-efficacy. The class focuses on self-management skills, including peak flow meter use; inhaler and spacer technique; understanding self-management plans; symptom recognition; and trigger management. The class is based on proven behavior change techniques and is designed to be taught interactively to encourage participants to learn and practice the skills taught in the class. Training is provided for instructors that focuses on content and process. Instructors may include RTs, RNs, health educators, and pharmacists.

**Followup Visits.** Most asthma care manager followup visits are conducted by telephone. At each followup encounter, the care manager addresses any new questions or concerns the member may have about his or her asthma and follows up on the member's progress toward goals to improve asthma control. The asthma care manager assesses the member's asthma control by reviewing symptoms,

peak flow range, and extent of limitations due to asthma and, if asthma is not in control, works with the member to determine precipitating factors. The asthma care manager assesses and reinforces self-management skills, helps members to set goals, facilitates referrals, coordinates appointments, classes, and resources and communicates progress to the primary care provider and other team members involved in members' asthma care.

**Program Exit.** When members achieve asthma control and self-management skills, they "graduate" from the program and return to the primary care team for their asthma care. Members who meet the criteria for level 3 are referred to an asthma specialist.

## Outcomes

On a quarterly basis, the Asthma Population Management Program staff monitors outcomes for quality and utilization measures. The following rates represent regional averages for each measure in 2002 as compared to 1998:

- ED visit rate: The 2002 rate was 3.9 visits per 1,000 members with asthma; the 1998 rate was 7 visits per 1,000 members with asthma.
- Hospitalization rate: The 2002 rate was 4.9 hospitalizations per 1,000 members with asthma; the 1998 rate was 10.4 hospitalizations per 1,000 members with asthma.
- Asthma high-risk rate: The 2002 rate was 7.8 percent of total asthma members that met high-risk criteria; the 1998 rate was 13.5 percent of total asthma members that met high-risk criteria.
- Physician medication ratio (inhaled corticosteroids as a percent of all inhaled medications): In 2002, 88 percent of all physicians had a prescribing ratio better than 30 percent; the rate in 1998 was 52 percent.

Member and provider biannual reports on the degree of satisfaction show a very high degree of satisfaction from both groups.

## Success Factors

Important elements of the program that have contributed considerably to its success include:

- Clear criteria that define three progressive levels of asthma care and services, each tailored to specific needs of the subpopulation identified
- Strong support and commitment among physician mentors/champions and local leaders for implementing and sustaining the program
- Strong linkages between program sites and EDs, hospitals, and physicians to enhance outreach to patients.

## Budget

**Reimbursement.** The cost of the program is included in member's health plan coverage. Copays are charged for face-to-face visits with asthma care managers. Asthma classes, discussed earlier, are a covered benefit.

## Appendix A–4. A Children’s Hospital-Based Program

### Rainbow Babies and Children’s Hospital, Cleveland, OH

#### Background

In the mid-1990s, Rainbow Babies and Children’s Hospital found that the number of days its asthma patients spent in the inpatient setting was greater than in similarly sized pediatric hospitals. When managers in the respiratory care department investigated the situation, they found that the care patients were receiving varied considerably depending on their physicians. In addition, the role of the RT in the care of these patients was virtually nonexistent. The RT managers organized a committee to identify ways to improve coordination of care for the hospital’s asthma patients.

The committee, headed by the hospital’s respiratory care managers and the medical director of the pediatric asthma center, and composed of nurses, RTs, social workers, and interested physicians, developed an algorithm for asthma care based upon the NAEPP Guidelines. The resulting protocol serves as a charting tool, assessment document, and decision map. The protocol supports the delivery of consistent, appropriate care to patients in the hospital’s asthma unit.

#### Program Design

**Staff.** The staff includes physicians, RTs, RNs, and social workers.

**Role of RTs.** RTs routinely assess chest sounds and vital signs, perform bedside spirometry, and provide asthma education.

**Target Group.** The program serves an inner-city population with approximately 1,600 to 2,000 annual ED visits due to asthma.

**Patient Referral.** All patients admitted to the asthma unit are referred from the ED or from the hospital.

**Caseload.** The asthma program currently sees approximately 900 to 1,000 patients each year. Of these patients, 85 percent are non-Caucasian, and 60 percent are younger than 5 years of age. The age range of patients accepted into the program is between 1 and 18 years of age.

#### Implementation Strategies

The algorithm that guides the program calls for the RT to routinely assess chest sounds and vital signs and to perform bedside spirometry. All patients who are diagnosed with moderate or severe persistent asthma receive a peak flow meter, along with the essential education to correctly use the device. RTs and nurses administer all aerosols to the patients in the program, and parents are instructed in the administration of these medications. In addition, all patients in the program receive an emergency action plan tailored to meet their specific needs.

Once a patient’s immediate situation is under control, educational sessions begin. The sessions also include the caregiver(s) of children with asthma. One-on-one sessions with the RT, nurse, or social worker stress the need for the patient and family to assess their home environment. Patients receive information on asthma triggers and trigger avoidance, along with other handouts on the disease. The program also provides written and verbal reinforcement in the use and care of aerosol nebulizers, MDIs, peak flow meters, and medications, as well as instructions on how to use an asthma diary to monitor asthma control.

Patients who appear to need more followup also receive home visits. A local DME company conducts these visits, sending RTs into the patients’ homes to evaluate the home environments and the patients’ and their families’ understanding of the

disease and ability to deal with it. This detailed assessment, which usually requires from two to five visits to a patient's home, leads to the development of a customized plan aimed at ensuring that the patient and caregiver develop appropriate asthma self-management skills.

Although under the algorithm the RT provides a wide range of necessary services and education, physician involvement remains a key factor in the program. The medical director of the asthma unit is a board-certified pediatric pulmonologist who meets with staff and residents on a daily basis during patient rounds and also conducts a monthly staff meeting to discuss any problems that need to be resolved. A physician must also discharge the patient from the unit.

### **Outcomes**

Outcome indicators used in the program include length of stay, number and type of aerosols given, recidivism, and ED visits. The program also monitors patient recall of information provided during the inpatient phase, postdischarge symptomatic days, missed schooldays, and level of decreased activity within 30 days after discharge.

A study\* compared care delivered to pediatric asthma patients by RTs in the asthma unit with care delivered by RNs in other hospital units with non-protocol-based care. Results of the study indicated that an asthma unit staffed by RTs was associated with a reduced length of stay, reduced care-path variances, and lower costs of care compared with standard treatment administered by RNs. The use of RTs resulted in average cost savings of \$150 per case. The estimated savings for the asthma unit as a whole, based on a 4-year average census of 900 patients per year, was \$135,000. None of the outcomes collected in the study suggested any negative effects on quality of care or patient function as a result of the delivery of care by RTs in the asthma unit.

**Success Factors.** These results indicate that by implementing care practices based on the NAEPP Guidelines that included a significant role for RTs to routinely assess chest sounds and vital signs, perform bedside spirometry, administer aerosols to patients, and provide asthma education, Rainbow Babies and Children's Hospital improved outcomes for its patients at a cost saving.

### **Budget**

**Reimbursement.** Most of the patients seen in the asthma unit (60 to 70 percent) are insured by MCOs. Approximately 30 percent have third-party coverage. The only documentation insurers require is assurance that the unit has assessed and treated the patient appropriately and that the admission was medically necessary.

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\* Myers TR, Chatburn, RL, Kerckmar, CM. A pediatric asthma unit staffed by respiratory therapists demonstrates positive clinical and financial outcomes. *Respiratory Care* 1998;43(1):22-9.

## Appendix A–5. An Office-Based Program

### Beaver Medical Group, Licensed Practice (L.P.), Banning, CA

#### Background

The physician's office is often the asthma patient's first point of contact with the health care system. The four pulmonologists and two allergists with Beaver Medical Group, L.P. are using RTs to facilitate the development of a state-of-the-art disease-management program for the asthma patients under their care.

#### Program Design

**Staff.** The staff includes pulmonologists, allergists, and four full-time RTs.

**Role of RTs.** RTs interview patients to gather information for medical assessment and provide pulmonary function and other testing, patient education, and bronchoscopy support. Once patients are enrolled in the program, they are often seen primarily by the RT, thus freeing the pulmonologist to spend more time with new patients or those with more urgent medical needs.

**Target Group.** The program targets patients with a primary diagnosis of asthma.

**Patient Referral.** Ninety percent of the patients are enrolled in MCOs and are referred by them.

**Caseload.** The program clinic serves approximately 100 patients with asthma each day.

#### Implementation Strategies

Most of the patients have already been diagnosed with asthma when they enter treatment at the clinic. A thorough assessment is performed at the patient's first visit and includes a complete history and physical examination, pulmonary function studies, appropriate laboratory tests, chest x rays, and arterial blood gases. The first visit also includes a

review of the patient's potential triggers, including pets, exercise, weather, aspiration, and other medications.

Patients who smoke are engaged in a 20- to 30-minute discussion of the impact that smoking has on the lungs. Lung models are present in all exam rooms to reinforce the points being made in the discussion. Information on smoking cessation patches and other interventions is provided.

In keeping with the NAEPP Guidelines, the physician prescribes anti-inflammatory medications and other agents, using a regimen covered by the patient's insurers. During the first visit, the patient's medications are discussed in detail, and demonstrations and instructions are provided regarding the use of a MDI and spacer so that the patient understands the importance of proper use. In addition, patients are frequently provided with a peak flow meter to monitor their asthma at home.

A second visit is scheduled within a few days of the first so that the physician can review the results of the pulmonary function and other tests with the patient and develop a plan of care. A third visit occurs 2 to 4 weeks after the second and is devoted to an overall assessment, review of medications, and evaluation of the patient's use of MDIs and spacers.

The RT ensures patient compliance with the plan of care initiated by the physician by reinforcing education on the use of MDIs and spacers and the importance of using a peak flow meter at home to track and report worsening of symptoms or other changes that could suggest a change in the overall plan of care.

Most of the patients seen in the clinic receive a pulmonary function test and chest x rays on a yearly basis. A visiting nurse association provides home visits to assess patient status and compliance with treatment when necessary.

For patients with severe disease, regular appointments are scheduled on a monthly basis. Those

with mild or moderate disease are returned to their primary care physicians (PCPs), with a letter from the clinic physician outlining the recommended plan of care. Patients are encouraged to contact the office any time their symptoms worsen or change, or if they have difficulty obtaining an appointment with their PCP.

### **Outcomes**

Two important measures being tracked by this program include asthma-related ED visits by people ages 2–44 years and prescribing appropriate medications for people with asthma. Data collected over a 2-year period (2000–02) show that the Beaver Medical Group outperformed the average score of other members in the same payer network relative to these measures. The network average for asthma-related ED visits was 2.3 percent compared with 0.1 percent for the Beaver Medical Group; the network average for prescribing appropriate asthma medications for people with asthma was 74.4 percent compared with 90.3 percent for the Beaver Group.

### **Budget**

**Reimbursement.** Costs for this comprehensive clinic system are covered by the patients' insurance or the MCO.

## Appendix A–6. A Business-Based Program

### AirLogix, Inc., Dallas, TX

#### Background

AirLogix, Inc. is a for-profit, privately owned chronic respiratory disease-management company founded in 1994 by RTs. Based in Dallas, TX, AirLogix, Inc. uses RTs to provide respiratory wellness programs to primary payers such as MCOs, employer groups, and capitated physician groups. The company has managed more than 300,000 patients with asthma and chronic obstructive pulmonary disease (COPD) to date.

#### Program Design

The company's Health Management Program for asthma uses a proprietary self-management plan called the ActionPath™, which is based on the NAEPP Guidelines. The overriding objective of the program is to teach members who are at risk of asthma exacerbation about proper health management while they are well. The intended result is to reduce unnecessary resource utilization (for example, expensive hospitalizations and ED visits), thereby offsetting the cost of providing asthma case management services.

**Staff.** The staff includes RTs in several different roles, RNs, an information technology department, a medical director who is a pulmonologist, and a chief executive officer who is a nurse. In addition to clinical operations staff at the central location, there is a network of field staff as well to provide AirLogix's health care services. Also, a sales force promotes visibility of the company and its services in the marketplace.

**Role of RTs.** RTs play the following roles.

- **Respiratory care managers (RCMs)** are RTs who are responsible for the disease-management approach. They are responsible for integrating the way products and services are used and reimbursed, with the objective of maximizing

the quality, efficiency, and effectiveness of care. RCMs are responsible for the telephonic interventions with the patients and for assisting patients with issues involving DME, home health, pharmacies, social services, or comorbidities. RCMs work independently and with a diverse group of patients.

- **Home respiratory therapists (HRTs)** are local respiratory care practitioners who deliver AirLogix services and provide education in the patient's home, gathering and recording information on health care utilization, medications, quality of life, and functional status in accordance with AirLogix policies.
- **Education coordinators** develop, implement, and control the provision of orientation and continuing education for program service providers in accordance with the policies of AirLogix, Inc., and the directives of the Medical Director and health plan or client organizations. The education coordinator's responsibilities range from interviewing RCMs and HRTs to training of all clinical operations staff to achieve the highest level of clinical and computer proficiency. The education coordinator writes and revises training manuals and orientation practices for the clinical operations team, responds to inquiries, coordinates monthly continuing education classes, and schedules classes for cardiopulmonary resuscitation certification.
- **Account managers** are licensed, registered, or certified RTs with strong management skills. They manage the day-to-day account activity and work closely with key members of each health plan. Account managers recruit, interview, hire, and manage the RNs, HRTs, RCMs, and clinical assistants for their accounts. They also perform close monitoring, from account expenses to home therapist evaluations. They attend quarterly meetings with the field staff and weekly clinical operations meetings. They must maintain licensure with the State.



**Target Group.** The program serves patients with chronic respiratory disease, including asthma, for health plans and other payers throughout the United States.

**Patient Referral.** Patients who have chronic respiratory diseases are initially identified using claims data through AirLogix's proprietary identification and prioritization system or by referral from a client organization, a health care provider, or an individual member participating in a covered health plan.

**Caseload.** The caseload varies with the program and depends on disease severity among participants and intervention requirements (encounters by home visit or telephone). A typical staffing ratio is 500 members to 1 clinical staff member for RCMs in the corporate office, and 200 members to 1 clinical staff member for HRTs in the field.

**Community Outreach.** AirLogix RTs in each community take part in health fairs and other events as agreed upon with the client. This may include educating teachers and school nurses on asthma and providing in-service training to physicians and their office staffs on national respiratory guidelines.

### **Implementation Strategies**

Standards and guidelines from the NAEPP Guidelines and the Global Initiatives on Asthma were used to develop components, protocols, and materials for AirLogix's Health Management Program for asthma.

Members of the AirLogix client organizations who are referred for service are contacted by telephone to collect additional information used to assess eligibility. This brief interview, called the tele-assessment, provides member-specific data on disease severity, quality of life, functional status, and current symptoms. The results of the tele-assessment are coupled with claims history to determine the appropriate initial intervention level for each member, using AirLogix's algorithms.

Members are initially placed into one of the following approaches to care, depending on their current risk of health care utilization: education and outreach, telephonic visit, or home visit. Members move between approaches as their health status and risk for utilization changes. AirLogix's Information Technology system, AirWorx, automatically tracks members to ensure they are receiving the specific care they need, when they need it.

Members placed in the Education and Outreach Program receive AirLogix's National Health Information educational booklet and diary, along with the self-management kit. The kit materials include information on understanding the physiology of respiratory disease, early warning signs, identification and avoidance of disease triggers, the importance of medication and compliance, and guidance on determining and following a self-management plan. The booklet also contains general information related to smoking cessation, nutrition, home safety, and mental health. The self-management kit contains a spacer for use with MDIs, an instructional video, and a peak flow meter and fits neatly into a fanny pack that AirLogix provides to members. Members in Education and Outreach Program can call and speak with an RCM at any time by using the AirLogix toll-free number.

Members meeting criteria for more intensive followup receive an AirLogix initial home visit with followup visits, either by telephone or in their home. At or before the initial scheduled visit, the member receives the self-management kit, education booklet, and diary. The visit generally lasts 1 to 2 hours and is performed by a licensed RT. The visit focuses on education, assessment, and baseline data collection. Comprehensive education and self-management reinforcement occur throughout the visit, with an emphasis on understanding the disease, adhering to the physician's plan of care, and learning proper peak flow meter and inhaler techniques, when appropriate. The assessment and corresponding data collection focus on current respiratory symptoms, current medication

regimen (as compared with prescribed), smoking status, comorbid conditions, quality-of-life status, functional status, nutritional needs, mental health issues, availability of caregiver and support systems, acute health care utilization over the preceding year, environmental and seasonal issues, home safety, and lung function (home visit only).

Throughout the initial visit, the RT evaluates the member's individual circumstances to determine whether he or she needs additional medical and/or community resources or referrals. AirLogix makes every effort to facilitate relationships with the provider and surrounding community. When needed, AirLogix provides additional assistance to the member in the areas of home health care, DME, social service referrals, access to community resources, pharmacy communications, and access to financial resources. Because costs can be a major barrier to appropriate care and compliance, AirLogix works with the member and caregiver to obtain the financial assistance needed for optimal adherence to the physician's plan of care.

After the visit, the member's physician receives a comprehensive report, an ActionPath™, or a Visit Results form, summarizing the findings. The report summarizes all assessment results, the self-reported and prescribed medication regimen, unscheduled health care utilization, and observations about the home environment. ActionPath™ includes a sample self-management plan based on the most current medical literature to help the physician develop the member's plan of care.

Based on the results of the most recent visit, members receive followup visits, either by telephone or in the home. Followup visits focus on the reinforcement of the member's self-management plan, preventative medication regimen, and early exacerbation detection and management. Each time a member is contacted, the medical and lifestyle assessment is conducted to address any changes and to continually educate the member on those topics that need additional reinforcement.

## Outcomes

Outcome data compiled over a period of more than 6 years on 9,164 program enrollees throughout the United States indicate that the company's overall approach to keeping respiratory patients well and out of the hospital is working. When compared with self-reported preprogram data, the postprogram data indicate that hospital admissions, hospital days, and ED visits declined dramatically. For asthma patients, hospital admissions declined 85 to 93 percent; hospital days declined 85 to 95 percent; and ED visits declined 88 percent. When postprogram paid claims were reviewed, AirLogix demonstrated significant decreases in costs for asthma patients.

In addition, lost productivity (defined as missed schooldays or workdays or missed workdays of a parent caring for an asthmatic child) dropped significantly for asthma patients. Reductions were 80 to 90 percent for missed workdays or missed workdays due to a child's illness, and 75 to 80 percent for missed schooldays. Quality-of-life and functional status markers also showed improvement, with 80 percent of adult asthmatics stating they no longer awoke at night with shortness of breath after at least 90 days in the program. Asthmatics who smoked at the time of program enrollment and were in the program for at least 9 months had a 26 percent quit rate.

## Budget

**Reimbursement.** Health plans, employers, and other clients reimburse AirLogix in several ways. Currently, AirLogix has contracts where reimbursement is made on a case rate, fee-for-service basis, a per member per month rate, and per disease member per month rate. In most health plan contracts, AirLogix agrees to achieve certain agreed-upon financial and clinical objectives for the population each year.

## Appendix B.

# Asthma Resources

**Allergy and Asthma Network,  
Mothers of Asthmatics, Inc.**  
2751 Prosperity Avenue, Suite 150  
Fairfax, VA 22031-4397  
Phone: (703) 641-9595  
Fax: (703) 573-7794  
<http://www.aanma.org>  
E-mail: [aanma@aol.com](mailto:aanma@aol.com)

**American Academy of Allergy,  
Asthma, and Immunology**  
611 East Wells Street  
Milwaukee, WI 53202  
Phone: (800) 822-ASTHMA (800-822-2762)

**American Academy of Pediatrics**  
141 Northwest Point Boulevard  
Elk Grove Village, IL 60007-1098  
Phone: (847) 434-4000

**American Association for Respiratory Care**  
11030 Ables Lane  
Dallas, TX 75229-4593  
Phone: (972) 243-2272  
Fax: (972) 484-2720  
<http://www.aarc.org>  
E-mail: [info@aarc.org](mailto:info@aarc.org)

**American College of Allergy, Asthma, and  
Immunology**  
85 West Algonquin Road  
Arlington Heights, IL 60005  
Phone: (800) 842-7777

**American College of Chest Physicians**  
3300 Dundee Road  
Northbrook, IL 60062-2348  
Phone: (847) 498-1400

**American College of Emergency Physicians**  
1125 Executive Circle  
Irving, TX 75038-2522  
Phone: (800) 798-1822

**American Lung Association**  
For the affiliate nearest, call (800) LUNG-USA  
(800-586-4872)

**American Medical Association**  
515 North State Street  
Chicago, IL 60610  
Phone: (312) 464-5000

**American Thoracic Society**  
1740 Broadway  
New York, NY 10019-4374  
Phone: (212) 315-8625

**Asthma and Allergy Foundation of America**  
1125 15th Street, N.W., Suite 502  
Washington, DC 20005  
Phone: (800) 7-ASTHMA (800-727-8462)

**National Asthma Education and Prevention Program**  
National Heart, Lung, and Blood Institute  
Health Information Center  
P.O. Box 30105  
Bethesda, MD 20842-0105  
Phone: (301) 592-8573  
TTY: 240-629-3255  
Fax: 301-592-8563  
<http://www.nhlbi.nih.gov>

**National Center for Environmental Health**  
Centers for Disease Control and Prevention  
Phone: (800) 311-3435  
<http://www.cdc.gov/nceh/default.htm>

**National Jewish Medical and Research Center**  
1400 Jackson Street  
Denver, CO 80206  
Phone: (800) 423-8891

**Society for Academic Emergency Medicine**  
901 North Washington Avenue  
Lansing, MI 48906-5137  
Phone: (517) 485-5484

