
Asthma

Challenges in vulnerable populations

The numbers are frightening—asthma affects approximately 21 million adults and 6.3 million children in this country. The lower the socioeconomic level, the higher the prevalence of asthma—and the higher the morbidity and mortality.

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According to AAPA's 2005 census report, PAs were involved in approximately 11.6 million asthma visits, an increase of almost 20% from 2003. PAs are being asked to take on more of the burden of chronic disease care, and to do so in less time. The effect of time constraints in the delivery of care has been shown to limit the PA's ability to provide appropriate preventive services as well as adequate care for chronic diseases.¹ Primary care providers may want to tailor their approach to identified high-risk patient population groups, hoping to limit the exacerbations and long-term sequelae of poorly controlled chronic ailments such as asthma.

Asthma defined

Asthma is a chronic, reversible lung disease characterized by bronchial inflammation, bronchospasm, and/or bronchial hyperreactivity. The disorder manifests in many

ways other than the classic symptom of wheezing. Recurrent cough (with or without associated wheezing), shortness of breath, reduced expiratory flow, chest tightness, exercise intolerance, and respiratory distress all may be symptoms of asthma. Asthma should also be considered if patients present with symptoms that occur or increase with exercise, viral illness, seasonal or weather patterns, or exposure to environmental allergens such as cigarette smoke or animal dander.² Asthma symptoms vary from person to person in frequency, timing, and severity. Marked diurnal variability occurs, with peak expiratory flow (PEF) values at about 4:00 PM and a trough approximately 12 hours later.³

The symptoms of asthma usually appear by age 5 years, with boys twice as likely to be affected. By age 30 years, however, gender distribution is equal. Approximately 1 in every 13 children in the United States has asthma,⁴ and the prevalence of childhood asthma may be even greater if children with mild symptoms such as chronic cough, recurrent croup, or exercise-induced bronchospasm are included.⁵

Etiology

Inflammation of the tracheobronchial tree in allergic and nonallergic persons with asthma is caused by hypersensitivity to a number of environmental or external triggers. Any of these triggers may stimulate the respiratory tract's epithelial cells to begin a complex cascade of more than 50 different inflammatory mediators.⁶ Table 1 (page 44) lists some of the multiple factors that

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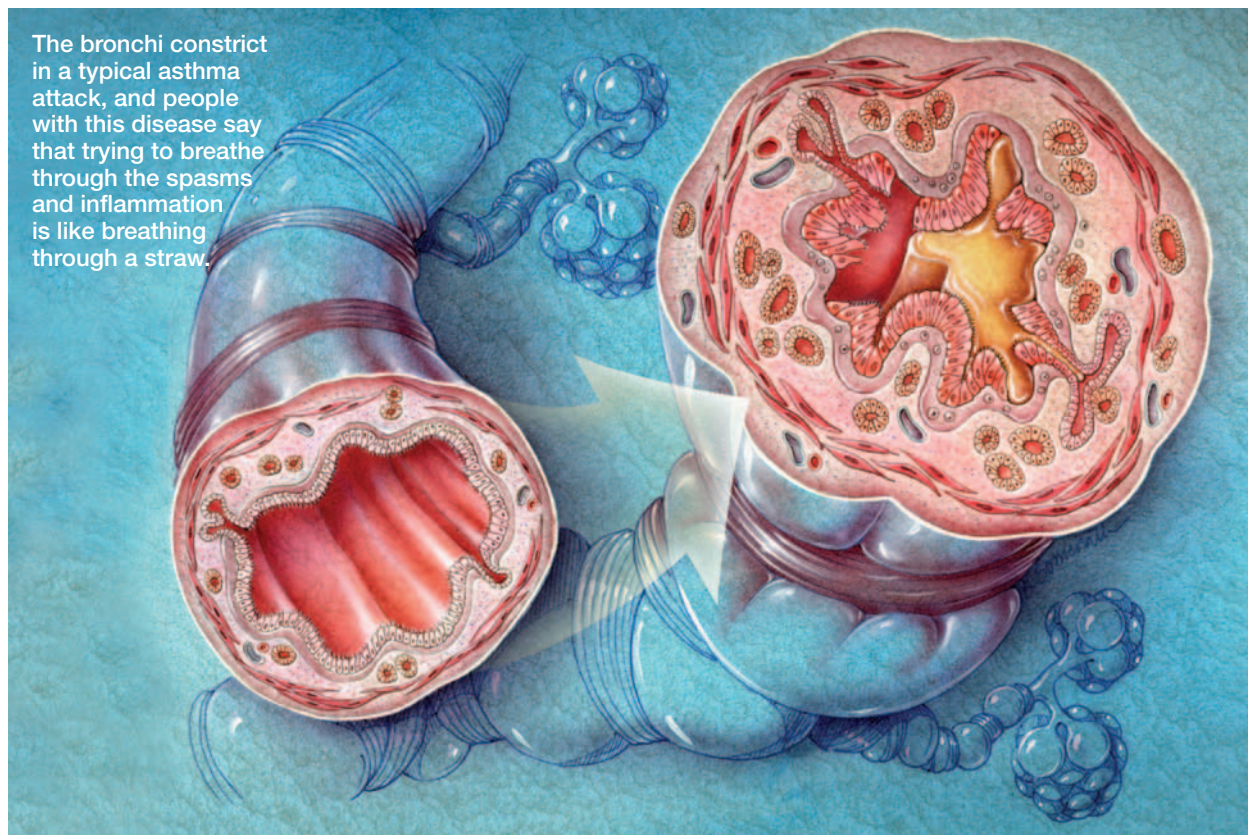
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Learning objectives

- Describe the symptoms associated with asthma and their manifestation depending on age
- Outline the prevalence of asthma and the influence of socioeconomic factors on the illness
- Discuss common triggers and allergens responsible for asthma attacks
- Review the diagnostic process and how severity level classification relates to therapy



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are involved in airway obstruction.⁷ Airway hyper-responsiveness is also an essential component in the pathogenic mechanisms of asthma.

Prevalence

The American Lung Association estimates that 21 million adults and 6.3 million children younger than 18 years have asthma. The disease accounts for 14 million lost school days for all children, 14.5 million lost work-days for all adults, and \$17.2 billion in annual costs.⁸ Data from the CDC's National Center for Health Statistics show that patients made 15 million asthma-related outpatient visits in 2001. Blacks had a 40% higher office visit rate than did nonblacks.⁹

Whether ethnicity plays a more significant role in increased asthma morbidity and mortality than does socioeconomic status (SES) is difficult to ascertain. Many US cities have large populations of minorities living at the poverty level who share high rates of asthma prevalence and severity. Although asthma prevalence rates are only slightly higher in blacks than in non-blacks, blacks are 4 to 6 times more likely to die from asthma. Asthma mortality rates are highest among black men living in inner cities.^{10,11} A study from the National Institute of Allergy and Infectious Diseases noted that asthma was more severe in approximately 50% of the patients who reported significant barriers

to medical care.¹² Both access barriers and consolidation of minority populations are found in low-SES inner-city areas.

Evidence is mounting that SES may be a more significant risk factor than ethnicity for asthma prevalence, morbidity, and mortality.¹³⁻¹⁵ A study investigating asthma mortality in Chicago noted that persons residing in poorer neighborhoods had a higher mortality rate than persons residing in more affluent areas.¹⁵ This study noted particularly high rates of mortality in blacks and people of low SES. These findings may be extrapolated to other large cities, where similar socioeconomic and demographic conditions exist.

Several theories have been proposed as to why minorities and the impoverished are at greater risk for disease-related mortality (see Table 2, page 44). Poverty, lack of education, and barriers to receiving health care appear to predispose minorities in the United States to increased mortality and morbidity rates.¹⁶

Discrepancy in care

Numerous studies have noted the racial and ethnic disparities of the US health care system. Minorities have issues with health care access, and communities that are largely Hispanic or black have higher rates of physician shortages than other communities.¹⁷ Some minority populations in the United States face mortality rates

comparable to those found in the developing world.¹⁸ An Institute of Medicine study showed that nonminorities in the United States receive more aggressive health care than minorities.¹⁹

Again, it is difficult to identify any one causative factor for such discrepancy in care. Minority groups have aggressively sought to increase the number of competent providers available for practice in underserved areas. Latino health student organizations on college campuses have worked to educate, motivate, and inspire minority students to pursue careers in medicine, with the idea that minority physicians are more likely than nonminority physicians to practice in underserved and low-income communities.^{17,20} Some state and federal agencies also have loan repayment and other incentive programs that attempt to attract graduating primary care residents to underserved areas.

Lack of continuity of care

Since minority communities have fewer physicians per capita, residents with chronic diseases are less likely to seek routine and continued care. Some primary care providers report poor adherence to prescribed asthma treatment, and some providers may not be offering appropriate continuity-of-care treatment plans to their patients.²¹ Urgent care and emergency department (ED) visits during acute episodes result in short-term “fix-it” care instead of long-term disease control. Compared to whites, Hispanics are twice as likely to utilize ED services for their primary care needs.¹⁶

Lack of health insurance

The lack of affordable and available health care insurance coverage plagues minority populations. The cost of asthma may be 2.1% to 30.1% of total family income.¹³ According to the US Census Bureau’s recent report on the number of Americans without health insurance, minorities represent most of the uninsured, with 32.7% of Hispanics and 19.5% of blacks having no health care coverage.²² Compared to the general population, Hispanics are less likely than any other ethnic group to have health insurance coverage, and they spend a disproportionate amount of their disposable income on health care.¹⁶ Rising medical costs and lack of affordability appear to constitute a large part of the problem of securing adequate health care coverage. Minorities are overrepresented in lower-wage jobs, and these are less likely to come with competitive benefit packages.

Costs of medication

The rising cost of prescription drugs has created a barrier not only for older citizens but also for people who are uninsured and for those whose income is at or below the federal poverty level. Low-SES groups may also

suffer from “fiscally induced asthma” (disease exacerbations caused by lack of affordable treatment options). New advances in the understanding and treatment of asthma have prompted providers to utilize multiple medications for successful prevention and treatment of asthma symptoms. This may create barriers for low-SES asthmatic patients because new and possibly more effective medications may be either too expensive or not covered through assistance programs.

Population density

Minority populations are often heavily concentrated in inner cities.²³ These areas tend to have an overall higher population density than suburbs. In addition, public housing units (usually populated disproportionately by minorities) promote high-density living conditions. Crowding may contribute to the increase in asthma prevalence because it encourages transmission of viral respiratory tract infections (RTIs) and may promote more unsanitary living conditions.

Higher exposure to triggers

Minority populations may have increased rates of exposure to certain common trigger factors that are responsible for asthma attacks. Triggers include cigarette smoke, pollens, molds, dust mites, cockroach excrement, ozone, RTIs caused by viral or bacterial microorganisms, household and other chemicals, perfumes, paints, exercise, pet

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Key Points

- ▶ A chronic, reversible lung disease, asthma is characterized by bronchial inflammation, bronchospasm, and/or bronchial hyperreactivity.
- ▶ Persons of low socioeconomic status have greater exposure to common asthma triggers and may have increased morbidity and mortality.
- ▶ The incidence of asthma is rising nationwide, with a disproportionate number of Hispanics and blacks being affected.

Competencies

Medical knowledge	◆◆◆
Interpersonal & communication skills	◆◆◆
Patient care	◆◆◆
Professionalism	◆◆◆◆
Practice-based learning and improvement	◆◆◆◆
Systems-based practice	◆◆◆◆

For an explanation of competencies ratings, see the table of contents.

dander, and air pollution. The last is a known trigger for asthma attacks, with high particulate levels increasing exacerbation rates. Interestingly, a recent study suggests there actually may be a correlation between air pollution and the incidence of asthma in children.²⁴ The California Air Resources Board continues to study the role that air pollution plays in the incidence of asthma.²⁵ Some studies have also identified anxiety and depression as potential triggers for asthma attacks.^{26,27}

Exposure to tobacco smoke is one of the more common asthma triggers for children. Evidence shows that smoking remains a serious problem among those with lower SES and education levels.¹⁸ Families with annual incomes less than \$10,000 are twice as likely to have children exposed to cigarette smoke than are families whose annual incomes are higher than \$40,000.¹³ These factors make asthma management more challenging and may account for the higher rates of asthma hospitalizations among minority children.²⁸

Air pollution is a major problem in most urban environments across the United States. According to

the most recent data from an American Lung Association report, Los Angeles, Detroit, and Atlanta are among the most polluted metropolitan areas in the United States.²⁹

The US census bureau also shows these cities have minority population rates of 34% to 81%. Particulate matter released in the air and gases such as ozone are known to cause respiratory complications.

Allergens are organic or inorganic substances that cause allergic reactions. Common allergens associated with asthma exacerbations include pollens, indoor molds, dust mites, and cockroach excrement. Indoor mold is often found in poor housing stock where roofs are leaky and plumbing is bad. Infestations of cockroaches are found in unsanitary living conditions and in inner-city environments where old and poorly maintained housing may be found.

RTIs caused by viruses or bacteria are commonly associated with asthma exacerbations. Many patients with asthma, especially children, have increased wheezing during RTIs.³⁰ Research from the early 1970s indicated that most of the infections triggering asthma attacks were viral.³¹ Crowded living conditions, secondhand smoke, poor hygiene, and infrequent hand washing are factors known to increase infection rates.

Diagnosis and treatment

During their early years of training, almost all clinicians learned the phrase, “All that wheezes is not asthma.” Many severe disease processes can mimic asthma symptoms. The differential diagnosis of asthma should include viral RTIs, which are seen most often, as well as pneumonia, foreign body aspiration, vocal cord dysfunction, heart disease, and cystic fibrosis.

Asthma is diagnosed using the medical history, family history, and results of a physical examination. Wheezing itself is not sufficient for diagnosis because many children will have episodes of wheezing during viral upper RTIs. One study found that wheezing in the first 3 years of life has a rather benign prognosis and almost 60% of children had stopped wheezing by age 6 years.³² The history should determine whether there is a family history of asthma or a history of allergies or of exposure to secondhand smoke. In addition, providers may be able to identify trigger and other risk factors by inquiring what changes have recently occurred in the patient’s living environment.³³

The physical examination typically reveals bilateral expiratory wheezing, a prolonged expiratory phase, increased nasal secretions, sinusitis, rhinitis, nasal polyps, and atopic dermatitis. Once the diagnosis of asthma has been made, the National Asthma Education and Prevention Program guidelines recommend classifying the patient according to the frequency of symptoms and the

TABLE 1 Factors involved in airway obstruction
Denudation of the airway epithelium
Edema of the airway mucosa
Inflammation <ul style="list-style-type: none"> • Neutrophil, eosinophil, and lymphocyte infiltration
Mast cell activation
Mucous plugging <ul style="list-style-type: none"> • Alterations in respiratory secretions • Hypertrophy of bronchial smooth muscle • Hypertrophy of mucous glands
Spasm of airway smooth muscle
Subepithelial collagen deposit
Data from Chesnutt MS, Prendergast TJ. ⁴

TABLE 2 Risk factors for increased asthma morbidity and mortality in minority and poor populations
Cost of prescription medication
Decreased access to care
Higher exposure to trigger factors
Lack of continuity of care
Lack of health insurance
Population density

TABLE 3

NAEPP asthma guidelines for patients older than 5 years

Symptoms	Lung function	Acute therapy	Prevention
Step 1: Mild intermittent			
<ul style="list-style-type: none"> • Symptoms <2x/wk • Asymptomatic, with normal PEF between exacerbations • Exacerbations brief • Nighttime symptoms <2x/mo 	<ul style="list-style-type: none"> • FEV₁/FVC ≥80% of predicted • PEF variability <20% 	<ul style="list-style-type: none"> • Short-acting beta-agonists, inhaled or oral • May also use space chamber or nebulizer for medication delivery 	<ul style="list-style-type: none"> • Not required
Step 2: Mild persistent			
<ul style="list-style-type: none"> • Symptoms >2x/wk but <1x/d • Exacerbations may affect activity • Nighttime symptoms >2x/mo 	<ul style="list-style-type: none"> • FEV₁/FVC ≥80% of predicted • PEF variability 20%-30% 	<ul style="list-style-type: none"> • Short-acting beta-agonists, inhaled or oral • May also use space chamber or nebulizer for medication delivery 	<ul style="list-style-type: none"> • Low-dose inhaled corticosteroids OR • Cromolyn OR • Nedocromil OR CONSIDER • Leukotriene modifier
Step 3: Moderate persistent			
<ul style="list-style-type: none"> • Daily symptoms • Daily use of rescue medications • Exacerbations affect activity • Exacerbation >2x/wk but <1x/d • Nighttime symptoms >1x/wk 	<ul style="list-style-type: none"> • FEV₁/FVC ≥60% but <80% of predicted • PEF variability >30% 	<ul style="list-style-type: none"> • Short-acting beta-agonists, inhaled or oral • May also use space chamber or nebulizer for medication delivery 	<ul style="list-style-type: none"> • Medium-dose inhaled corticosteroids with long-acting inhaled beta-agonist OR • Low- to medium-dose inhaled corticosteroid with leukotriene modifier
Step 4: Severe persistent			
<ul style="list-style-type: none"> • Continual symptoms • Limited physical activity • Frequent exacerbations and nighttime symptoms 	<ul style="list-style-type: none"> • FEV₁/FVC <60% of predicted • PEF variability >30% 	<ul style="list-style-type: none"> • Short-acting beta-agonists, inhaled or oral • May also use space chamber or nebulizer for medication delivery 	<ul style="list-style-type: none"> • High-dose inhaled corticosteroids with long-acting inhaled beta-agonist AND • Oral corticosteroids PRN
<p>Key: FEV₁, forced expiratory volume in 1 second; FEV₁/FVC = FEV₁ as a percentage of FVC; FVC, forced vital capacity; NAEPP, National Asthma Education and Prevention Program; PEF, peak expiratory flow.</p> <p>Note: Patients are assigned the most severe grade if any one of the features of severity is sufficient to place a patient in that category. Symptoms are variable from one patient to another. Some patients may experience life-threatening exacerbations with extended periods of normal lung function or no symptoms.</p> <p>Source: National Asthma Education and Prevention Program. NAEPP Expert Panel Report. Guidelines for the Diagnosis and Management of Asthma—Update on Selected Topics. Available at: http://www.nhlbi.nih.gov/guidelines/asthma/execsumm.pdf. Accessed December 20, 2005.</p>			

results of spirometry or pulmonary function testing (see Table 3).³⁴ Once a patient is categorized, therapy options can be recommended for both acute exacerbations and prevention.

Patient education

The patient's understanding of asthma treatment and exacerbating factors is key to asthma control. Providers should give each patient an asthma action plan (to allow patients to monitor their asthma and identify the risk of

an acute attack) and recommend ways to avoid exacerbations and maintain control.

Conclusion

Asthma is the number one chronic disease of childhood. Evidence shows that its incidence is rising nationwide, with a disproportionate number of Hispanics and blacks being adversely affected. Providers must educate patients to be proactive in asthma management. Since lower-SES and minority groups have higher asthma

morbidity and mortality rates, clinicians should become more sensitive to the fiscal and environmental conditions these groups face. Management strategies should be appropriately tailored to ensure that treatments can be obtained and continued. □

REFERENCES

- Ostbye T, Yarnall KS, Krause KM, et al. Is there time for management of patients with chronic disease in primary care? *Ann Fam Med*. 2005;3(3):209-214.
- Gross KM, Pointe CD. New strategies in the medical management of asthma. *Am Fam Physician*. 1998;58(1):89-100, 109-112.
- Reddel H, Jenkins C, Woolcock A. Diurnal variability—time to change asthma guidelines? *BMJ*. 1999;319:45-47.
- Chesnutt MS, Prendergast TJ. Asthma. In: Tierney LM, McPhee SJ, Papadakis MA. *Lange Current Medical Diagnosis and Treatment 2004*. 43rd ed. New York, NY: McGraw-Hill; 2004:220-232.
- President's Task Force on Environmental Health Risks and Safety Risks to Children. Asthma and the Environment: A Strategy to Protect Children. 2000. Available at: <http://www.aspe.hhs.gov/sp/asthma/appxd.pdf>. Accessed December 20, 2005.
- National Institute of Allergy and Infectious Disease, National Institutes of Health. Asthma: A Concern for Minority Populations. 2001. Available at: <http://www.niaid.nih.gov/factsheets/asthma.htm>. Accessed December 20, 2005.
- Barnes PJ, Chung KF, Clive CP. Inflammatory mediators of asthma: an update. *Pharmacol Review*. 1998;50(4):515-596.
- American Lung Association. Fact sheets: Asthma in Adults and Children. 2005. Available at: <http://www.lungusa.org>. Accessed December 20, 2005.
- National Center for Health Statistics. Asthma Prevalence, Health Care Use and Mortality, 2002. Available at: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm>. Accessed December 20, 2005.
- Taylor WR, Newacheck PW. Impact of childhood asthma on health. *Pediatrics*. 1992;90(5):657-662.
- McFadden ER Jr, Warren EL. Observations on asthma mortality. *Ann Intern Med*. 1997;127(2):142-147.
- NIAID Inner-City Asthma Study Finds Multiple Factors Lead to Increased Asthma Morbidity [news release]. National Institute of Allergy and Infectious Diseases, National Institutes of Health. 1997. Available at: <http://www.niaid.nih.gov/newsroom/releases/asthma.htm>. Accessed December 20, 2005.
- Evans R 3rd. Asthma among minority children: a growing problem. *Chest*. 1992;101(6 suppl):368S-371S.
- Weiss KB, Gergen PJ, Crain EF. Inner-city asthma—the epidemiology of an emerging US public health concern. *Chest*. 1992;101(6 suppl):362S-367S.
- Marder D, Targonski P, Orris P, et al. Effect of racial and socioeconomic factors on asthma mortality in Chicago. *Chest*. 1992;101:426S-429S.
- Hispanic health in the United States. Council on Scientific Affairs. *JAMA*. 1991;265(2):248-252.
- Komaromy M, Grumbach K, Drake M, et al. The role of black and Hispanic physicians in providing health care for underserved populations. *N Engl J Med*. 1996;334(20):1305-1310.
- Nickens HW. The health status of minority populations in the United States. *West J Med*. 1991;155(1):27-32.
- Blakey R. Report finds minorities get poorer health care. March 2002. Available at: <http://archives.cnn.com/2002/HEALTH/03/20/race.healthcare/index.html>. Accessed December 20, 2005.
- Chicano/Latino Medical Student Association handout. January 2002.
- Caban MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med*. 2001;155(9):1057-1062.
- DeNavas-Walt C, Proctor BD, Lee CH. Income, poverty, and health insurance coverage in the United States: 2004. US Department of Commerce, Economics and Statistics Administration, US Census Bureau. August 2005. Available at: <http://www.census.gov/prod/2005pubs/p60-229.pdf>. Accessed December 20, 2005.
- Ginzberg E. Access to health care for Hispanics. *JAMA*. 1991;265(2):238-241.
- Kim JH, Kim JK, Son BK, et al. Effects of air pollutants on childhood asthma. *Yonsei Med J*. 2005;30(46(2)):239-244.
- California Air Resources Board. Asthma and air pollution. 2005. Available at: <http://www.arb.ca.gov/research/asthma/asthma.htm>. Accessed December 20, 2005.
- Netjek VA, Brown ES, Khan DA, et al. Prevalence of mood disorders and relationship to asthma severity in patients at an inner-city asthma clinic. *Ann Allergy Asthma Immunol*. 2001;87(2):129-133.
- Alt HL. Psychiatric aspects of asthma. *Chest*. 1992;101(6 suppl):415S-417S.
- Gergen PJ, Weiss KB. Changing patterns of asthma hospitalization among children: 1979 to 1987. *JAMA*. 1990;264(13):1688-1692.
- American Lung Association. State of the Air 2005. Best and worst cities. Available at: http://lungaction.org/reports/sota05_cities.html. Accessed December 20, 2005.
- Busse WW, Lemanske RF Jr, Dick EC. The relationship of viral respiratory infections and asthma. *Chest*. 1992;101(6 suppl):385S-388S.
- Minor TE, Dick EC, DeMeo AN, et al. Viruses as precipitants of asthmatic attacks in children. *JAMA*. 1974;227(3):292-298.
- Martinez FD, Wright AL, Taussig LM, et al. Asthma and wheezing in the first six years of life. The Group Health Medical Associates. *N Engl J Med*. 1995;332(3):133-138.
- Kemp JP, Kemp JA. Management of asthma in children. *Am Fam Physician*. 2001;63(7):1341-1348.
- Ressel GW; Centers for Disease Control and Prevention; National Asthma Education and Prevention Program. NAEPP updates guidelines for the diagnosis and management of asthma. *Am Fam Physician*. 2003;68(1):169-170.