AMERICAN LUNG ASSOCIATION®

Lung Disease Data: 2008

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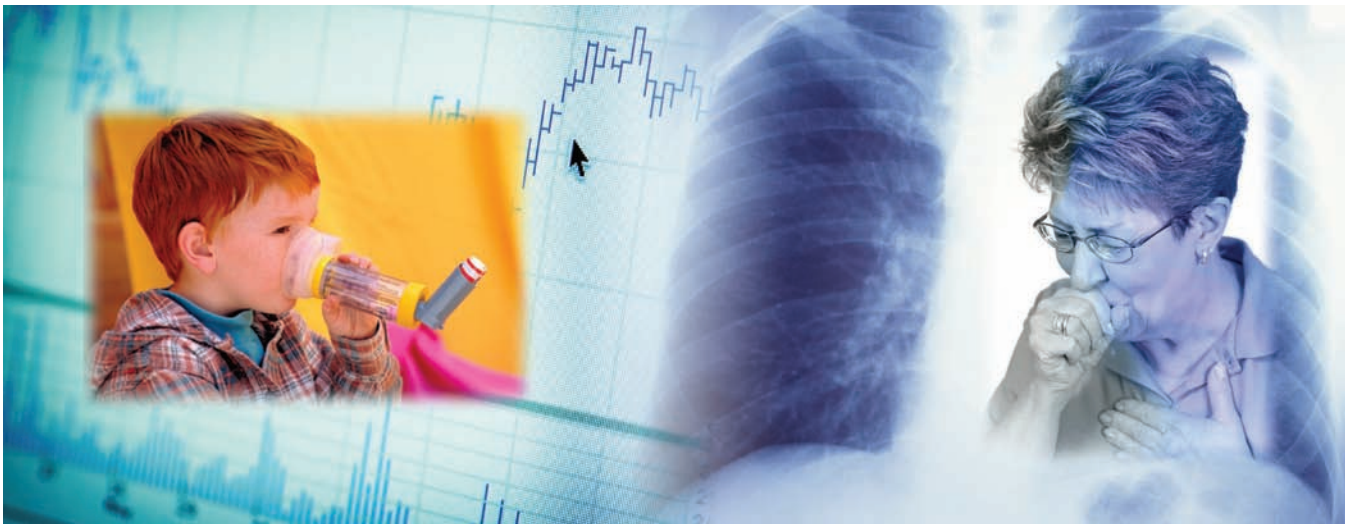

Acute Respiratory Distress Syndrome (ARDS)

Air Quality

Asthma

Chronic Obstructive Pulmonary Disease (COPD)

Cystic Fibrosis

HIV/AIDS Related Lung Disease

Influenza and Pneumonia

Lesser-Known Lung Diseases

Lung Cancer

Obstructive Sleep Apnea (Sleep-Disordered Breathing)

Occupational Lung Diseases

Pulmonary Arterial Hypertension (PAH)

Respiratory Distress Syndrome and Bronchopulmonary Dysplasia (RDS & BPD)

Respiratory Syncytial Virus (RSV)

Sarcoidosis

Sudden Infant Death Syndrome (SIDS)

Tobacco Use

Tuberculosis (TB)

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Helpful Definitions

Prevalence: The number of existing cases of a particular condition, disease, or other occurrence (e.g., persons smoking) at a given time.

Incidence: The number of new cases (as, of a disease) occurring during a particular period of time (e.g., 100 cases of TB from 1998 to 2002).

Prevalence or incidence rate: Cases in a particular population quantity—e.g., per hundred or per thousand.

Age-adjusted figure: A figure that is statistically corrected to remove the distorting effect of age when comparing populations of different age structures.

Note: All statistics in this document apply specifically to the United States and are for the most recent available year. Factors used in expressing these data, as determined by the collecting agencies:

- Mortality (death) rates are per 100,000 population.
- Chronic disease prevalence is per 1,000 population.
- Hospital discharge rates are per 10,000 population.
- Incidence rates are per 100 or per 100,000 population.
- Morbidity is defined as illness.

Introduction

What do the lungs do?

The lungs, with their tiny air sacs called alveoli (pronounced al-vee-oh-lie), have sometimes been compared to sponges. They are actually far more complex than many other organs. The heart, for example, is a relatively basic muscular pump with one-way mechanical valves designed for the purpose of keeping the bloodstream flowing in one direction. The lungs must play multiple roles—supplier of oxygen, remover of wastes and toxins, and defender against hostile intruders, among others.

They contain at least three dozen distinct types of cells, each with its own special tasks and abilities. Some scavenge foreign matter. Others, equipped with delicate, hair-like cilia, sweep the mucous membranes lining the smallest air passages. Still others act on substances crucial to blood-pressure control, or serve as sentries to spot invading agents of infection. The roles of many others remain mysteries, posing challenges to researchers.

In mechanical terms, our lungs can be described as the site of gas exchange. Oxygen—the fuel all the cells and organs of our body need to function—is extracted from the air we inhale, carried within the bloodstream and distributed to other organs and tissues. With each exhalation, we dispose of the carbon dioxide that is the by-product of our bodily functions. In our lungs, in the course of a single day, an astonishing 8,000 to 9,000 liters of breathed-in air meet 8,000 to 10,000 liters of blood pumped in by the heart through the pulmonary artery. The lungs relieve the blood of its burden of waste and return a refreshed, oxygen-rich stream of blood to the heart through the pulmonary vein.

What are lung diseases?

The lungs are internal organs; yet they are uniquely and constantly exposed to our external environment, a direct interface with the world outside. With each breath, a host of alien substances enters our bodies, leaving the lungs a ravaged battlefield. Lung disease is any disease or disorder where lung function is impaired. Lung diseases can be caused by long-term and immediate exposure to smoking (active and passive), air pollution (indoor and outdoor), occupation-

al exposures such as asbestos and silica dust, carcinogens that trigger tumor growth, infectious agents, and overreactive immune system defenses.

There are many types of lung diseases including:

- *Obstructive lung diseases such as asthma, chronic bronchitis and emphysema*. These all affect a person's airways and limit or block the flow of air in or out of the lungs.
- *Infectious illnesses such as pneumonia, influenza, respiratory syncytial virus (RSV)* and *tuberculosis (TB)*. Bacteria or viruses cause these diseases that can also affect the membrane (or *pleura*) that surrounds the lungs.
- *Lung cancer*. A disease characterized by uncontrolled growth and spread of abnormal cells.
- *Respiratory failure, pulmonary edema, pulmonary embolism* and *pulmonary hypertension*. These conditions are caused by problems with the normal gas exchange and blood flow in the lungs.
- *Pulmonary fibrosis and sarcoidosis.* These are diseases characterized by stiffening and scarring of the lungs.
- Occupational diseases, such as *mesothelioma* and *asbestosis*, caused by exposure to hazardous substances.

Just as there is no single cause for lung disease, there is no single symptom of lung disease. Some conditions may send disease-specific signals, such as the characteristic wheezing sound made as the asthma sufferer attempts to exhale.

Some lung disorders, such as emphysema, may be evidenced mainly by increasing shortness of breath, eventually upon the slightest physical effort, as tired muscles fail to receive sufficient oxygen.

Other forms of lung disease may be signaled by persistent cough, chest pain, shortness of breath, abnormal sputum production, bloody sputum or a combination of these symptoms.

When an infectious agent causes a lung disease, there may also be fever and/or chills. Any suspicion that the lungs might not be functioning properly means that a person should seek medical attention.

What is *Lung Disease Data: 2008*?

In the pages that follow, we have presented important facts and figures about some of the most common lung diseases in the United States today.

The American Lung Association strongly believes that if cigarette smoking, preventable premature childbirth, disregard for workers' safety and violation of clean-air laws were to end today, we could expect a future largely free of the most lethal forms of lung disease.

Below are a few important facts on lung diseases overall:

- Every year almost 400,000 Americans die from lung disease—an age-adjusted death rate of 135.5 per 100,000.[1]

- Lung disease is the number three killer (behind heart disease and cancer) in the United States, responsible for one in six deaths.[2]
- Lung disease death rates are currently increasing, while death rates due to other major causes of death, such as heart disease, cancer and stroke, are declining.[3]
- Overall, various forms of lung disease and breathing problems constitute one of the leading causes of death in babies under the age of one year, accounting for 20.2 percent of infant deaths in 2004.[4]
- More than 35 million Americans have chronic lung diseases.[5]
- An estimated 438,000 Americans die each year from diseases directly related to cigarette smoking, including heart and lung diseases.[6]
- Millions of children and adults with lung disease in this country are exposed to levels of ozone and particle air pollution that could potentially make them sick.
- Asthma and chronic obstructive pulmonary disease (emphysema and chronic bronchitis), the most common obstructive lung diseases, are associated with substantial health impairment and work disability.
- Lung disease costs the U.S. economy $95 billion in direct health-care expenditures every year, plus indirect costs of $59 billion—a total of $154 billion.[7]

Acute Respiratory Distress Syndrome (ARDS)

What is acute respiratory distress syndrome?

Acute respiratory distress syndrome (ARDS) is the sudden failure of the respiratory system. It can occur in anyone over the age of one who is critically ill. ARDS can be life-threatening because normal gas exchange does not take place due to severe fluid buildup in both lungs.[1] The condition is characterized by rapid breathing, difficulty getting enough air into the lungs and low blood oxygen levels.[2]

Other names for this condition include adult RDS (prior to 1994), increased permeability pulmonary edema and non-cardiac pulmonary edema. Former names include stiff lung, wet lung and shock lung.[3]

ARDS is caused mainly by extensive lung inflammation and small blood vessel injury due to sepsis (bacterial infection of the blood), trauma and/or severe pulmonary infection such as pneumonia. However, ARDS also can be linked to multiple transfusions, inhalation of salt water, smoke inhalation of toxic chemicals, aspiration of vomit (inhaling vomit into the lungs), narcotics, sedatives, overdoses of tricyclic antidepressants and shock from any cause.[4]

Onset usually occurs within 24 hours to three days of the original illness or injury.[5]

Cigarette smoking increases the risk of ARDS.[6]

Who has ARDS?

The incidence of ARDS has been difficult to determine partly because of the variety of causes, clinical manifestations and differing criteria used to define it. Various published estimates have ranged from 1.5 to 75 cases per 100,000 persons.[7] In 2007, the National Heart, Lung and Blood Institute estimated that approximately 190,000 Americans are affected by ARDS annually.[8]

What is the health impact of ARDS?

Approximately 25 percent to 40 percent of ARDS cases are fatal which is an improvement from the ARDS mortality rate of 50 percent to 70 percent just 20 years ago.[9] In 2004, 1,736 deaths due to ARDS were reported.[10] Table 1 displays

ARDS incidence and mortality by race. Research shows that men and blacks have higher mortality rates compared to women and other races.[11] Deaths usually result from multi-system organ failure due to the lack of oxygen, rather than lung failure alone. The cause of a patient's ARDS helps predict their chances for survival. The best chances for a positive outcome occur in young trauma-related ARDS patients and patients with fewer chronic health problems. In addition, patients with milder forms of ARDS tend to have a better chance of recovering than those with a more severe form of the illness. For example, patients who develop ARDS due to sepsis (infection of the blood) usually do not do as well as patients whose ARDS is related to trauma or pulmonary infection.

Want to learn more about ARDS and diverse communities? Please view the *State of Lung Disease in Diverse Communities: 2007* report at **http://www.lungusa.org/solddc-ards**

The greatest risk factors for mortality from ARDS include advanced age, shock and liver failure. Within a week to 10 days, about half of ARDS patients are either deceased or have been weaned off treatment.[12]

Table 1: Acute Respiratory Distress Syndrome Incidence and Mortality [I,II] *

	Incidence		Mortality[3]	
Race	Number [1]	Rate [2]	Number	Rate
Total	190,000	1.5–75.0	1,736	0.6
White	---	---	1,439	0.6
Black	---	---	243	0.8
Hispanic [III]	---	---	54	0.4

Sources:
1. National Institutes of Health. National Heart, Lung and Blood Institute. Diseases and Conditions Index. Acute Respiratory Distress Syndrome (ARDS): What Is ARDS? November 2007. Available at http://www.nhlbi.nih.gov/health/dci/Diseases/Ards/Ards_WhatIs.html. Accessed on February 4, 2008.
2. Wheeler AP, Bernard GR. Acute Lung Injury and the Acute Respiratory Distress Syndrome: A Clinical Review. *Lancet*. 2007; 369:1553-64.
3. Centers for Disease Control and Prevention. National Center for Health Statistics. CDC WONDER On-line Database, compiled from Compressed Mortality File 1999-2004 Series 20 No. 2J, 2007. Accessed on March 4, 2008.

Notes:
I. Mortality rates are per 100,000 population and age-adjusted to the 2000 U.S. standard population as of 2004.
II. Acute respiratory distress syndrome incidence (2005) and rates (2003) are per 100,000 population.
III. Hispanics are not mutually exclusive from Whites and Blacks
*** Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**
--- Data not available.

Want to learn more about ARDS? Please view the fact sheet at **http://www.lungusa.org/ardsfactsheet**

Lung function in most survivors of ARDS will return to normal or near normal within several months; however some will have lasting damage to their lungs or to areas outside the lungs. A study found that one year after discharge from the intensive care unit, ARDS survivors may still suffer side effects, mostly persistent muscle wasting and weakness. Quality of life in these survivors is compromised with poor mental and physical health outcomes.[13]

How is ARDS diagnosed and managed?

ARDS is usually diagnosed in a patient who is already critically ill from shock, sepsis or other trauma. The diagnosis is made when there is difficulty in providing adequate oxygenation and diffuse abnormalities on chest x-rays.

Treatment of ARDS involves supportive care in an intensive care unit. Treatment consists of supplemental oxygen and mechanical ventilation along with careful attention to fluid balance and a supportive breathing technique called positive end expiratory pressure (PEEP). These are combined with continuing treatment of the underlying illness or injury.[14]

The goal of mechanical ventilation is to support the patient's breathing during the time needed for the lungs to recover. New advances in mechanical ventilation are being developed. Preliminary results from a study by the National Heart, Lung and Blood Institute suggested that receiving small, rather than large, breaths of air from a mechanical ventilator reduced the number of deaths by 22 percent and increased the number of days without ventilator use.[15]

Pulmonary rehabilitation and support groups are beneficial to survivors.[16]

What is new in ARDS research?

In epidemiological studies, ARDS and acute lung injury (ALI), a less severe form of ARDS, are associated with high mortality rates. Compared to healthy controls and other cases with similar lung disorders, patients with ARDS/ALI had low levels of protein-C and high levels of plasminogen activator inhibitor-1, important proteins in blood clotting. Abnormal levels of these proteins are independently associated with higher mortality and other clinical outcomes such as organ failure. Measuring these levels may provide insight to the development of new therapies.[17] This finding requires further study.

Future research in ARDS will need to focus on mechanistic and cellular studies combined with animal and clinical work, such as determining which animal models translate best to humans and then applying biological marker research to them. Such work will help improve detection and treatment of ARDS.

What is the American Lung Association doing about ARDS?

The American Lung Association is currently funding a number of studies on ALI that could also improve treatment for ARDS. One such study at the University of California, San Francisco is testing a method for improving fluid transport in the lungs, while another at Brigham and Women's Hospital is researching whether altering certain immune system responses will affect inflammation in the lungs.

Want to learn more about how the American Lung Association supports leading research in lung disease? Please view the webpage at **http://www.lungusa.org/researchawardsnationwide**

The American Lung Association (www.lungusa.org) sponsors Better Breathers Clubs throughout the country for patients who suffer from chronic lung diseases including chronic obstructive pulmonary disease (chronic bronchitis and emphysema), asthma and others. Also, many hospitals have support groups for people with chronic lung disease.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight ARDS. Join us to win the battle against lung disease by visiting http://lungaction.org.

Air Quality

What is the connection between air quality and lung disease?

Numerous studies have shown that air pollution can cause lung disease, including lung cancer, as well as cardiovascular disease, birth defects and even death. Sadly, millions of Americans live in areas where the pollution in the outdoor air all too often puts their health and even their lives at risk.

Indoor air pollution can be as hazardous to an individual's health as outdoor air pollution. Studies by the U.S. Environmental Protection Agency (EPA) indicate that indoor levels of many air pollutants may be one to five times higher than outdoor levels. These levels of indoor air pollutants are of particular concern because it is estimated that most people spend as much as 90 percent of their time indoors, meaning their exposure to indoor air pollutants may be 10 to 50 times more than outdoor exposures.[1]

What are the most common outdoor air pollutants?

The Clean Air Act, the landmark federal air pollution law, provides the principal framework for outdoor air quality in the United States. It sets national air quality standards that safeguard the public against six pollutants: ozone, particulate matter, nitrogen dioxide, sulfur dioxide, carbon dioxide and lead.[2]

Want to learn more about the basics of outdoor air pollution? Please visit the *State of the Air* report at **http://stateoftheair.org**

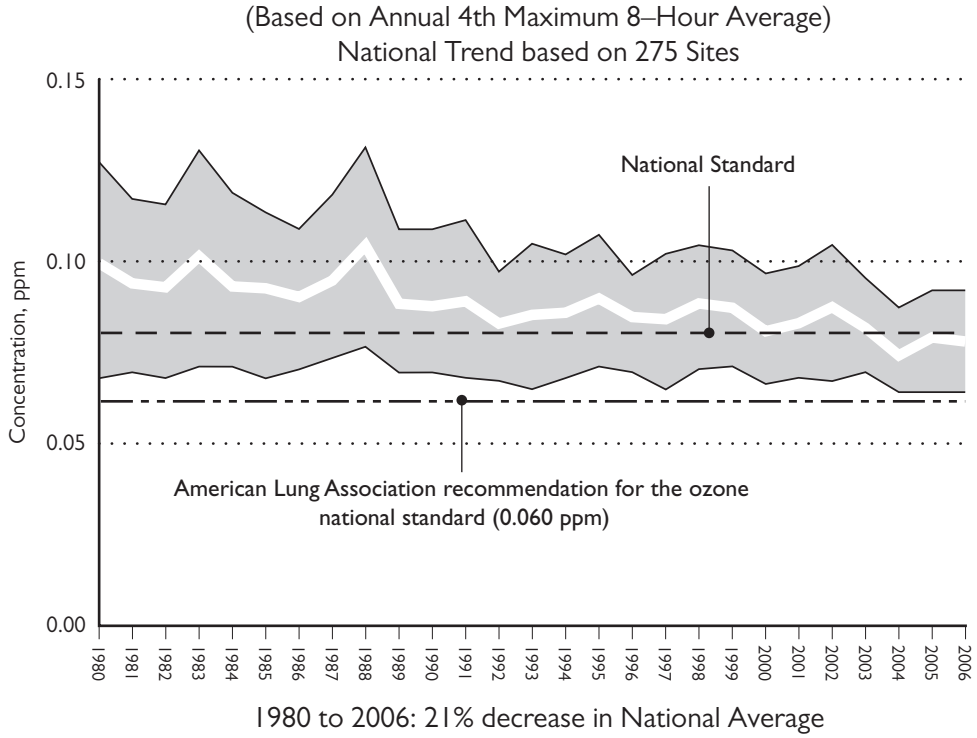
Ozone (O_3) is an extremely reactive gas molecule composed of three oxygen atoms. It is the result of emissions of volatile organic compounds, including hydrocarbons, reacting with nitrogen oxides released in fuel combustion, in the presence of sunlight. Ozone is very harmful to breathe and attacks lung tissue by chemically reacting with it.

Studies have provided strong evidence that exposure to levels of ozone currently considered safe increases the risk of premature death.[3] In addition, ozone exposure can cause shortness of breath and coughing, trigger asthma attacks and reduce lung function, often leading to hospital admissions and emergency room visits.[4,5,6,7]

Ozone is the main component of smog. In the United States, it usually reaches the highest levels during the summer months. Wind can carry ozone hundreds of miles, so people who do not live in areas with lots of industry or automobiles are not necessarily safe from high ozone levels.[8]

Many areas in the United States produce enough ground-level ozone during the summer months to cause health problems that can be felt right away, such as shortness of breath, chest pain when inhaling deeply, wheezing and coughing, and increased susceptibility to respiratory infections. Figure 1 shows the national trend in ozone air quality since 1980.

Figure 1: U.S. Ozone Air Quality, 1980–2006



Source: Environmental Protection Agency. Air Trends: Ozone. October 1, 2007. Available at http://www.epa.gov/air/airtrends/ozone.html. Accessed on February 19, 2008.

Two studies published in 2005 explored ozone's ability to reduce lung function, or the ability of the lung to work efficiently. Each study looked at otherwise healthy groups of people who were exposed to ozone for long periods: outdoor postal workers in Taiwan and college freshmen who were lifelong residents of Los Angeles or the San Francisco Bay area. Both studies found that long exposure to elevated ozone levels had decreased their lung function.[9,10]

Short-term exposure to ozone also has been linked to aggravation of chronic obstructive pulmonary disease (COPD), which includes chronic bronchitis and emphysema.[11,12] Repeated inflammation due to exposure to ozone over a period of years can lead to a chronic stiffening of the lungs. (Please see the COPD section of this report for more information on this disease.)

Inhaling ozone may affect the heart as well as the lungs. One new study linked exposure to high ozone levels for as little as one hour to a particular type of

alteration in heartbeat rhythm (cardiac arrhythmia) that itself increases the risk of premature death and stroke.[13]

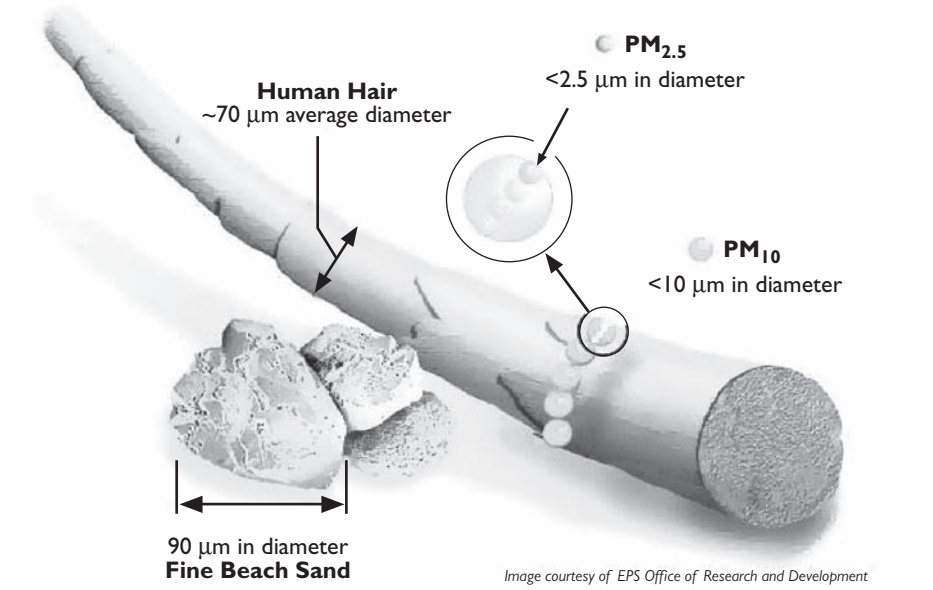
Want to learn more about ozone and lung disease? Please view the factsheet at **http://www.lungusa.org/ozonefactsheet**

Particulate matter air pollution (PM) is a complex mixture of substances, including carbon-based particles, dust and acid aerosols formed in the atmosphere from byproducts of gaseous combustion, such as volatile organic compounds (VOCs), sulfur dioxide and nitrogen oxides.[14]

Sources of PM are vast and varied, including diesel bus and truck emissions, ordinary automobile exhausts, industrial and utility smokestacks, coal-fired power plants, mining and construction. Particle pollution is especially high in urban industrial and heavily trafficked areas, as well as in some rural locales with unpaved roads and extensive wood burning.[15]

The particles vary in size; the largest are more easily trapped in the nose or throat, while smaller particles can be drawn into the smaller air passages. Those of special concern have a diameter of 10 microns or less, or less than one-seventh the diameter of a human hair. Those measuring 2.5 to 10 microns are called coarse particles.[16] Figure 2 illustrates this.

Figure 2: Particle Matter Size Comparison

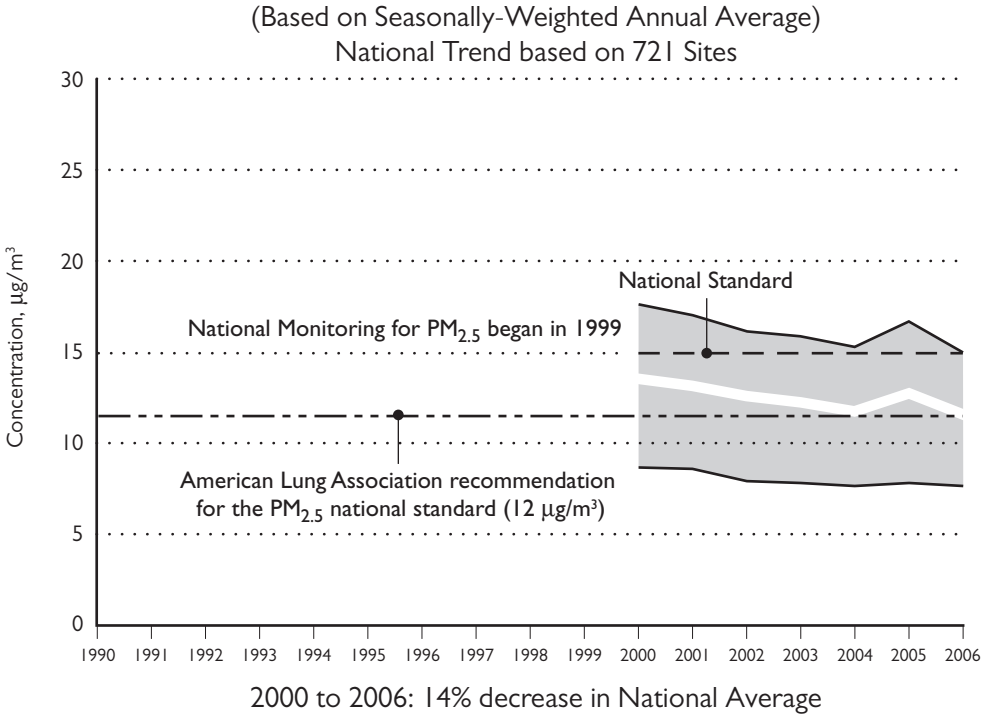


Source: Environmental Protection Agency. Particulate Matter: Basic Information. March 6, 2007. Available at http://www.epa.gov/air/particlepollution/basic.html. Accessed on February 4, 2008.

Fine particles, with a diameter of 2.5 microns or less ($PM_{2.5}$) represent the most serious health threat. Particles this small easily penetrate the alveoli, the very smallest air sacs in the lung. Because this region of the lung is slow to clear itself of foreign substances, these small PM deposits can continue to cause damage for long periods of time. One study showed that the tiniest particles (or ultrafine, less than 1 micron) may pass from the lungs into the blood stream

and then through the rest of the body. Figure 3 shows the national trend in $PM_{2.5}$ air quality since 2000.

Figure 3: U.S. National $PM_{2.5}$ Air Quality, 2000–2006



Source: Environmental Protection Agency. Air Trends: Ozone. October 1, 2007. Available at http://www.epa.gov/air/airtrends/pm.html. Accessed on February 19, 2008.

Exposure to particle pollution increases the risk of premature death and can trigger asthma attacks, wheezing, coughing and lung irritation in people with sensitive airways. Persons with chronic cardiovascular disease and diabetes are also at high risk.[17]

Recent research has estimated that fine particle pollution from U.S. power plants cuts short the lives of more than 23,000 people each year. Hundreds of thousands of Americans suffer from asthma attacks, cardiac problems, and upper and lower respiratory problems associated with exposure to fine particles from power plants.[18]

Outdoor air particles also may increase the risk for lung cancer. Numerous studies have also shown a strong link between outdoor air particles and heart and lung-related problems and death.[19]

Want to learn more about particle pollution and lung disease? Please view the fact-sheet at **http://www.lungusa.org/particlepollutionfactsheet**

Nitrogen dioxide (NO_2) forms when fossil fuels (oil, gasoline, coal) are burned at high temperatures. Its major sources are motor vehicle exhaust, coal-fired electric utilities and industrial boilers. Nitrogen oxides are also a key ingredient in the formation of ozone and fine particulate air pollution.[20,21]

Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza. Frequent or continued exposure to much higher NO_2 concentrations than those normally found in outdoor air may cause impaired lung function and more acute respiratory illnesses in children.[22]

Sulfur dioxide (SO_2) is formed when fuel containing sulfur (mainly coal and oil) is burned, and during metal smelting and other industrial processes.

Major health concerns associated with exposure to high concentrations of SO_2 include difficulty breathing, lung illnesses, asthma attacks, changes in pulmonary defenses and aggravation of existing heart disease. Sulfur dioxide also is a key ingredient in the formation of fine particulate air pollution.[23]

Emissions of SO_2 often contribute to the formation of fine particulate matter, so controls aimed at reducing particulate matter have often focused on reducing sulfur dioxide. For example, cleaning up coal-fired power plants to reduce the fine particulate matter they produce has required cleaning up the sulfur dioxide as well.

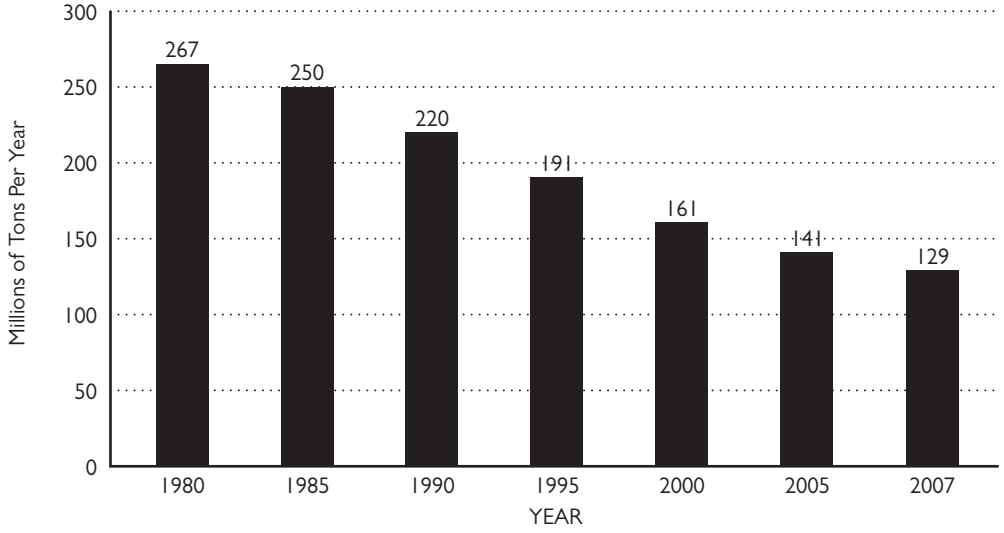
Carbon monoxide (CO) is a colorless, odorless gas formed when carbon in fuel is not burned completely. CO can cause harmful health effects by reducing the delivery of oxygen to the body's organs and tissues. At low levels of exposure, CO can be poisonous, creating headaches, nausea and sleepiness. Higher levels can be life-threatening and are often found indoors. CO exposure also may injure the eyes, reduce work capacity, make manual and complex tasks more difficult, and hamper learning ability.[24]

Want to learn more about carbon monoxide and lung disease? Please view the fact sheet at **http://www.lungusa.org/cmfactsheet**

Lead is a metal found naturally in the environment and in manufactured products. Due to the phase-out of leaded gasoline between 1975 and 1986, outdoor lead levels have decreased by more than 90 percent. Although the primary impact of lead is not on the lungs, they are the major route for lead particles to enter the body. Lead harms the brain and nervous system and damages the kidneys, liver and other organs. High levels of exposure to lead can cause seizures, behavioral disorders and death. Even at low doses, lead exposure is associated with damage to the nervous system of fetuses and children six years of age and under.[25]

Most outdoor air pollution comes from burning fossil fuels, whether from generating electricity, operating industrial processes or driving the family car. Although the national air quality and emission levels for all six principal pollutants covered by the Clean Air Act have improved over the past 20 years, about 129 million tons of major air pollutants were released into the air in 2007 in the United States. That same year, over 100 million people lived in counties that did not meet EPA standards for at least one of the pollutants.[26] Figure 4 shows the decrease in total emissions since 1980, while Figure 5 displays the number of people living in counties with unhealthy air quality by type of pollutant in 2006.

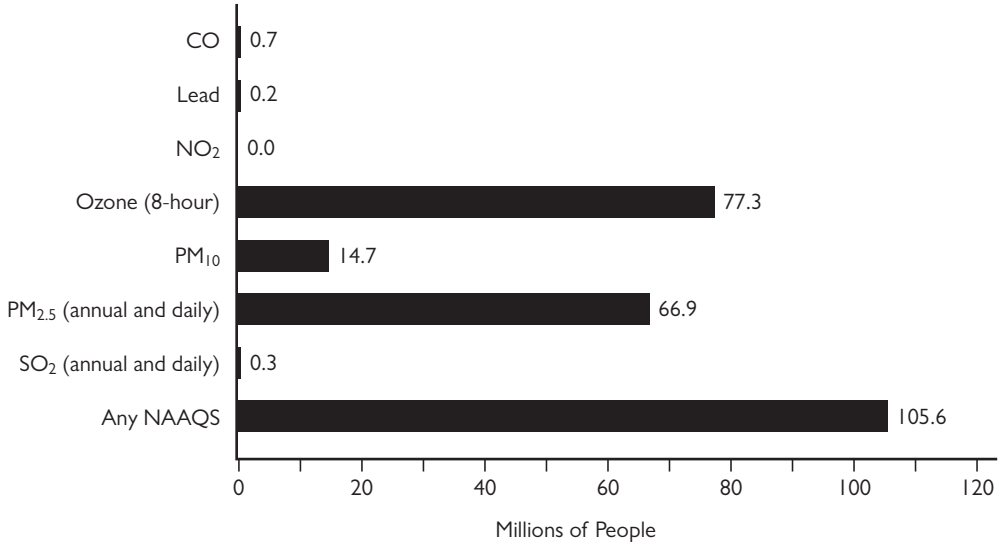
Figure 4: Total Emission Estimates for 6 Major Pollutants, U.S., 1980–2007



Source: U.S. Environmental Protection Agency. Air Trends: Basic Information. April 28, 2008. Available at http://www.epa.gov/air/airtrends/sixpoll.html. Accessed on May 2, 2008.
Notes:

1. Totals include carbon monoxide, lead, nitrogen oxides, volatile organic compounds, particulate matter (2.5 and 10 microns) and sulfur dioxide.
2. In 1985 and 1996 EPA refined its methods for estimating emissions.
3. The estimates for 2002 are from 2002 NEI v2; the estimates for 2003 and beyond are preliminary and based on 2002 NEI v2.
4. For CO, NO_x, SO_2 and VOC emissions, fires are excluded because they are highly variable; for direct PM emissions both fires and dust are excluded.
5. PM estimates do not include condensable PM.
6. EPA has not estimated $PM_{2.5}$ emissions prior to 1990.
7. The 1999 estimate for lead is used for 2000, and the 2002 estimate for lead is used for 2005 and 2007.
8. $PM_{2.5}$ emissions are not added when calculating the total because they are included in the PM_{10} estimate.

Figure 5: Number of People Living in Counties With Air Quality Concentrations Above the Primary NAAQS Levels, U.S., 2006



Source: U.S. Environmental Protection Agency. Air Trends: Basic Information. October 1, 2007. Available at http://www.epa.gov/air/airtrends/sixpoll.html. Accessed on January 3, 2008.

In addition to these six major pollutants, there are other hazardous or toxic air pollutants that may not be as widespread, but can be found in high concentrations, especially in industrial areas or near roadways and coal-fired power plants. These include pollutants (such as benzene) that are known to cause cancer, and others (such as mercury) that damage the nervous system or brain.

Every day, air quality data are collected by state and local air pollution control agencies from a network of monitors set up across the nation. Air quality information may be included as part of a local weather forecast on TV and radio, or may be printed in the newspaper. The EPA posts air pollution forecasts on the Internet at http://www.airnow.gov. For help locating a source of air quality information, call your local Lung Association at 1-800-LUNG-USA.

Want to learn more about local air quality forecasts? Please view the fact sheet at **http://www.lungusa.org/aqifactsheet**

What are the most common indoor air pollutants?

Outdoor air pollution levels generally have improved in most areas of the United States. However, most individuals spend the majority of their time inside.[27] Pollutants in the air in the home, school or workplace increasingly have been recognized as threats to lung health. Poor indoor air quality can cause or worsen chronic respiratory diseases such as asthma, lung cancer and chronic bronchitis. And it can even kill.

Environmental tobacco smoke (ETS) or secondhand smoke is estimated to cause 3,400 deaths from lung cancer and approximately 22,000 to 69,600 deaths from cardiovascular diseases in nonsmokers annually.[28] In addition, secondhand smoke can trigger asthma attacks and increases the risk of lower respiratory tract infections, pneumonia and many other conditions.[29]

Smoking is a significant contributor to indoor air pollution, most importantly through the creation of particulate matter. One study found that median PM levels in homes where smoking occurred were almost nine times greater than those in smokefree homes and were associated with significantly more negative respiratory symptoms. Exposure to PM and reported symptoms tended to increase together in both smokers and nonsmokers in these homes, though in this study smokers seemed to suffer more seriously.[30]

Radon is a naturally-occurring gas caused by the radioactive decay of uranium. Radon breaks down into odorless, tasteless and colorless particles that are often present in the home.[31] The main source of high-level radon pollution is uranium-containing soil such as granite, shale, phosphate and pitchblende that surrounds buildings. Radon enters a home through cracks in walls, basement floors, foundations and other openings. It also may contaminate the water supply, especially in private wells.[32] It is estimated that 15,000 to 22,000 people die annually in the United States of lung cancer associated with radon exposure.[33] Any home in any community can have high levels of radon.[34]

Smokers who are exposed to radon substantially increase their risk of developing lung cancer when compared to nonsmokers also exposed to radon.

Want to learn more about radon and lung disease? Please view the fact sheet at **http://www.lungusa.org/radonfactsheet**

Combustion products (aside from tobacco smoke) include carbon monoxide, nitrogen dioxide, sulfur dioxide and particle pollution. Sources of combustion products include stoves, furnaces, dryers, fireplaces and heaters. Carbon monoxide (CO), which is colorless and odorless, can be especially dangerous. Fatal and near-fatal carbon monoxide poisonings occur most often during the winter months due to misuse or malfunction of a heating device. An average of 480 persons die annually in the United States from accidental CO exposure not related to fires.[35]

Biologicals include substances such as waste matter and dander from living organisms (both pets and pests), pollen, molds, mildew, dust mites, bacteria and viruses. Biologicals cause many allergic reactions and worsen asthma in those people allergic to them. Biologicals may be a source of serious, potentially life-threatening diseases, such as legionnella. In office buildings, heating, cooling and ventilation systems are frequent sources.[36]

Dampness in indoor spaces can increase mold and mildew, which can lead to breathing problems with symptoms such as cough, wheeze, upper respiratory tract symptoms and, in sensitized persons, asthma symptoms.[37]

Volatile organic compounds (VOCs) are emitted as gases from building materials and furnishings, as well as an array of home and office products ranging from cosmetics, paints, "air fresheners" and cleaners to pesticides, copiers and printers, glues and adhesives and craft supplies. VOCs can irritate the eyes, nose and throat, and cause a range of health effects, particularly in some workplaces where the concentrations may be higher than in the home. Research has linked some VOCs to increased risk of cancer.[38]

Lead dust is a particular danger to children and unborn babies. It can harm their physical and mental development and cause acute illness in both children and adults. In older buildings (often found in poor, urban areas) lead dust comes from the breakdown of old, lead-based paint that is still on the walls. However, any home built before 1978 can have lead paint—it is estimated that 83 percent of privately owned housing units built before 1980 have lead-based paint somewhere in the building.[39] While small children nibbling on chips of lead paint has been the most widely publicized image of lead poisoning, children ingesting lead dust or contaminated soil is the more devastating reality.[40]

Asbestos can be found in older homes and buildings, as well as in schools and industrial settings. It was once widely used in shingles, fireproofing, heating systems, and floor and ceiling tiles. When asbestos-containing material is damaged or disintegrates, microscopic asbestos fibers are dispersed into the air. Inhaling these fibers increases the risk of a range of diseases, including lung cancer, asbestosis and mesothelioma. Although breathing asbestos increases

the risk of lung cancer in anyone, this risk is even greater if a person smokes. While most asbestos-associated cancers are related to the intensity and duration of exposure, the symptoms of the disease do not usually appear until about 20 to 30 years after the first exposure to asbestos. Removal of asbestos-containing materials is usually not recommended because the harmful fibers can be released into the air during the removal process. The EPA recommends removal only in order to prevent significant exposure. A management program for intact asbestos-containing materials is often recommended instead.[41,42]

Want to learn more about asbestos and lung disease? Please view the asbestos air pollution listing at **http://www.lungusa.org/asbestos**

One estimate predicted that improving building environments could result in health benefits for more than 15 million of the 89 million U.S. indoor workers, with estimated economic benefits of $5 billion to $75 billion annually. Potential benefits include 5 million to 7 million fewer communicable respiratory infections, a 6 percent to 15 percent reduction in asthma flare-ups among the 4.7 million indoor workers with asthma, and a 20 percent to 50 percent reduction in nonspecific building-related health symptoms.[43,44]

Want to learn more about indoor air pollution and lung disease? Please view the fact sheet at **http://www.lungusa.org/iapfactsheet**

Who is at risk?

Exposure to indoor or outdoor air pollution can pose a wide range of health risks for many populations. The most vulnerable include children, the elderly, and people with chronic lung disease, cardiovascular disease and diabetes.

Children and teens

Physically, infants, children and teens are more vulnerable to air pollution than adults because their respiratory defenses are not fully formed. Their airways are smaller and more likely to become blocked when irritated. They breathe more rapidly, taking in more polluted air per pound of body weight. In fact, children's lungs do not fully develop until they are past adolescence.[45]

Air pollution may even affect children before they are born. One recent study found that maternal exposure to air pollution during pregnancy, even at low levels, may increase the risk of low birth weight.[46]

In addition, children spend a lot of time outdoors playing and breathing hard, especially in the summer when ozone pollution levels are the highest. Also, for reasons not fully understood, children do not acknowledge the symptoms of ozone exposure even when they are having trouble breathing.[47] Because of this, they are less likely than adults to protect themselves from further harm by reducing their activity level or going inside.

A number of studies have added to the evidence that children are especially vulnerable to the harmful effects of ozone and particulate matter. One study

found that being very active outdoors in high-ozone areas may increase a child's risk of developing asthma. Researchers at the University of Southern California in Los Angeles found that children living in communities with high ozone levels who played three or more team sports were more likely to develop asthma. The risk of asthma increased with each additional sport played by a child in a high-ozone community.[48]

A 2007 study published in the journal *Lancet* found that children living within 500 yards of freeways faced risks of life-long harm to their lungs from pollution, even if they lived in an otherwise clean community.[49] Similar research found children who lived within about 250 feet of a major road had an increased risk of asthma.[50] Other studies have shown that as ozone levels increase, so do emergency room visits and hospital admissions for asthma in children.[51]

Smokers

Recent studies indicate that smokers are at a greater risk for developing respiratory symptoms from both indoor and outdoor air pollution, on top of their already greater risk due to the smoking itself. While smoking directly contributes to respiratory problems, it also would appear to increase a smoker's vulnerability to other harmful factors such as air pollution.[52]

People over 65 years of age

For most people, breathing ability diminishes over time as a part of the normal process of aging. So, even healthy people over 65 years of age are at increased risk from exposure to air pollutants like ozone, which further reduce their lung function. Older adults also may face increased risk of hospitalization and premature death from breathing ozone and particulate matter.[53] Air pollutants also increase an individual's susceptibility to respiratory infections such as influenza and pneumonia, of which people over 65 years of age are the primary victims.

People with lung disease

People with asthma and chronic obstructive pulmonary disease (COPD) are at increased risk for negative health effects from exposure to air pollution. Studies find that air pollution may trigger increased use of medication in children with asthma.[54] People with COPD may be more likely to visit emergency rooms or be admitted to the hospital due to air pollution exposure.[55]

Other chronic conditions

Individuals who have chronic conditions such as cardiovascular disease or diabetes are at increased risk for developing serious health problems when exposed to high levels of air pollution, especially fine particle air pollution. The American Heart Association has concluded that particle pollution significantly increases the risk of death from heart problems and can reduce life expectancy "by a few years."[56] Studies of people with diabetes found that they, too, have a greater risk of air pollution-related health problems, especially due to particle pollution.[57,58] These vulnerable groups include a large number of people, and information on the risks they face from air pollution is growing, especially for those with heart disease.

Other communities at risk

Non-White and low-income populations often experience greater exposure to substandard outdoor air quality. In particular, research indicates that minorities live in greater concentrations both in areas that do not meet EPA air quality standards and areas near freeways or industries that emit large quantities of air pollution. One study found that in 2002, 71 percent of both African Americans and Hispanics lived in counties that violated federal air pollution standards, compared to 58 percent of the White population.[59,60]

In addition, because of low-quality housing, overcrowding and lack of air conditioning, children in low-income communities also may spend more time outdoors on smoggy summer days.[61]

Communities of color and low income are also disproportionately located near freeways and other areas with heavy diesel truck traffic. Diesel emissions also are released during fuel production, refining, distribution and dispensing. Facilities involving these activities often are located in these at-risk communities. Use of diesel fuel increases toxic air pollution, raising the risk of lung cancer and other lung diseases.[62,63]

Want to learn more about air quality and diverse communities?
Please view the *State of Lung Disease in Diverse Communities* report at
http://www.lungusa.org/solddc-airquality

More recent studies have been concerned with power plants and the release of nitrogen oxides and sulfur dioxide, which form particle pollution that has been linked to more than 550,000 asthma attacks and 23,600 premature deaths each year nationwide. Pollution from power plants affects all Americans, but 68 percent of African Americans live within 30 miles of a coal-fired power plant, compared to only 56 percent of Whites.[64]

Low-income populations also may experience higher exposure to substandard indoor air quality. For example, studies conducted in an inner-city neighborhood in Baltimore found high levels of particulate matter pollution indoors. High rates of smoking indoors contributed to the increased levels.[65,66]

High-risk groups

A large number of people are at risk because their activities cause them to be exposed to high doses of ozone. Studies show that the adverse effects of ozone are dependent on the dose.[67]

Workers

People who work outdoors, such as construction workers, police officers, farmers and mail carriers, are exposed to ozone all day, every day, throughout the ozone season. They exert themselves and breathe hard, which worsens the effect of air pollution on their respiratory system.[68,69] Besides suffering the acute or short-term effects of day-to-day exposure, these individuals are also at increased risk of long-term effects of air pollutants. For example, chronic

exposure to ozone has been associated with permanent scarring of the lungs and reduced breathing ability.[70]

Exercising adults

Cyclists, joggers and others who engage in intense, regular outdoor exercise in and around polluted areas make up one of the largest at-risk groups, and perhaps the least likely group to be recognized as such. Unfortunately, the exercise they do to improve their health also puts them at increased risk of harm from air pollution. Breathing rates increase with exercise, increasing the dose of inhaled pollutants. Studies of hikers, joggers and bicyclists have found reduced breathing ability and symptoms such as coughing and tightness of the chest after a normal workout at ozone levels that would be categorized by the EPA as "Unhealthy for Sensitive Groups."[71,72,73] People who exercise in the afternoon and early evening, when daily ozone levels are highest, compound their risk.

Other responders

A number of studies have shown that among healthy adults there is a wide variation in individual response to ozone.[74,75] Some people are more likely to have a marked reaction than others. For example, if lung capacity is measured in a group of people exposed to the same ozone concentration, the breathing of some will be more impaired than that of others. These sensitive individuals are known as "responders." Scientists believe that genetic factors contribute to the variability in response to ozone exposures.[76]

What can be done about air pollution?

The best way to deal with air pollution is to prevent and reduce exposure.

Removing or avoiding peak air pollutants is a good way to reduce overall exposure. Limiting time outside when air pollution forecasts predict unhealthy conditions and generally trying to avoid outdoor activities near busy roadways and other sources of pollution are other options. This is especially true for at-risk groups, such as children, adults over 65 and people with asthma, other chronic lung diseases, cardiovascular diseases or diabetes.

Air pollution such as ozone (smog) can make people who have asthma react more strongly than usual to their asthma triggers. Teachers, coaches and camp directors should be educated about reducing exposure to air pollutants, and why it is especially important for at-risk children and adults.

You can help reduce air pollution by becoming an e-advocate. Sign up at **www.lungaction.org**

There are many ways to prevent indoor air pollution. A few simple and easy methods include declaring a home a smokefree zone, increasing ventilation, reducing humidity to below 50 percent, fixing leaks and eliminating moisture, frequently washing bedding in hot water, avoiding the use of toxic cleaners, and testing for radon.[77] For more information on these and other potential sources

of air pollution, why they are important, and what can be done about them, please visit the Air Quality section of our website at http://www.lungusa.org.

What is new in air quality research?

An eight-year study of air pollution and lung development involving more than 1,700 fourth-grade students from southern California found that higher levels of outdoor air pollution may impair the development of children's lungs. Higher concentrations of particulate matter, nitrogen dioxide, acid vapor and elemental carbon in the air corresponded with decreases in the amount of air children could exhale. These pollutants were strongly correlated with each other, which is expected since they share the same source—motor vehicles.[78]

The impact of air pollution on children's lungs in this study was similar for boys and girls, smokers and nonsmokers, children with asthma and children who did not have diagnosed asthma. This indicates that all children are at risk when exposed to polluted air. The study also reported that the average decrease in lung function was similar to that found in children whose mothers smoked, but less than personal smoking. The harm from breathing air pollution as children grow may surface during young adulthood in the form of weakened lung function, which increases the risk of lung disease and premature death.[79]

Want to learn more about Air Pollution? Please view related press at **http://www.lungusa.org/airqualitypress**

What is the American Lung Association doing about air quality?

American Lung Association volunteers and staff have been fighting for cleaner outdoor air since the 1960s and have led the fight for enforcement of the Clean Air Act. Thanks to this law, harmful air emissions have dropped by over half since 1970. The Lung Association has taken repeated legal action to make sure the law is enforced. The Lung Association also works regularly with the U.S. Environmental Protection Agency and with state and local air pollution control agencies on action that will improve outdoor and indoor air quality. Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to protect air quality. Join the battle against lung disease by visiting http://lungaction.org.

The Lung Association also takes legal action to ensure that the laws that protect Americans from air pollution are followed. Most recently, the Lung Association pushed the EPA to adopt a national outdoor air quality standard that provides much more protection from ozone air pollution. The national air quality standard is the official limit on the amount of air pollution that states can have. The EPA adopted a new, more protective ozone standard on March 12, 2008. The tighter ozone standard means that the federal, state, and local governments, as well as business, industry and agriculture, must clean up

much more air pollution than ever before.

A major Lung Association pollution-fighting tool is its annual *State of the Air* report that grades air pollution in counties throughout the nation. *State of the Air* provides information to help people easily understand local air pollution issues. In addition, the report ranks cities and counties, showing those with the most serious pollution problems as well as those with the cleanest air.

Want to learn more about the state of air quality in your area? Please visit the *State of the Air* report at **http://stateoftheair.org**

The American Lung Association also has successfully fought to ban smoking indoors in many states and cities nationwide. The Lung Association created the 2010 Smokefree Challenge to push for smokefree air across the nation by 2010. According to the Lung Association's *State of Tobacco Control* report, a record 32 states, the District of Columbia and Puerto Rico received passing grades for smokefree air in 2007.

The American Lung Association works with schools to ensure better indoor air quality for all students and staff. In one segment of this effort, the Lung Association promotes the Asthma Friendly Schools Initiative, which includes Indoor Air Quality Tools for Schools materials developed by the EPA in conjunction with the Lung Association.

A number of American Lung Association programs educate the public about effective ways to improve indoor air quality. Included are the American Lung Association Health House and Master Home Environmentalist programs. The American Lung Association Health House is a useful guide for those who wish to build a home with materials and techniques that reduce indoor air pollution. The Master Home Environmentalist program helps concerned homeowners evaluate their own homes for potential indoor air quality problems. The American Lung Association also promotes smoke-free multi-family housing as well.

The Lung Association provides important information to the public when disasters threaten air quality. After the wildfires ravaged California in 2007, the Lung Association offered critical guidance to help people protect themselves from smoke and soot. In the aftermath of the devastating hurricanes that hit the Gulf Coast in 2005, the Lung Association produced a special brochure and enhanced media outreach to guide those who needed help cleaning up the damage (especially mold and mildew) in their flood- and rain-ravished homes.

Asthma

What is asthma?

Asthma is an inflammatory condition of the lungs that makes it difficult to breathe. Asthma is chronic, meaning that inflammation is always present, even when there are no noticeable symptoms. When provoked by a trigger, the inflammation worsens and the insides of the airways produce extra mucus, swell even more, and the muscles that wrap around the airways may tighten. These changes produce airway obstruction, chest tightness, coughing and wheezing that can lead to asthma attacks. If severe, the symptoms can cause severe shortness of breath and low levels of oxygen in the blood.

Asthma is characterized by excessive sensitivity of the lungs to various stimuli. Triggers range from viral infections to allergies, to irritating gases and particles in the air. Each person reacts differently to the factors that may trigger their asthma, including:

- respiratory infections and colds
- cigarette smoke
- allergens such as pollen, mold, animal dander, feathers, dust, food and cockroaches
- exercise
- exposure to cold air or sudden temperature change
- odors and fumes
- excitement or stress

A recent study conducted by researchers at the National Institutes of Health found that more than 50 percent of current asthma cases in the United States can be attributed to specific allergies. Thirty percent of those are associated with allergies to cats. Paradoxically, early exposure to cats may help protect against asthma, although it then becomes a risk factor for asthma if an allergy develops. While this study shows that preventing, blocking or reversing certain

allergic reactions could reduce a large proportion of asthma cases, almost half of cases are not associated with specific allergies and require further research to determine their cause.[1]

Secondhand smoke exposure in both adults and children is a risk factor for new asthma cases. Secondhand smoke exposure at work is related to a 116 percent increase in the risk of adult onset asthma.[2] Several studies have explored this relationship but in all cases it was impossible to separate newly developed cases of asthma in adults from the worsening of symptoms related to already established asthma. Measures such as banning smoking in workplaces have been shown to reduce employee exposure to secondhand smoke.[3]

Tobacco smoke contains more than 4,000 chemicals; many of them are toxic, carcinogenic (capable of causing cancer) and mutagenic (capable of causing genetic mutation or change). These substances can be transferred across the placenta to the fetus either by a mother's smoking or her exposure to secondhand smoke during pregnancy. Recent studies have suggested that children of smokers are twice as likely to develop asthma as the children of nonsmokers, and that even apparently healthy babies born to women who smoked during pregnancy have abnormally narrowed airways, which may predispose them to asthma and other respiratory disorders. This research was extended by a recent study that reported a child's risk of being diagnosed with asthma by the age of seven increased by 23 percent if their mother smoked even less than 10 cigarettes a day during pregnancy. The chance of developing asthma increased by 35 percent if the mother smoked more than 10 cigarettes a day while pregnant.[4] Data from several studies show that prenatal maternal smoking is a risk factor for asthma onset in children, especially young children. While the mechanism is not clear, it may be due to slowed lung growth.

Evaluation of other studies regarding postnatal exposure in children and exposure in adults show more varied findings. However, the preponderance of data suggests that exposure to secondhand smoke is a risk factor for development of asthma in childhood and adulthood.

Outdoor air pollution worsens existing asthma. Outdoor pollutants known to trigger asthma attacks include ozone, particulate matter, nitrogen dioxide, and sulfur dioxide.[5,6] Studies provide evidence that reducing outdoor air pollution also reduces asthma attacks. In Atlanta during the 1996 Olympics, the city's adopted measures to reduce traffic reduced ozone levels by over 25 percent. Investigators found that during the two weeks that the ozone levels dropped, fewer children suffered asthma attacks that required physician visits and hospital admissions, and resulted in a 41 percent drop in Medicaid-funded hospital admissions.[7]

Want to learn more about the air quality in your area? Please view the American Lung Association *State of the Air* report at **http://stateoftheair.org/**

There are many sources of outdoor air pollution. For example, pollution from power plants is estimated to cause more than 550,000 asthma attacks per year many of which could be avoided by cleaning up power plants to meet modern standards.[8]

Work-related exposure to vapors, dust and smoke also can increase the risk of developing asthma. Approximately 15 percent to 23 percent of asthma cases in the United States are due to occupational exposures.[9] According to one study, men working in forestry and with metals and women in the service industries (waitresses, cleaners and dental workers) have the highest risk for occupational asthma.[10] An estimated 11 million workers in a wide range of industries and occupations are exposed to at least one of numerous agents known to be associated with occupational asthma. A large sample of Asians aged 45 to 74 years showed that those who were exposed to vapors from chemical solvents, dyes, cooling oils, paints, wood preservatives and/or pesticides were 34 percent more likely to develop adult-onset asthma. When sorted by the type of vapor exposure, those exposed to chemical solvents were 44 percent more likely to develop the disease and those exposed to pesticides were 69 percent more likely to develop adult-onset asthma.[11]

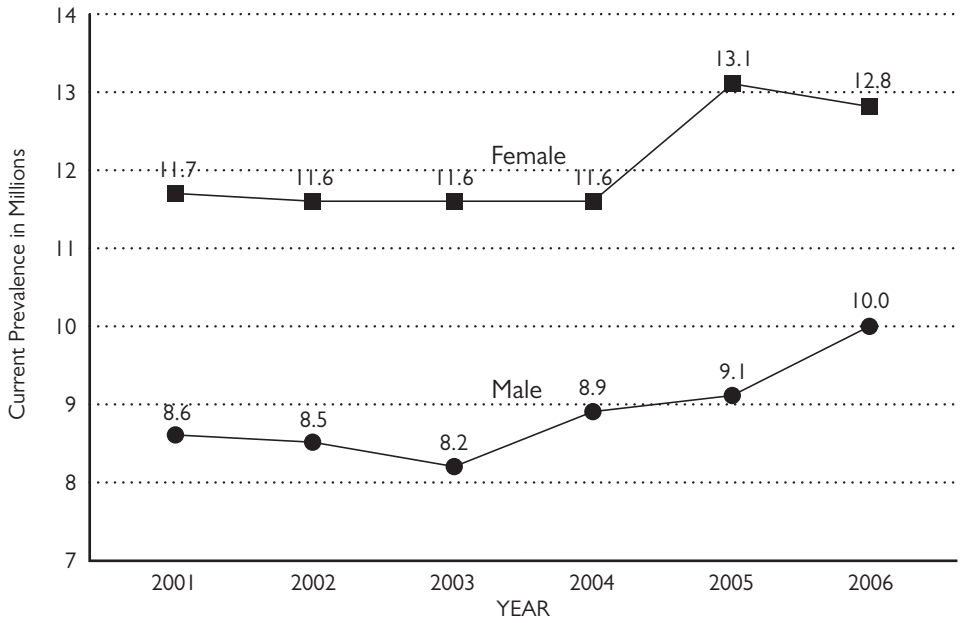
Want to learn more about occupational exposure and asthma? Please view the occupational lung diseases fact sheet at **http://www.lungusa.org/oldfs**

Who has asthma?

An estimated 34.1 million Americans have been diagnosed with asthma in their lifetime by a health professional. Close to 22.9 million Americans currently have asthma; 12.4 million had an asthma attack in 2006.[12]

Between 1982 and1996 asthma prevalence rates increased almost 59 percent. Rates declined from 2001 before increasing again each year since 2004. Current asthma prevalence rates have increased approximately 6 percent since 2001: certain subgroups are still disproportionately affected by asthma.[13] The trend in current asthma prevalence between 2001 and 2006 is shown in Figure 1.

Figure 1: Asthma—Trend in Current Prevalence by Sex, U.S., 2001–2006[1,*]



Source: Centers for Disease Control and Prevention. National Center for Health Statistics. National Health Interview Survey, 2001–2006. Analysis by the American Lung Association, Research and Program Services Division using SPSS and SUDAAN software.

Notes:

1. Current prevalence is defined as answering yes to both "Have you EVER been told by a doctor or other health professional that you had asthma?" and "Do you still have asthma?"

* **Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

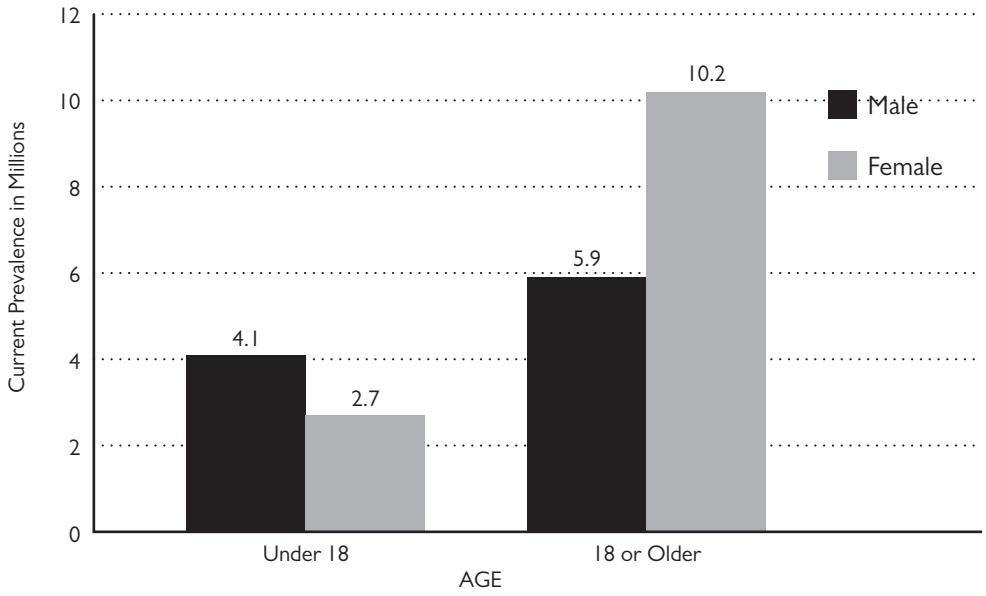
Asthma is the leading chronic illness of children in the United States. In 2006, over 6.8 million children under age 18 had asthma; 4.1 million had an asthma attack that year.[14] The highest asthma prevalence rate was seen in those 5 to 17 years of age (106.3 per 1,000 population). The rate in those under age 18 (92.8 per 1,000) was much greater than those aged 18 to 44 (72.4 per 1,000).[15]

In early childhood, asthma is more common in boys than in girls. In 2006, the asthma prevalence rate for boys aged 0 to 17 years (109.7 per 1,000) was more than 46 percent higher than the rate among girls (75.1 per 1,000).[16]

Want to learn more about children and asthma? Please view the information webpage at **http://www.lungusa.org/asthmaandchildren**

Conversely, beyond childhood women are more likely than men to develop asthma. In 2006, almost 10.2 million females aged 18 and older had asthma compared to 5.9 million adult males. Similarly, the prevalence rate among adult women (89.0 per 1,000) was 60 percent greater than the rate among adult men (55.6 per 1,000).[17] Current asthma prevalence by age and sex in 2006 is shown in Figure 2.

Figure 2: Asthma—Current Prevalence by Age and Sex, U.S., 2006[1,*]



Source: Centers for Disease Control and Prevention. National Center for Health Statistics. National Health Interview Survey, 2006. Analysis by the American Lung Association, Research and Program Services Division using SPSS and SUDAAN software.

Notes:

1. Current prevalence is defined as answering yes to both "Have you EVER been told by a doctor or other health professional that you had asthma?" and "Do you still have asthma?"

* **Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

Want to learn more about adults and asthma? Please view the information webpage at **http://www.lungusa.org/asthmaandadults**

Blacks suffer disproportionately from asthma. Asthma prevalence rates are almost 24 percent higher among Blacks (94.2 per 1,000) than Whites (76.1 per 1,000).[18]

Studies have suggested that Puerto Ricans have higher asthma prevalence rates than all other Hispanic subgroups and non-Hispanic Whites and Blacks.[19] This difference among Hispanic groups has not been explained by location, household size, use of home remedies, education level or by the country in which their education was completed.[20] Further research found that Puerto Ricans with asthma had lower lung function, higher risk of emergency department visits and longer asthma duration than Mexicans. The researchers also found that Puerto Ricans with asthma were less responsive to usual asthma medications, such as albuterol, than Mexicans with asthma.[21]

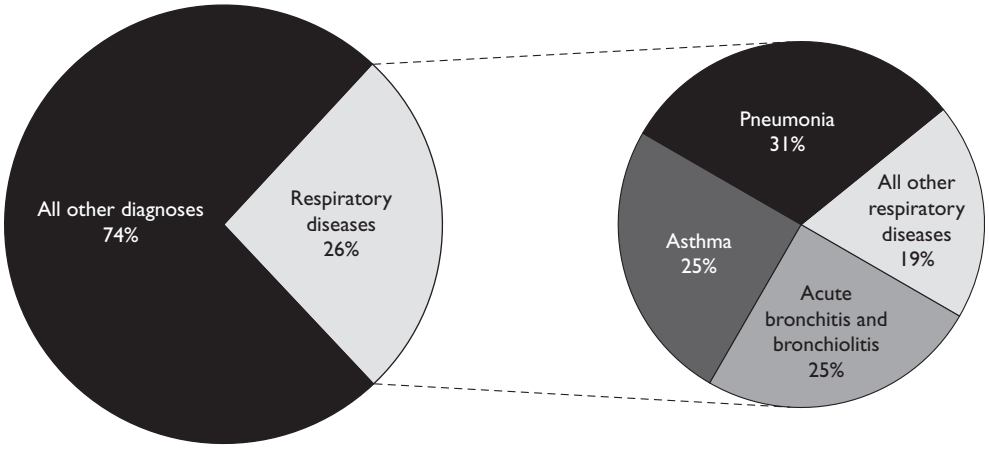
One possible reason why Puerto Rican children have higher asthma prevalence rates than other groups is increased sensitivity to indoor environmental risk factors, including rodents. In addition, problems with routine asthma management have been suggested that could be addressed by improved medical management, programs to help parents manage their children's asthma or school staff assistance with medications.[22]

What is the health impact of asthma?

Asthma is the third leading cause of hospitalization among children under the age of 15.[23] In 2005, approximately 32.6 percent of hospitalizations due to asthma were in those under age 15,[24] however, only 20.5 percent of the U.S. population was younger than 15 years of age.[25]

Figure 3 shows the percent of hospitalizations due to respiratory diseases and the type of respiratory disease for children under 15 years of age in 2005. Over a quarter (26%) of all hospitalizations in 2005 for this age group were due to respiratory diseases, and approximately a quarter of those were due to asthma.[26]

Figure 3: Hospitalizations for Types of Respiratory Diseases, Children Under 15 Years, 2005

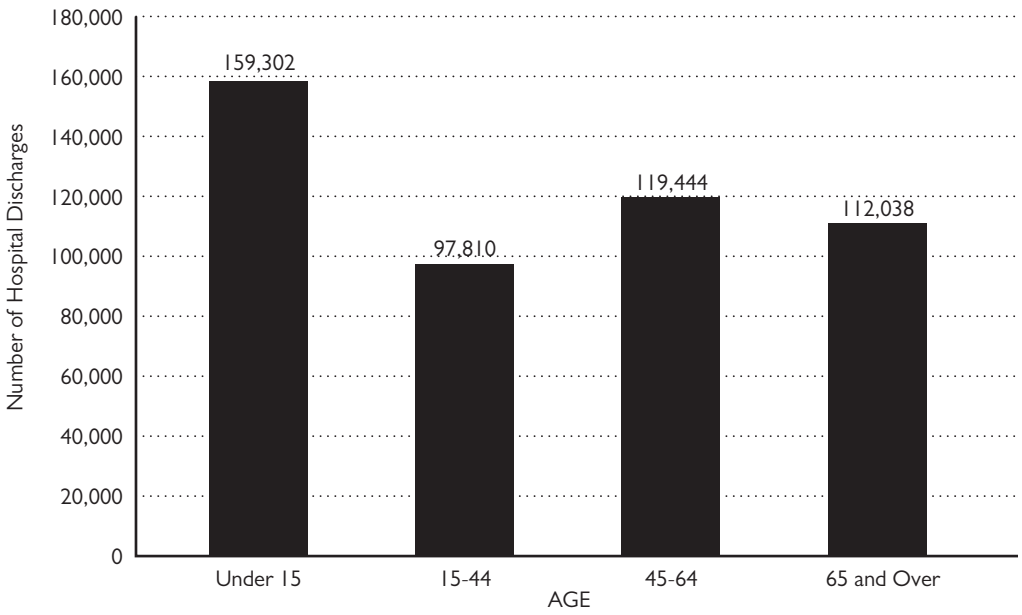


Source: Centers for Disease Control and Prevention. Quickstats: Percentage Distribution of Hospitalizations for Types of Respiratory Diseases Among Children Aged <15 Years—National Hospital Discharge Survey, United States, 2005. *Morbidity and Mortality Weekly Report.* July 20, 2007; 56(28):713.

Hospital discharges are listed by primary diagnosis (such as asthma), which is usually the main cause of the hospitalization. Hospital discharges provide an indication of who is experiencing severe asthma in the community and help tailor programs to those who need them most.

During 2005, 488,594 hospital discharges (16.6 per 10,000 population) were due to asthma. Between 2003 and 2005, there was a 16.2 percent decrease in hospitalization discharge rates for asthma in the United States. Figure 4 displays the number of hospital discharges for asthma in 2005, by age group. While those over 65 years of age have the highest discharge rate at 30.5 per 10,000 population, those under 15 years of age have the highest number of hospital discharges due to asthma, over 159,000.[27]

Figure 4: Asthma—Number of Hospitalizations by Age, U.S., 2005[1,2,*]



Source: Centers for Disease Control and Prevention. National Center for Health Statistics. National Hospital Discharge Survey, 2005.
Notes:
1. ICD-9 code 493
2. Hospitalizations are estimated based on the recorded primary discharge diagnosis
* **Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

Hospital discharge rates for asthma decreased in those under 15 and those 15 to 44 years of age between 1995 and 2005. Discharge rates over the past 10 years have remained fairly stable in those 45 to 64 years of age and have increased by 33 percent for those 65 years of age or older.[28]

More women than men are hospitalized due to asthma. In 2005, a total of 296,000 hospital discharges were reported in females while 192,000 were reported in males.[29]

The risk of hospitalization due to asthma is greater for Blacks than for Whites. Blacks are 3.8 times more likely to be admitted for pediatric asthma and up to 3 times more likely to be admitted for adult asthma.[30]

In 2005, there were 12.8 million physician office visits, 1.3 million hospital outpatient department visits and almost 1.8 million emergency room visits due to asthma.[31]

Asthma is a leading chronic condition causing limitation of activity.[32] A survey found that 48 percent of people with asthma say the disease limits their ability to take part in sports and recreation, 36 percent say it limits their normal physical exertion and 25 percent say it interferes with their social activities.[33] Approximately one-third of both children and parents reported at least some limitations in strenuous activity due to asthma.[34]

Asthma can be fatal, although deaths are infrequent. Still, any deaths from asthma signal the need for improved asthma management. One goal of asthma therapy is to keep asthma under control in order to prevent attacks and deaths.

In 2004, 3,816 people died of asthma in the United States. Preliminary data show that there were 3,857 deaths due to asthma in 2005.[35] Women die more frequently from asthma than do men, and Blacks more frequently than Whites. Approximately 64 percent of asthma deaths in 2004 occurred in women. Even when adjusted for age, death rates in females were 40 percent greater than in males. Non-Hispanic Blacks were over three times more likely to die from asthma than non-Hispanic Whites.[36]

People over the age of 65 are much more likely to die from asthma compared to other age groups, including young children. In 2004, the mortality rate among 65 to 74 year olds was 2.7 per 100,000 compared with 0.2 per 100,000 in children between the ages of 1 and 4. Those 85 and older have a mortality rate of 14.1 per 100,000, which is 70.5 times greater than the rate among young children.[37]

In 2004, 281 Hispanics died of asthma, an age-adjusted death rate of 1.1 per 100,000. The age-adjusted death rate in Hispanics was 65 percent lower than the rate in non-Hispanic Blacks, but almost the same as the rate in non-Hispanic Whites (1.0 per 100,000).[38] However, studies have suggested that Puerto Ricans may have higher age-adjusted death rates (4.4 per 100,000 in 2003) than all the other Hispanic subgroups and non-Hispanic Whites and Blacks.[39]

Fortunately, deaths from asthma have been continuously declining for the past six years.[40]

Asthma attacks are responsible for many missed school and work days. Of those reporting at least one asthma attack in 2003, children aged 5 to 17 years missed 12.8 million school days and employed adults aged 18 years or older missed 10.1 million work days.[41] Lost productivity due to missed work days is a major contributor to the burden asthma has on the U.S. health care system.

Asthma costs the U.S. economy an estimated $19.7 billion each year. This consists of $14.7 billion in direct health care costs and $5 billion in indirect costs (e.g., lost productivity). At $6.2 billion, prescription drugs represented the largest single direct medical expenditure.[42]

The cost of treating asthma for those under 18 years of age alone is estimated to be $3.2 billion a year.[43]

Want to learn more about asthma trends and data? Please view the *Asthma Trend Report*, which delineates information available from national- and state-based surveys on the mortality, prevalence, hospitalizations, ambulatory care visits, and economic costs due to asthma, at **http://www.lungusa.org/asthmatrends**

How is asthma diagnosed and managed?

During the diagnosis, a health care provider will take a patient's medical history, give the patient a physical examination and do some laboratory tests. These tests may include a chest or sinus x-ray, blood and allergy tests, and lung function tests.

The basic lung function test is spirometry, where a device (spirometer) is used to measure the amount and speed of the air the patient can exhale.

Methacholine challenge testing (MCT) is performed for both asthma research and for diagnostic purposes when the diagnosis is in doubt. MCT is useful when a patient has a history of symptoms suggesting asthma, but spirometry findings are normal.[44] Other "provocation tests" designed to provoke an asthma reaction, such as inhaled cold air, may be used.

The Asthma Control Test (ACT) test can be used to help evaluate the severity of asthma. The American Lung Association recommends that everyone 12 years of age and older with asthma take the test. The patient simply answers five questions that will produce a score that shows how well their asthma is being controlled. This information then can be used to develop an effective asthma management plan. Some health care providers also use the test to measure treatment progress.

Asthma management includes four components: Assessment and monitoring, education, control of environmental factors and other conditions, and medication. Assessment involves determining asthma severity so therapy can be started and assessing asthma control to monitor and adjust therapy as needed. Education in asthma self-management includes developing a written asthma action plan, followed by recommended measures to control triggers, environmental factors and other illnesses. The final component is selection of medication that will work best for each person.[45]

A variety of drugs are available for the treatment of asthma. For a chart listing asthma medications, please visit **http://www.lungusa.org/asthmamedschart**

Note this chart may not include all drugs available; a patient always should ask their health care provider which drug is best for their own, individual asthma treatment and management.

Those who suffer from asthma must typically take a variety of medications, usually on a regular daily basis, to prevent exacerbations or counter acute attacks. Asthma medications come in several forms, but most are taken using an inhaler or nebulizer. Metered dose inhalers or "puffers" dispense medicine that one breathes in. Some require devices called spacers to aid in spreading the medicine to the lungs.

The two main types of medication are daily controllers and quick-relievers. The goal of asthma management is to reduce the use of quick-relievers by preventing asthma attacks from occurring in the first place. Daily controller medications, also called anti-inflammatories, limit inflammation in the airways. They include inhaled corticosteroids and are critical for the management of most asthma cases. Other medicines in this group include cromolyn sodium and leukotriene modifiers, which come in pill form. Steroid pills also may be used to treat asthma but only for severe cases as they have many more side effects.

Leukotriene modifiers are a class of oral anti-inflammatory asthma drugs that block the activity of chemicals called leukotrienes, which are involved in airway inflammation.

In July 2003, the Food and Drug Administration (FDA) approved Xolair, a product used to treat people 12 years of age and older with moderate to severe allergy-related asthma that cannot properly be controlled with inhaled steroid treatments. Xolair is taken by injection once or twice a month.[46]

Bronchodilators are a class of drugs often used in asthma treatment. There are different types, including short-acting beta adrenergics (SABAs), long-acting beta adrenergics (LABAs) and methylxanthines (theophylline) for daily control. There are also combinations of inhaled corticosteroids and LABAs. The FDA strongly warns against the use of LABAs unless accompanied with inhaled corticosteroids, for a combined treatment for asthma.

Quick-relief medications are used if asthma symptoms start to get worse or to prevent asthma symptoms caused by exercise. Albuterol is a common quick-reliever medication. Asthma is considered to be under good control if an albuterol inhalation is only needed two to three times per week. The chart mentioned earlier lists other medications that are used for quick relief, including bronchodilators. Whether or not "desensitization" or allergy shots are useful in asthma is still controversial. They seem to work when only one or a few highly specific allergens can be identified as asthma triggers.

Despite the numerous drugs available, asthma is still poorly controlled and several studies indicate that guidelines established by the National Asthma Education and Prevention Program (NAEPP) are not being followed uniformly. The NAEPP guidelines are based on an expert panel's summary of current and relevant research concerning asthma care. As such, the recommendations reflect the best practices available at this time for reducing exacerbations, hospitalizations, missed work days and improving quality of life for those with asthma.[47]

NAEPP guidelines recommend the use of daily anti-inflammatory medication in adults and children over the age of five to achieve and maintain control of persistent asthma.[48] A study focusing on the care provided to children of color examined the adherence to NAEPP guidelines by primary care providers in Connecticut and found that only 38 percent of children with persistent asthma were treated with anti-inflammatory therapy. After educating physicians on the NAEPP guidelines, 96 percent of children with persistent asthma were treated with anti-inflammatory therapy.[49]

NAEPP guidelines also recommend that every asthma patient should have a written asthma self-management plan. This plan is designed to meet individual needs and provides key information on managing asthma by learning how to avoid triggers, take medications properly, be aware of symptoms and take action when needed. A European study found that adding self-treatment guidelines to a self-management program for adults resulted in better control of asthma.[50] In 2003, only 39.5 percent of those with asthma under 18 years of age and 33.6 percent of those with asthma over 18 years of age, had ever had such a plan. Of the children, 72.4 percent had been taught to recognize early signs of an asthma attack compared to 55.1 percent of adults. Asthmatics under 18 years of age were significantly more likely than adults over 18 to have received asthma self-management education no matter what form it took.[51] A

2005 study in New York City found that only 22 percent of adult asthmatics had a written plan to deal with asthma attacks and 31 percent had a written plan to handle worsening symptoms. Of those with written plans, approximately half were following the plan. Two-thirds of patients reported receiving verbal instructions for managing asthma. Verbal advice was followed more often than written advice. Verbal instructions were followed by 64 percent of patients when their symptoms worsened and by 74 percent of patients for asthma attacks.[52]

A review of asthma studies determined that self-management education reduces hospitalizations, emergency room visits and days missed from work or school, thus improving quality of life.[53] Asthma education in schools, individual verbal instruction, or written information in an asthma booklet all were found to decrease asthma symptoms and use of rescue asthma medication.[54] In addition to drug therapy, the American Lung Association highly recommends individualized asthma self-management plans that actively involve the patient.

What is new in asthma research?

As part of the Lung Association's commitment to fight asthma, the American Lung Association Asthma Clinical Research Centers (ACRC) Network was created. The network consists of 20 centers and a data coordinating center that conduct large clinical trials that will provide useful information important for the direct care of people with asthma. Currently, the ACRC is recruiting children between the ages of 6 and 17 for a study of the connection between gastroesophageal reflux (GERD, or acid reflux) and asthma. GERD is frequent among people with poorly controlled asthma and can cause tightening of the airways.

Want to learn more about the American Lung Association Asthma Clinical Research Centers Network and its trials or how to participate? Please visit the website at **http://www.lungusa.org/acrc**

Other leading researchers are conducting vital studies that will ultimately benefit those who suffer unnecessarily from asthma. This research includes the following:

Two new methods are being explored for more accurate diagnoses and improved treatment selection. Induced sputum (matter discharged from the airways) analysis and exhaled nitric oxide make up a new category of inflammometry, or the measuring of airway inflammation. These methods are useful in distinguishing between two different types of inflammation in asthmatics. This is important since the type of inflammation influences the choice of medication.[55]

Several studies have focused on genetic and molecular-level biological markers in relation to asthma. The role of genetics in asthma risk, development and severity are complex but may offer good insight to individual treatment options. The Salmeterol Multicenter Asthma Research Trial has greatly contributed to the FDA's evaluation of LABA safety in asthma treatment; as mentioned earlier,

the FDA sternly cautions against the use of LABAs alone.

Investigation of genetic variation of the beta-adrenergic receptor gene has shown large differences among races. Blacks have a much higher frequency of a gene which can potentially reduce the response to beta-agonist asthma therapy. Genetic components and gene-environment interactions are very complex and require further and more complete investigation. Nevertheless, genetics play an important role in asthma development and treatment.[56]

Infants with symptoms of bronchiolitis[1] severe enough to require hospitalization are at increased risk for developing asthma. Most research has focused on bronchiolitis caused by the respiratory syncytial virus (RSV). Please view the RSV chapter of this report for more information. Two main questions require further research: Does the type of virus leading to bronchiolitis change a child's risk of developing asthma, and does bronchiolitis cause asthma or tend to develop more often in infants who are susceptible to asthma development? Exploring these two areas could help identify children at risk for either asthma or bronchiolitis and potentially offer an opportunity to change the outcome of one through treatment of the other.[57]

Researchers are looking into methods to decrease the contraction of smooth airway muscle and ease subsequent airway obstruction, which worsens asthma. They are following multiple leads including using a heated probe to thin the muscle wall (bronchial thermoplasty).[58] Bronchial thermoplasty has been effective in decreasing the rate of attacks, increasing percentage of symptom-free days and reducing the use of rescue medication in patients with severe asthma.[59]

Researchers also have been looking into the association between weight and asthma. Analysis of seven studies indicate that overweight and obese individuals (body mass index of 25 or more) are 51 percent more likely to have asthma than individuals of normal weight. More specifically, overweight persons were 38 percent more likely and obese (severely overweight) persons 92 percent more likely to have asthma than persons of normal weight. Overweight and obese women were 68 percent more likely to have asthma than their normal weight counterparts, compared to 46 percent of obese men.[60]

In nonsmoking patients with moderate to severe asthma, scientists are exploring why those who have frequent attacks often face greater declines in lung function. These studies suggest that intense airway inflammation may contribute to faster decline in lung function.[61] Further studies are needed to explore this association and prevent the decline in lung function from occurring in those with asthma.

Researchers also are exploring how air pollution triggers asthma episodes and whether it actually causes asthma. The effects of ambient air pollutants have been associated with various cellular and tissue physiological changes.[62] Although these studies do not establish that air pollution caused asthma, they provide evidence for concern about increased risk of asthma development.[63]

[1] Bronchiolitis is an inflammation of the bronchioles, which are thin-walled air passages in the lungs.

What is the American Lung Association doing about asthma?

Asthma, once thought of as a "simple" hypersensitive reaction, is now known to be a complex condition with a range of causes and contributing factors, with airway inflammation as its central feature. There has been a recent explosion of research on all aspects of asthma; in the near future, a better understanding of the disease process is expected to lead to improved therapies.

The American Lung Association supports extensive research in asthma in a number of critical areas including genetics, infections, mechanisms of the allergic and inflammatory responses, management, and treatment.

The American Lung Association has made a major commitment to asthma research through its ACRC network. The first ACRC study found that influenza vaccines are safe for children and adults with asthma. The study, published in *The New England Journal of Medicine*, puts to rest previous concerns about possible side effects of the influenza shot in people with asthma. This finding will prevent many thousands of days of influenza-related suffering, including hospital stays and visits to the emergency room, and will save many hundreds of millions of dollars.

Want to learn more about additional studies funded by the American Lung Association? Please visit the website at **http://www.lungusa.org/researchawardsnationwide**

Currently, 15 articles have been published in highly prestigious journals covering six completed ACRC studies. The Leukotriene Modifier or Corticosteroid or Corticosteroid-Salmeterol Trial (LOCCS) was published most recently in *The New England Journal of Medicine,* reporting on a trial in which the treatment failure rate (approximately 20 percent) in patients whose asthma was well-controlled because they received twice-daily inhaled doses of fluticasone (100μg, a synthetic corticosteroid) was no different from people who did not receive that medication over a period of 16 weeks, when they were switched to once-daily fluticasone (100μg) plus salmeterol (50μg, a beta-adrenergic agonist). These results are noteworthy because reducing drug use to the minimum necessary is an important part of asthma management.[64] Patients in this same study who were switched to once-daily montelukast (a chewable tablet) had a higher failure rate of 30.3 percent but the therapy was still effective in reducing their asthma symptoms.[65]

The ACRC already has begun to leverage the expertise of its leading asthma researchers by attracting financial support from the National Institutes of Health and pharmaceutical companies. The ACRC has made major progress in its first seven years and the Lung Association is confident that it will continue to improve the lives of the millions of asthma sufferers.

In addition to scientific and clinical research on asthma, the American Lung Association provides many health education programs to the public. These programs are designed to educate and help patients and their families better manage their asthma. *Breathe Well, Live Well* is the Lung Association's newest program and is designed to help adults develop asthma self-management

knowledge and skills to improve their quality of life. It is available at http://www.lungusa.org/breathewell. Another program is *Open Airways For Schools*, an asthma-management program that educates and inspires children through an interactive approach. Both programs are led by American Lung Association-trained facilitators and are available in English and Spanish. More information is available at http://www.lungusa.org/openairways. The American Lung Association is also the sponsor of the Asthma-Friendly Schools Initiative (AFSI), a comprehensive approach to asthma management in schools, ensuring that children with asthma are healthy, in school and ready to learn. The Asthma-Friendly Schools Toolkit is available to download for free at www.lungusa.org./afsi. The toolkit is a valuable resource for community organizations as they collaborate with schools to create comprehensive asthma-management systems and includes a series of policies for adoption by school districts.

Want to learn more about Breathe Well, Live Well? Please visit the webpage for health professionals at **http://www.lungusa.org/breathewellpro**

The American Lung Association participates in many city, state and national asthma coalitions to develop initiatives that meet specific community needs and to raise awareness of asthma as a public health issue. Local Lung Associations around the country also hold Asthma Awareness Days and Asthma Walks, both aimed at calling attention to this devastating chronic illness. Find an Asthma Walk near you at http://www.lungusa.org/asthmawalk.

The asthma NexProfiler is an interactive decision-support tool available through a partnership of the American Lung Association and NexCura, Inc. The asthma NexProfiler helps asthma patients and their physicians make better-informed treatment decisions using information from evidence-based, peer-reviewed medical literature.

Need help with treatment decisions for asthma? Please view the asthma NexProfiler at **http://www.lungusa.org/asthmatreatment**

The American Lung Association leads the way in changing public policies at the federal, state and local level that help patients with asthma and their families. Lung Associations across the country pushed for legislation requiring schools to allow students with asthma to carry their inhalers with them while in school; most states now have passed such proposals. American Lung Association experts helped review the National Asthma Education and Prevention Program guidelines (see more about these guidelines earlier in this chapter), which will help health care providers and their patients better manage the disease. The Lung Association also supports federal legislation to improve asthma surveillance to collect data on asthma nationwide.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight asthma. Join the battle against lung disease by visiting http://lungaction.org.

Chronic Obstructive Pulmonary Disease (COPD)

What is chronic obstructive pulmonary disease?

Chronic obstructive pulmonary disease (COPD) is a term referring to two lung diseases, chronic bronchitis and emphysema. Both conditions cause obstruction of airflow that interferes with normal breathing. Both frequently exist together, so physicians prefer the term COPD. COPD is preventable and treatable. This definition of COPD does not include other obstructive diseases such as asthma, although uncontrolled asthma over a lifetime can result in damage and COPD.

Chronic bronchitis is the inflammation and eventual scarring of the lining of the bronchial tubes. When the bronchi are inflamed or infected, less air is able to flow to and from the lungs and a heavy mucus or phlegm is coughed up. Once the bronchial tubes have been irritated over a long period of time, excessive mucus is produced constantly, the lining of the bronchial tubes thickens, an irritating cough develops, air flow may be hampered and the lungs become scarred, eventually obstructing airflow.[1] The bronchial tubes then make an ideal breeding place for bacterial and viral infections.

Symptoms of chronic bronchitis include chronic cough, increased mucus, frequent clearing of the throat and shortness of breath.[2] The condition has been defined by the presence of a mucus-producing cough most days of the month, three months of a year for two years in a row without other underlying disease to explain the cough. More recent definitions include reduced lung function.

Emphysema begins with the destruction of air sacs (alveoli) in the lungs where oxygen from the air is exchanged for carbon dioxide in the blood. Damage to the air sacs is irreversible and results in permanent "holes" in the tissues of the lower lungs. As air sacs are destroyed, the lungs can transfer less and less oxygen to the bloodstream, causing shortness of breath. The lungs also lose their elasticity, which is important for keeping airways open. In advanced emphysema cases, patients are extremely short of breath.[3]

Symptoms of emphysema include cough, shortness of breath and a limited tolerance for exercise. As the disease advances, the work of breathing is so great that major weight loss occurs.

Smoking is the leading risk factor for COPD. Other risk factors include exposure to air pollution and second-hand smoke, a history of childhood respiratory infections and heredity. Particulate matter (PM) from cigarette smoke and air pollution, including smoke from poorly ventilated wood stoves and the burning of biomass[1,4], are related to lung damage. Particles that have a diameter of 2.5 to 10 microns, or less than 1/7 the diameter of a human hair, are called coarse particles and are of special concern. Larger particles are more easily trapped in the nose or throat, while smaller particles can be drawn into the small air passages.[5]

Fine particles, with a diameter of 2.5 microns or less ($PM_{2.5}$) represent the most serious threat. Particles this small easily reach deep into the lung and may even pass into the bloodstream.[6] Once they have penetrated the lungs, fine particles can cause inflammation and impair immune responses.[7]

Alpha-1 antitrypsin deficiency-related (Alpha-1) emphysema is caused by an inherited deficiency of a protein called alpha -1 antitrypsin (AAT) or alpha-1 protease inhibitor. Alpha-1 emphysema is responsible for five percent or less of the emphysema in the United States.[8] AAT, produced by the liver, is a "lung protector." In the absence of AAT, the risk of developing emphysema is far greater than normal. Symptoms almost never appear before 25 years of age and sometimes never develop, especially in nonsmokers. In those who smoke, symptoms occur between 32 and 41 years of age, on average.[9]

Want to learn more about chronic bronchitis? Please view the disease listing at **http://www.lungusa.org/chronicbronchitis**

One study found that certain genes in mice appear to influence the risk of developing emphysema. The researchers said this may explain why some smokers remain disease-free. If similar genes are found in humans, these findings may one day help identify people who are at risk of emphysema well in advance of symptoms.[10]

Occupational exposure to certain industrial pollutants also increases the risk for COPD and contributes to its burden. One study found that an estimated 19.2 percent[11] of COPD cases among workers aged 30 to 75 years was due to occupational exposures. A combination of tobacco use and occupational exposure greatly increases the risk of developing COPD.

Who gets COPD?

Over 12.1 million U.S. adults (aged 18 and over) were estimated to have COPD in 2006.[12] However, close to 24 million U.S. adults have evidence of impaired lung function, indicating an under-diagnosis of COPD.[13] This is a serious issue because damage to the lungs is not noticed until the disease is well-advanced, thus limiting effective treatment options.

Previously, COPD was more of a concern for men than women as women had lower prevalence rates of the disease. This was due to the far higher rate of

[1] Any organic material made from plants or animals.

smoking among men compared to women during much of the past century. As the smoking rate among women increased after World War II, so did their risk of developing COPD. Since there is a long lag period between smoking initiation and COPD diagnosis, the increased COPD prevalence rate in women has only been noticed recently. Women are twice as likely as men to be diagnosed with chronic bronchitis. In 2006, 2.9 million men were diagnosed compared to 6.6 million women.[14]

Want to learn more about COPD trends and data? Please view the *COPD Trend Report,* which delineates information available from national surveys on the mortality, prevalence, hospitalizations and economic costs due to COPD, at **http://www.lungusa.org/copdtrends**

The reasons behind this change and difference by gender have been understudied and are not well understood.[15] A recent study found that the variation between genders in COPD rates could be due primarily to differences in smoking behavior and exposure to other environmental risk factors, such as occupations where there is a lot of dust present.[16] However, women appear to have a greater vulnerability to cigarette smoking, the leading risk factor for COPD and lung cancer. This may be due to differences in how cigarette smoke is metabolized by women. Additional research suggests that women are at higher risk for DNA damage and are less able to repair DNA. While neither process is fully understood, it is likely that both contribute to the higher COPD and lung cancer rates seen in women along with other pathways that have yet to be discovered.[17] For more information on gender differences in smoking-related diseases, please see the tobacco and lung cancer chapters of this report.

Research suggests that one or more inherited risk factors interact with smoking to increase COPD risk. It is not known if such inherited risk factors differ among races.[18]

Want to learn more about COPD? Please view the fact sheet at **http://www.lungusa.org/copdfactsheet**

COPD prevalence is estimated by results of the National Health Interview Survey (NHIS), which asks respondents if they have been diagnosed with chronic bronchitis in the last year (current prevalence), and if they have ever been diagnosed with emphysema (lifetime prevalence). COPD prevalence takes into account the overlap of persons with both diseases (approximately 10%). The total estimated COPD prevalence is then slightly less than simply adding together prevalence estimates for chronic bronchitis and emphysema. Data on numbers of deaths represent counts obtained from death certificates. COPD deaths include those from any chronic lower respiratory disease, including chronic bronchitis, emphysema and bronchiectasis, but do not include asthma.

In 2006, an estimated 9.5 million Americans were diagnosed with chronic bronchitis by a health care professional: 3.2 million 18 to 44 year olds, 4.1 million 45 to 64 year olds and 2.2 million people over 65 years of age. Chronic

bronchitis affects people of all ages, but the highest prevalence rate was seen among those 65 years of age and older at 60.9 per 1,000 persons while those ages 18 to 44 had the lowest rate estimated at 28.8 per 1,000 persons. Persons aged 45 to 64 years had a prevalence rate of 55.4 per 1,000 persons.[19]

White Americans appear to be more likely to have COPD than other racial or ethnic groups.[20] Not only are they more likely to have the disease, but they are also more likely to die from it.[21]

Chronic bronchitis prevalence had decreased in recent years but increased slightly in 2006 for both Whites and Blacks. The highest prevalence rate among Whites was in the 65 years of age and older population (63.1 per 1,000) and in the 45 to 64 years of age population for Blacks (61.7 per 1,000).[22]

The emphysema prevalence rate is very low in those under age 45. Of the estimated 4.1 million Americans ever diagnosed with emphysema in their lifetime, 93 percent were 45 or older.[23] The risk of being diagnosed with COPD doubles every 10 years after the age of 40.[24] In 2006, the reported emphysema lifetime prevalence rate was 18.5 per 1,000 population.[25] Men tend to have higher emphysema prevalence rates than females. In 2006, almost 2.5 million males (23.4 per 1,000 population) had emphysema compared to 1.6 million females (13.9 per 1,000). From 1997 to 2006, the prevalence rate increased by 6 percent in women and 16 percent in men.[26]

Emphysema rates are highest in non-Hispanic Whites (23.5 per 1,000) and lowest in Hispanics (3.9 per 1,000). Non-Hispanic Blacks have an emphysema rate of 7.4 per 1,000.[27]

Want to learn more about COPD and diverse communities? Please view the *State of Lung Disease in Diverse Communities 2007* report at **http://www.lungusa.org/solddc-copd**

An estimated 100,000 Americans, primarily of northern European descent, have Alpha-1 deficiency emphysema. Another 20 million Americans carry a single deficient gene that causes Alpha-1 and may pass the gene on to their children.[28] A recent study suggested that there are at least 116 million Alpha-1 carriers among all racial groups, worldwide.[29]

What is the health impact of COPD?

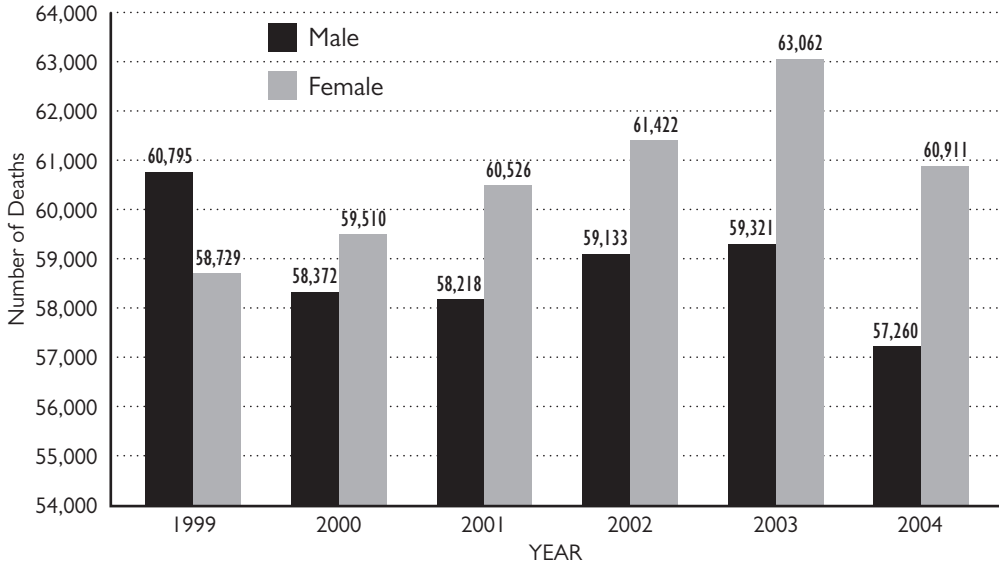
COPD is the fourth leading cause of death, claiming the lives of 118,171 Americans in 2004.[30] Preliminary data show this number increased to 127,000 in 2005.[31] That is one death every four to five minutes. COPD is expected to become the third leading cause of death by the year 2020.[32]

Approximately 80 to 90 percent of COPD deaths are caused by smoking. Men and women smokers are nearly 12 and 13 times as likely to die from COPD, respectively, compared to those who have never smoked.[33]

Although, historically, men have been more likely than women to die of COPD, women have exceeded men in the number of deaths since 2000. In 2004,

almost 61,000 females died of COPD compared with 57,000 males.[34] Figure 1 displays the number of deaths due to COPD by sex from 1999 to 2004.

Figure 1: Number of COPD Deaths by Year and Sex, U.S., 1999–2004*



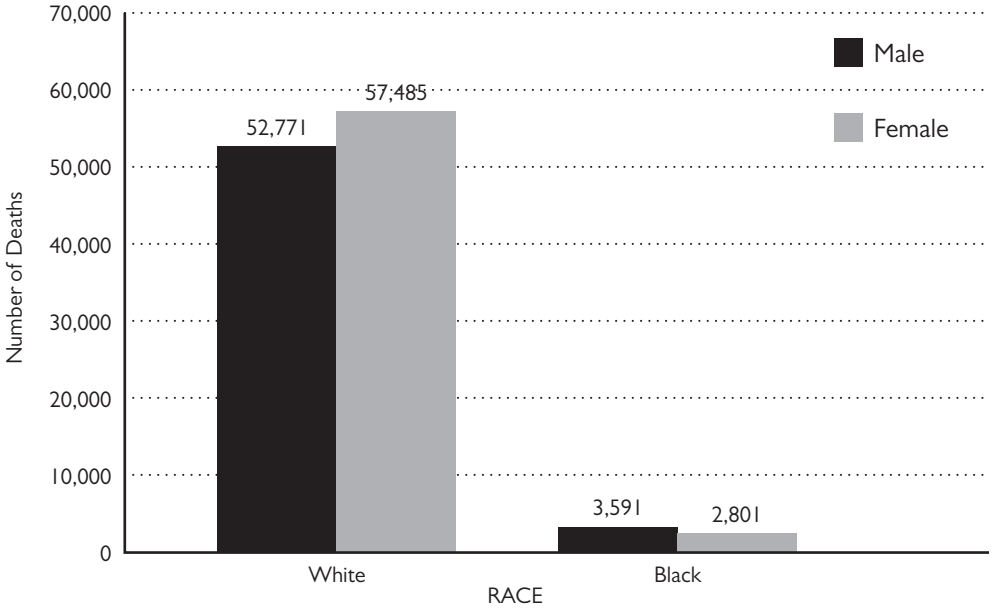
Source: Centers for Disease Control and Prevention. National Center for Health Statistics, Monthly Vital Statistics Report, 1999–2004.
Note:
* **Comparisons should only be made between groups and diseases using rates, not number of deaths, as these do not take into account differences which may exist in population size or demographics.**

Racial and ethnic groups differ in smoking rates and patterns. Native Americans have the highest percentage of current smokers (26.9%) while Asians have the lowest (11.2%). Current smoking prevalence in Hispanics is relatively low (15.1%). Non-Hispanic Whites (21.8%) and non-Hispanic Blacks (22.6%) have similar current smoking prevalence percentages. Due to the long lag period between smoking onset and COPD presentation, future COPD prevalence rates among these groups are predicted to reflect these differences with more Native Americans and non-Hispanic Blacks presenting with the disease.[35]

In 2004, there were 6,330 deaths due to COPD in non-Hispanic Blacks and 2,826 in Hispanics. The age-adjusted death rate for chronic bronchitis was 0.2 per 100,000 persons for both non-Hispanic Blacks and Hispanics. This rate is 50 percent lower than that for non-Hispanic Whites, 0.3 per 100,000 persons. However, emphysema leads to far more deaths than chronic bronchitis. The age-adjusted death rate for emphysema in 2004 was 2.8 among non-Hispanic Blacks and 1.6 per 100,000 persons among Hispanics. The age-adjusted death rate for emphysema in non-Hispanic Whites was 5.1 per 100,000 persons, almost two times greater than that of non-Hispanic Blacks and over three times greater than Hispanics.[36]

Figure 2 shows the number of deaths by race and sex in 2004. White women suffered the most deaths due to COPD with almost 58,000 dying in 2004 alone.

Figure 2: Number of COPD Deaths by Race and Sex, U.S., 2004*

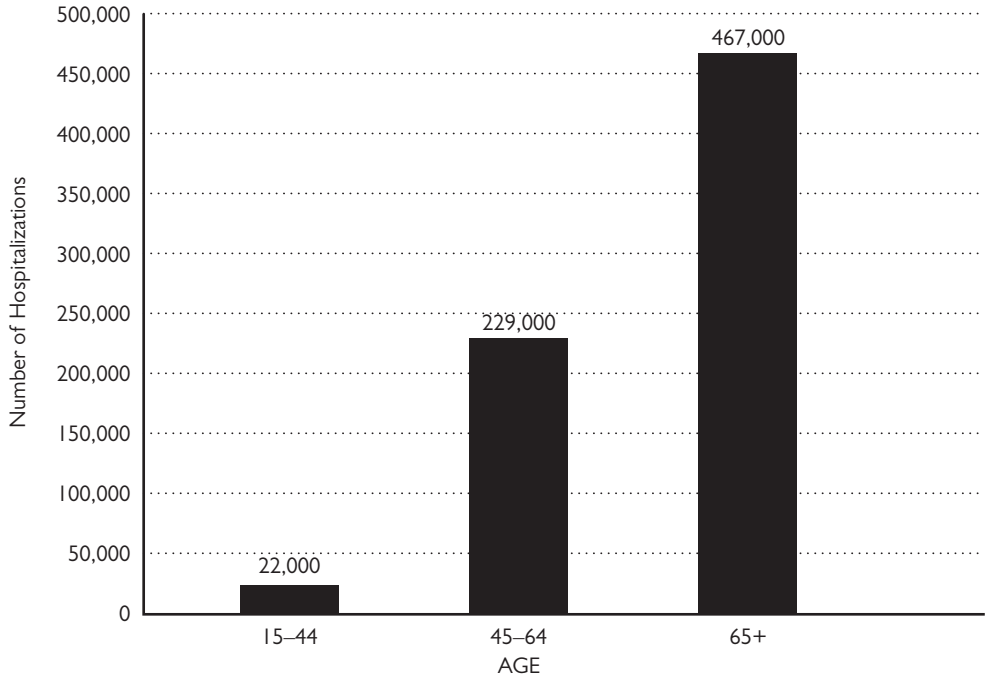


Source: Centers for Disease Control and Prevention. National Center for Health Statistics: National Vital Statistics Report. Deaths: Final Data for 2004.
Note:
* **Comparisons should only be made between groups and diseases using rates, not number of deaths, as these do not take into account differences which may exist in population size or demographics.**

An estimated 721,000 hospitalizations due to COPD were reported in 2005, a rate of 24.4 per 10,000 population.[37] Between 1988 and 1992, men had slightly higher rates of COPD hospitalization than women. However, since 1993, the rate in women has surpassed that for men. In 2005, the rates among men and women were 22.6 and 26.1 per 10,000, respectively. [38]

COPD is an important cause of hospitalization in the aged population. Approximately 65 percent of all COPD hospitalizations were in people 65 years of age and older in 2005. The rate for the population 65 years of age and older (126.9 per 10,000) was significantly higher than the rate for any other age group. For instance, the hospitalization rate in the 65 years of age and older group was over four times higher than that in the 45 to 64 years of age group (31.4 per 10,000).[39] The number of hospitalizations by age in 2005 are displayed in Figure 3.

Figure 3: Number of COPD Hospitalizations by Age, U.S., 2005[1,2,*]



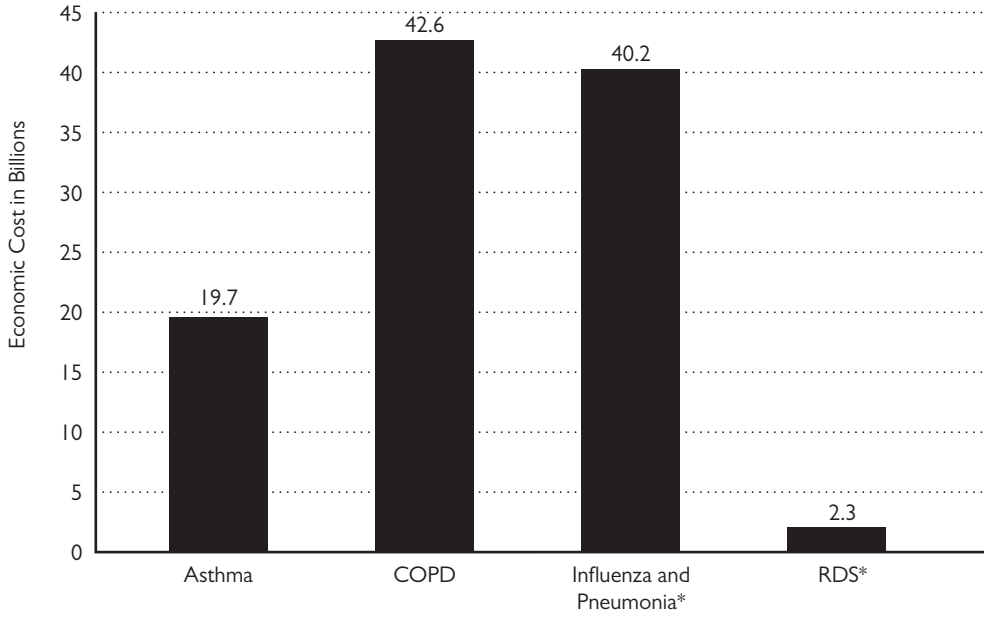
Source: National Center for Health Statistics. National Hospital Discharge Survey, 2005.
Notes:
1. ICD-9 codes 490-492, 494-496
2. Hospitalizations are estimated based on the recorded primary discharge diagnosis
* **Comparisons should only be made between groups and diseases using rates, not number of hospitalizations, as these do not take into account differences which may exist in population size or demographics.**

The impact of COPD on quality of life is profound. A survey by the American Lung Association revealed that half of all COPD patients (51%) say their condition limits their ability to work. It also limits them in normal physical exertion (70%), household chores (56%), social activities (53%), sleeping (50%) and family activities (46%).[40]

Patients with COPD also need psychological or other emotional support. COPD patients' inability to be as active as they once were, and their increasing dependency on others and even on machines, also can lead to profound depression and dependency, often further complicating their physical illness. One study of people with chronic breathing disorders found that 80 percent of the 1,334 people studied suffered from depression, anxiety or both. Although depression and anxiety are very treatable for people with COPD, only 31 percent of COPD patients are being treated for these conditions.[41]

Chronic bronchitis and emphysema take a heavy toll on the economy. According to estimates by the National Heart, Lung, and Blood Institute, in 2007 the annual cost to the nation for COPD was $42.6 billion. This included $26.7 billion in direct health care expenditures, $8 billion in indirect morbidity (illness-related) costs and $7.9 billion in indirect mortality (death-related) costs.[42] Figure 4 displays the economic cost of COPD compared to other select lung diseases.

Figure 4: Economic Cost of Selected Lung Diseases, U.S., 2007



Source: U.S. Department of Health and Human Services. National Institutes of Health. National Heart, Lung, and Blood Institute. Morbidity and Mortality: 2007 Chartbook on Cardiovascular, Lung, and Blood Diseases. Unpublished data provided upon special request to NHLBI.
Note:
* Unpublished data, 2005.

How is COPD diagnosed and managed?

COPD does not strike suddenly and is often neglected by individuals until it has reached an advanced state, because people mistakenly believe that the disease is not life-threatening. By the time a patient sees a health care provider, the lungs frequently have been critically injured and the patient may be in danger of developing serious respiratory problems or heart failure. For this reason, COPD is called the "silent killer."

COPD can be easily diagnosed with a pulmonary function test known as spirometry. Spirometry measures how well the lungs exhale. In the test, a person breathes into a mouthpiece connected to an instrument called a spirometer. The spirometer records the amount and rate of air that is breathed in and out over a specified time.

Other tests that may be used to assess a patient with COPD include bronchodilator reversibility testing, chest x-ray (to exclude other diagnoses), arterial blood gas measurement (amount of oxygen and carbon dioxide in the blood) and alpha-1 antitrypsin deficiency screening. Alpha-1 screening should be performed when COPD develops in patients under 45 years of age, in patients with a strong family history of COPD, people with COPD who have never smoked, smokers with a family history of COPD and people with a family history of alpha-1 emphysema.

If AAT deficiency is discovered in a child or young person in whom emphysema has not yet developed (in children, liver disease may also occur, and the defect

can be detected by a blood test), a remedy may be liver transplantation, effectively preventing emphysema. If lung disease is already evident, lung transplantation is sometimes considered.

A second treatment alternative for alpha-1 emphysema is administration of the missing AAT protein. However, AAT replacement therapy is costly and it must be given intravenously, on a weekly basis, for life. Its long-term effects are still being studied.

While COPD lung damage is irreversible, there are treatments that can improve a patient's quality of life. Stopping smoking is the single most effective—and cost-effective—way to reduce the risk of developing COPD and slow its progression. Any current or former smoker over age 40 or never-smoker with a family history of COPD, emphysema or chronic bronchitis, those with exposure to occupational or environmental pollutants and those with a chronic cough, sputum (matter discharged from air passages) production or breathlessness, should seek testing for COPD with spirometry.[43] For more information about the health benefits of quitting smoking, please see the tobacco chapter of this report.

Treatment with medication can improve and prevent COPD symptoms, reduce the frequency and severity of exacerbations, improve health status and improve the ability to exercise.

Bronchodilators are used to help open the airways in the lungs and decrease shortness of breath. Inhaled or oral steroids can help decrease inflammation in the airways in some people. Antibiotics are often used to treat infections.

A study was conducted among 6,112 patients between the ages of 40 to 80 who had been diagnosed with COPD and were current or former smokers. The study was conducted to determine the effect of inhaled corticosteroids and a long-acting bronchodilator on the treatment of COPD. The study supports the use of the drugs salmeterol plus fluticasone propionate in the management of COPD. This combination treatment resulted in less worsening of symptoms and improved health status and lung function.[44]

Non-drug treatment such as pulmonary rehabilitation, oxygen therapy and surgery can improve a COPD patient's quality of life. One factor that can help protect against COPD development or slow its progression is physical activity, which keeps muscles working effectively and may help slow the decline in lung function.[45]

Want to learn where pulmonary rehabilitation is available near you? Please visit **http://www.lungusa.org** or call the Lung HelpLine at 1-800-LUNGUSA (586-4872).

COPD patients of all ages benefit from pulmonary rehabilitation programs that focus on supervised exercise training and education to help the patients manage their disease. These activities play an important part in helping a patient maximize their ability to perform daily activities. The minimum length of an effective rehabilitation program varies with insurance coverage but is usually two months; the longer the program continues, the more effective the results.

The long-term administration of oxygen (>15 hours per day) to patients with chronic respiratory failure increases survival and exercise capacity and improves mental state. Close to one million persons living in the United States are on long-term oxygen therapy.[46] The introduction of portable oxygen concentrators has allowed thousands of patients with chronic lung disease to travel and maintain active lifestyles.

Lung transplantation is now being done and may be a more readily available option in the future. Techniques have been improving, many more such operations are being performed each year and pulmonary specialists are optimistic about the procedure's lifesaving potential. Racial disparities in who gets transplantations are due, in part, to social determinants of health such as poverty and unequal access to health care.[47] These factors need to be addressed in order to eliminate this disparity.

There has been much interest in a procedure called lung volume reduction surgery (LVRS), in which some of the most severely damaged lung tissue is removed to ease the burden on the remaining tissue and chest muscles. Recently, a study was conducted to determine the effects of LVRS. It was found that LVRS for pulmonary emphysema improved weight (body mass index), airflow obstruction, breathing difficulties (dyspnea) and exercise capacity (BODE) index. The BODE index is a predictor of survival in COPD.[48] Another study, conducted by the National Emphysema Treatment Trial Research Group, concluded that LVRS can be recommended for patients whose emphysema is concentrated in the upper-lobe of a lung and who suffer from low-exercise capacity, and may be considered for other patients.[49]

What is new in COPD research?

Scientists have identified a single gene, the SERPINA1 gene, located on human chromosome number 14, that bears the code that triggers AAT production in the liver.[50] Future therapy may correct this inherited defect by delivering DNA carrying the missing genetic coded "message" to the liver or other organs.

Recently, a study was conducted to determine the association between the use of corticosteroids in the treatment of COPD and the risk of pneumonia among the elderly. Almost 176,000 patients with COPD were followed for 15 years (1988-2003), with their use of inhaled corticosteroids and any hospitalizations due to pneumonia being tracked over this time. Use of inhaled corticosteroids was associated with a 70 percent increase in risk of hospitalization for pneumonia; those taking the largest dose (equivalent to fluticasone 1,000 micrograms per day or more) were at 2.3 times greater risk. The authors concluded that there is an excess risk of pneumonia hospitalization and an excess risk of hospitalization followed by death within 30 days for elderly COPD patients using inhaled corticosteroids. The death rate due to all causes was not different among pneumonia patients who had or had not inhaled corticosteroids in the recent past.[51]

As lung cancer risk may increase among patients with COPD, a study was conducted in 2006 to evaluate whether the use of inhaled corticosteroids by

COPD patients would decrease their risk of lung cancer. The study focused on patients who took their medication for COPD regularly (80% of the time) and found that corticosteroid medications show promise as a COPD medication and that these patients had a decreased risk of developing lung cancer.[52] Other studies also support the use of corticosteroids in the treatment of COPD to reduce the risk of death and lung cancer.[53,54]

What is the American Lung Association doing about COPD?

The American Lung Association funds researchers working in the laboratory and with patients who are looking for answers to fundamental questions about how the lungs are damaged in COPD and what can be done to treat and prevent this destruction. Several examples of the many COPD studies being funded by the American Lung Association include:

Determining the risk of COPD in HIV-positive versus HIV-negative smokers.

Examining two types of molecules involved in inflammation, interleukin-13 (IL-13) and leukotrienes, to see whether they play a role in determining who develops COPD from cigarette smoke exposure.

Investigating whether excess air trapped in the lungs may be one of the reasons why some patients with COPD remain dependent on a mechanical ventilator.

Studying a protein, elastin, responsible for the elasticity of the lungs. When elastin in the lungs is broken down, lung elasticity is lost, a hallmark of COPD. Building a comprehensive understanding of the role of elastin in COPD eventually will allow for positive identification of patients at increased risk for premature and severe forms of COPD.

The American Lung Association is currently working on a nationwide initiative to create state-of-the-art programs and services as well as to facilitate collaborative partnerships with key organizations who share the Lung Association's commitment to improve the quality of life for people living with COPD.

In advocacy, the American Lung Association is a leader in COPD-related policy change in Congress. The Lung Association advocates for increasing funding for COPD research at the National Institutes of Health, Department of Veterans Affairs and other federal programs. The Lung Association also is working to raise the profile of COPD at the Centers for Disease Control and Prevention. As a longtime leader on tobacco control, Lung Association volunteers and staff advocate for policies at the federal, state and local level that will increase access to smoking cessation programs, protect the public from secondhand smoke, and prevent children from starting to smoke. Such policies include comprehensive state and local smokefree laws, granting the U.S. Food and Drug Administration (FDA) regulatory control over the manufacturing, distribution and advertising of tobacco products, increasing funding for comprehensive tobacco control and cessation programs at the state level, and increasing cigarette excise taxes. The Lung Association actively supports legislation to provide

Medicare coverage for pulmonary rehabilitation services for COPD patients. Further, the Lung Association continues to work for regulatory changes to facilitate air travel for patients on oxygen therapy. As a member of the U.S. COPD Coalition's policy workgroup, the American Lung Association works closely with key members of the Congressional COPD Caucus, which promotes public awareness, prevention and early detection of COPD.

The Lung Association also has worked to increase state and national surveillance and collection of data on COPD. For example, due to several proposals by the Lung Association, the state of Hawaii will include a question in its 2008 Behavioral Risk Factor Surveillance Survey (BRFSS) on COPD in order to collect state-level prevalence data. The Lung Association is optimistic that other states will follow Hawaii's lead in the future so that state-level COPD surveillance can be attained nationwide. In turn, effective programs can be developed targeting states with high prevalence of COPD in order to reduce its burden.

People with COPD often say that one of the worst aspects of their illness is the feeling that they have lost control over their health. For over 40 years, the American Lung Association has helped millions of patients through its Better Breathers Clubs. These support groups are located throughout the United States and meet regularly to provide peer support and education needed to understand and better manage the disease. These clubs are for adults with all chronic lung diseases, their families and their caregivers.

By joining a support group, participants gain a sense of control over their disease and enter a positive cycle: They get out of the house, meet other people and become motivated to take action. Then they start to feel better—psychologically and physically.

Want to learn more about Better Breathers Club and find one in your area? Please view the club listings at **http://www.lungusa.org/bbc**

Often these groups are led by a respiratory therapist who can educate group members and their families about ways to live well with COPD. Groups may invite medical professionals to share their expertise on topics including nutrition, exercise, breathing techniques, new treatments, stress and depression, and medical equipment. The education patients receive in these groups may help them to avoid preventable hospitalizations and emergency room visits.

The COPD NexProfiler is an interactive decision support tool provided under the auspices of the American Lung Association and NexCura, Inc. The COPD NexProfiler helps COPD patients and their physicians make better-informed treatment decisions using information from evidence-based, peer-reviewed medical literature.

Need help with treatment decisions for COPD? Please view the COPD NexProfiler at **http://www.lungusa.org/copdtreatment**

Thousands of patients with COPD have joined with the Lung Association to

tell Congress to make life easier for people with this disease by broadening the use of portable oxygen concentrators and other approved devices on airplanes, by cleaning up outdoor pollution and by covering pulmonary rehabilitation under Medicare. Join the American Lung Association in its advocacy work by visiting http://lungaction.org.

In addition to its advocacy efforts, the Lung Association offers smoking cessation programs such as Freedom From Smoking® and Not On Tobacco, as well as self-help programs to assist smokers who want to quit. The American Lung Association Lung Help Line (1-800-LUNG-USA; 586-4872), staffed by registered nurses, respiratory therapists and quit-smoking specialists offers free counseling and support to callers, including those seeking information about COPD.

Cystic Fibrosis

What is cystic fibrosis?

Cystic fibrosis (CF) is a lifelong, hereditary disease that causes thick, sticky mucus to form in the lungs, pancreas and other organs. In the lungs, this mucus blocks the airways, causing lung damage and making it hard to breathe. In the pancreas, it clogs the pathways leading to the digestive system, interfering with proper digestion. In 90 percent of cases, the airways are affected.

Cystic fibrosis is the second most common inherited disorder occurring in childhood in the United States, behind sickle cell anemia. CF results in shortened life expectancy. More than 10 million Americans are unknowing, symptomless carriers of the defective cystic fibrosis gene. [1]

An individual must inherit a defective gene from each parent to have cystic fibrosis. Each time two carriers of the defective gene conceive, there is a 25 percent chance that their child will have cystic fibrosis; a 50 percent chance that the child will be a carrier of the gene; and a 25 percent chance that the child will not have the gene at all. The odds remain the same with each child.[2]

Want to learn more about Cystic Fibrosis (CF)? Please view the CF fact sheet at **http://www.lungusa.org/cffactsheet**

Although CF begins at conception, symptoms may not appear at first. The severity and symptoms of the disease vary considerably due to different mutations of the gene.[3] Diagnosis is sometimes delayed for decades because of the mildness of the symptoms or failure to recognize them. Only about 10 percent to 15 percent of babies with cystic fibrosis have symptoms at birth. Typical symptoms include:

- wheezing,
- persistent cough and excessive mucus,
- repeated cases of pneumonia,
- abnormal bowel movements,
- salty-tasting skin (which parents often notice when they kiss their child),

- failure to gain weight despite a good appetite,
- swollen belly accompanied by abdominal gas and discomfort, and
- broadening of the fingertips and toes.

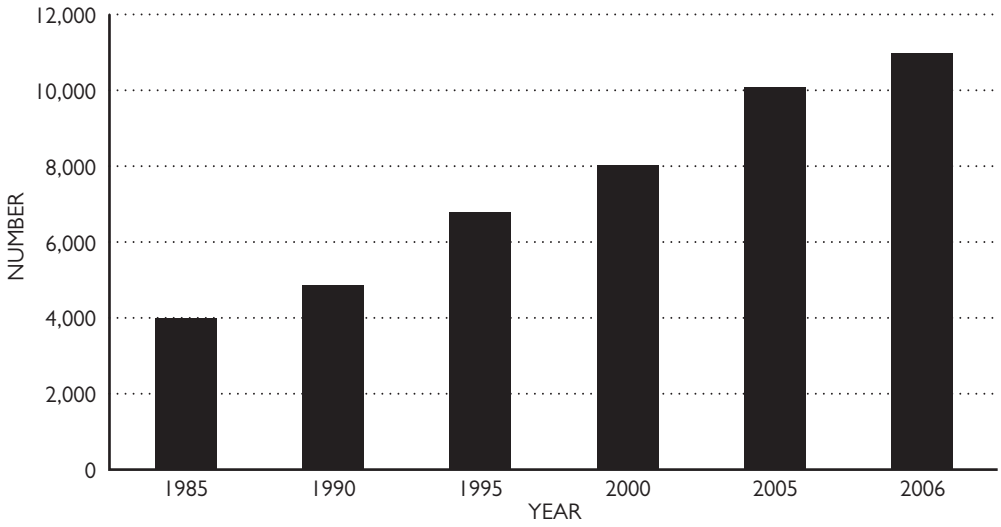
Who has cystic fibrosis?

Approximately 30,000 Americans have CF and there are an estimated 1,000 new cases diagnosed each year. It occurs equally in male and female babies and affects nearly every race.[4]

The overall birth prevalence of CF in the United States is about 1 in 3,700.[5] Cystic fibrosis occurs most commonly among Whites. It is estimated that 1 in 2,500 White births are affected in comparison to 1 in 13,500 Hispanics, 1 in 15,100 African Americans, and 1 in 31,000 to more than 100,000 Asians.[6] In the Cystic Fibrosis Foundation's Patient Registry of 24,487 cystic fibrosis patients, almost 95 percent were White, almost 7 percent were Hispanic and 4 percent were Black.[7] More than 70 percent of patients are diagnosed by age two.[8]

Figure 1 shows the number of adults with cystic fibrosis from 1985 to 2006.

Figure 1: Number of Adults with CF, U.S., 1985–2006*



Source: Cystic Fibrosis Foundation. Patient Registry 2006 Annual Report.
Note:
* **Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

Want to learn more about CF in diverse communities? Please view the *State of Lung Disease in Diverse Communities: 2007* report at **http://www.lungusa.org/solddc-cf**

What is the health impact of cystic fibrosis?

Of all the aspects of CF, lung disease is by far the most critical, causing a combination of airway obstruction, infection and inflammation that accounts for almost all deaths from the disease.

Children with CF can easily get lung infections, and the chronic lung dysfunction itself can cause severe debilitation. This can lead to pulmonary hypertension, which may in turn cause heart disease.

In 2004, 460 Americans died of cystic fibrosis, an age-adjusted mortality rate of 1.6 per million population.[9] Treatment of the disease has improved substantially over the past 25 years. The median age of survival in 2006 was 36.9 years compared to 25 years in 1985, 14 years in 1969 and 5 years in 1955.[10]

Recent estimates show an excess of $40,000 per year in direct medical costs and $9,000 per year in secondary costs per cystic fibrosis patient.[11]

How is cystic fibrosis diagnosed and managed?

The sweat test is the standard diagnostic test for cystic fibrosis. This test measures the amount of salt in the sweat. A high salt level indicates that a person has CF.[12]

Cystic fibrosis also can be identified before birth through prenatal screening and after birth through newborn screening. In 2001, the American College of Obstetricians and Gynecologists recommended that pregnant women be offered screening for genetic mutations. According to a 2004 report, about 20 percent of pregnant women in the United States receiving prenatal care were being screened for CF.[13]

In 2004, the Centers for Disease Control and Prevention recommended that all states consider routine screening for CF in all newborns. A review of research on CF screening of newborns found that it offered major benefits in improved growth, reduced number of infections and better chest scan results among CF patients.[14]

The specific gene responsible for the disease was identified in 1989 and since then, more than 1,500 mutations and DNA sequence variations have been identified in the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) gene.[15] The Delta F508 mutation is the most common and is found in almost all racial and ethnic groups. Delta F508 accounts for approximately 70 percent of all CF genes.[16] Genetic testing is available but is not commonly used because it does not catch all mutations. It only has a detection rate of 70 percent to 75 percent for potentially defective genes.

Theoretically, gene therapy is possible—delivering a "healthy" gene to the victim to replace the defective one. In April 2003, researchers announced encouraging results from the first-of-its-kind gene therapy trial involving CF patients and a new DNA technology in which strands of DNA are passed through a cell membrane and into the nucleus of the cell. The goal is for the DNA to produce a protein needed by people with CF to correct the basic defect of CF cells. The Phase I (safety) trial involved 12 patients, all of whom completed the trial without any major problems. The treatment was well tolerated, according to researchers at Case Western Reserve University, University Hospitals of Cleveland and Copernicus Therapeutics.[17] Currently, this product is being reformulated to increase its effectiveness before further clinical trials.[18] *Note: Successful gene*

therapy would affect only the individual patient. It would not prevent the defective genetic messages being relayed to offspring.

Until a cure for CF is developed, there are various treatment options. Treatment depends upon the stage of the disease and the organs involved. A variety of airway clearance techniques are used to clear mucus from the lungs and are an important part of CF management.[19]

Antibiotics are used to treat lung infections and are given intravenously, with pills and/or medicated vapors which are inhaled to open up clogged airways.[20]

Drugs delivered by aerosol represent an important breakthrough in treatment of the lung-disease aspects of cystic fibrosis. One such drug being used is a genetically engineered enzyme called recombinant human deoxyribonuclease, also known as rhDNase, or simply DNase. The enzyme, administered in aerosol form, thins out the mucus that clogs CF patients' airways, reducing the number of lung infections and improving lung function. The prescription drug does not replace standard therapies but is used in addition to them.

Bronchodilators have helped to deal with chronic lung dysfunction, and state-of-the-art diagnostic techniques, such as nuclear imaging, have permitted more accurate assessment of patient status. Corticosteroids and other anti-inflammatory drugs have been evaluated in several studies.

In some cases, lung transplantation has been attempted and over the past 10 years double-lung transplantation has replaced heart-lung as the preferred procedure. There has been steady improvement in the outlook with refinements in both surgical techniques and anti-rejection measures. As in other areas of medicine, there is a lack of donors and there are long waiting lists. However, a recent study published in the *New England Journal of Medicine* failed to show improved survival in children with CF who were selected for lung transplantation.[21]

Today, almost 45 percent of the cystic fibrosis population is aged 18 years or older. With the advances in treatment, however, adults with cystic fibrosis experience additional health challenges including CF-related diabetes, osteoporosis and infertility in men.[22]

What is new in cystic fibrosis research?

Quality research of CF is challenging because of the small number of patients available for study, a result of the comparatively low prevalence and life-shortening nature of the disease. However, by focusing on the research outcome measures of clinical efficacy and biomarkers, scientists already have identified several encouraging drug candidates. Future research using these methods will provide definitive efficacy and safety data needed to make drugs available to patients and clinics. [23]

Gene therapy is currently being explored but until it is deemed safe and effective by the medical community, it will not be available.[24]

Developments in treatment already have made chest mucus clearing easier for patients and allowed them increased freedom by enabling independent treat-

ment, without aid or supervision. Continued efforts on this front will further increase the ease of treatment, while the focus of CF patient care shifts toward new psychosocial challenges created by longer expected life spans, such patients taking over responsibility for treatment and care, gaining independence from parents and managing personal relationships.[25]

What is the American Lung Association doing about cystic fibrosis?

The American Lung Association is currently funding several studies on cystic fibrosis. The majority of these studies, being conducted at the University of Iowa, John Hopkins Children's Center, University of New Mexico and Duke University, seek to better understand the relationship between various bacterial agents and the disease.

Want to learn more about additional studies funded by the American Lung Association? Please visit the website at **http://www.lungusa.org/researchawardsnationwide**

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight cystic fibrosis. Join us to win the battle against lung disease by visiting http://lungaction.org.

HIV/AIDS-Related Lung Disease

What is the connection between HIV/AIDS and lung disease?

Human immunodeficiency virus (HIV) is the virus that causes acquired immunodeficiency syndrome (AIDS). It is passed from one person to another through blood, bodily fluids and sexual contact. In addition, infected pregnant women can pass HIV to their babies during pregnancy or delivery, as well as through breast-feeding.

HIV targets an important kind of white blood cell called the CD4 T-lymphocyte or T cells. T cells belong to the immune system and protect the body from germs and other disease-causing agents. As these important cells die, the body becomes more and more vulnerable to other diseases. Germs take this opportunity to invade the body and cause infections. People may be infected with HIV for years before developing AIDS.

AIDS is said to be present when people with HIV contract opportunistic infections. Such infections are called "opportunistic" because they occur only extremely rarely in people who do not have HIV/AIDS and have a normally functioning immune system. The lung is a major area of opportunistic infection in people living with HIV and AIDS.

The major risk factors for HIV/AIDS are unprotected sex, both homosexual and heterosexual, and intravenous drug use. The percentages of each may vary in different areas of the country.

Who has HIV/AIDS and related lung diseases?

AIDS is a worldwide epidemic. Most cases are found in Africa, but the disease is spreading most rapidly in Eastern Europe and Asia. According to the Joint United Nations Program on HIV/AIDS, there were an estimated 38.6 million people worldwide living with HIV/AIDS at the end of 2005. Of these, 36.3 million were adults, 17.3 million were women and 2.3 million were children 14 years of age or younger.[1]

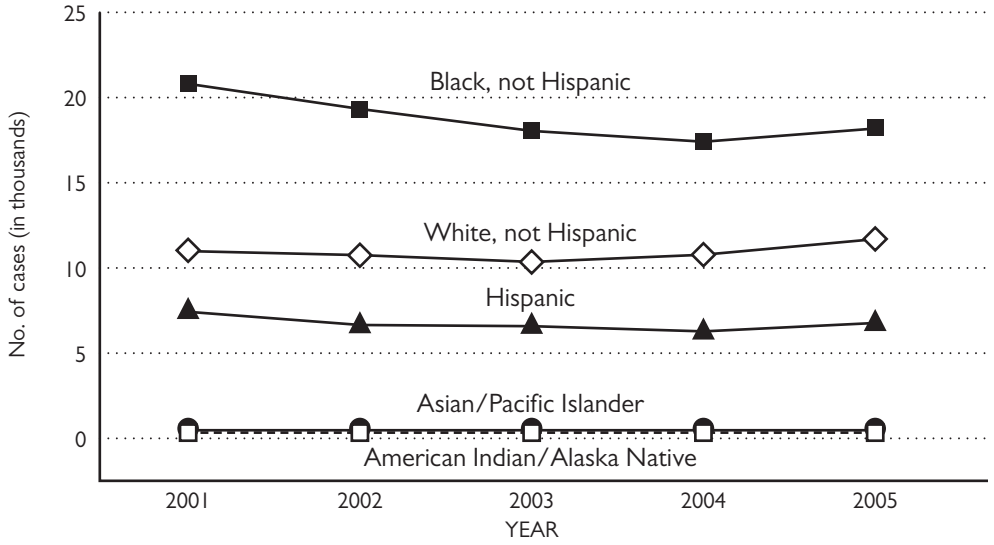
At the end of 2005, an estimated 475,220 persons in the United States were living with HIV/AIDS.[2] Approximately 25 percent of people with the infection

are unaware of their HIV-positive status.[3] The Centers for Disease Control and Prevention (CDC) estimates that there are approximately 40,000 new cases of HIV/AIDS in the United States each year.[4]

In the United States, HIV/AIDS is distributed unevenly among diverse communities. Since the epidemic began in 1981, racial and ethnic minority populations have constituted 61 percent of AIDS cases.[5]

Of the 40,608 AIDS cases newly diagnosed in 2005 among the 50 states and the District of Columbia, 50 percent were in non-Hispanic Blacks, 29 percent in non-Hispanic Whites, 19 percent in Hispanics, less than 2 percent in Asians and less than 1 percent in Native Americans. Figure 1 shows the number of HIV/AIDS cases among those aged 13 years and older by race/ethnicity and year. Non-Hispanic Blacks have a prevalence rate of HIV/AIDS that is eight times higher than non-Hispanic Whites. However, the number of cases in Blacks decreased the most compared to all other races since 2001 until recently when a rise was noted. The reversal of this trend is a cause for concern.[6]

Figure 1: Cases of HIV/AIDS by Race/Ethnicity and Year of Diagnosis, U.S., 2001–2005[1,2,3,*]



Source: Centers for Disease Control and Prevention. Department of Health and Human Services. Public Health Service. HIV/AIDS Surveillance Report. Cases of HIV Infection and AIDS in the United States and Dependent Areas, 2005. 17 (revised June 2007).

Notes:

1. Reported case counts have been adjusted for reporting delays.
2. Cases in persons 13 and older.
3. 33 states with confidential name-based HIV infection reporting.

* **Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

Forty-seven percent of the estimated 475,220 persons living with HIV/AIDS in 2005 were among non-Hispanic Blacks, more than all other racial/ethnic groups combined. These disparities show the need for an increase in prevention programs and development of new and culturally appropriate interventions.[7]

HIV was first recognized in the male gay community over 20 years ago, which initially led many people to think of it mistakenly as a "gay disease." As the number of people becoming infected with HIV/AIDS through high-risk heterosexual behavior or intravenous drug use continues to rise, this misconception has faded, although discrimination against gay men on the grounds that they are associated with HIV/AIDS still persists. Today, when most health experts talk about HIV/AIDS prevention for gay men, they focus on groups that have traditionally been hard to reach with safer-sex information: young gay men and gay men of color.

From 2001 through 2005, the estimated number of HIV/AIDS cases increased among men who have sex with men and women exposed through high-risk heterosexual contact. Of the estimated 341,524 male adults and adolescents living with HIV/AIDS in 2005, 61 percent had been exposed through male-to-male sexual contact. Thirteen percent had been exposed through high-risk heterosexual contact. Of the 126,964 estimated female adults and adolescents living with HIV/AIDS, 72 percent had been exposed through high-risk heterosexual contact.[8]

Which lung diseases are associated with HIV/AIDS and what is their health impact?

Some of the most common opportunistic infectious lung diseases seen in HIV-positive or AIDS patients are *pneumocystis carinii* pneumonia, tuberculosis, mycobacterium avium complex, fungal infections and viral and bacterial pneumonia. As improved treatment has reduced the risk of premature death from these diseases, other chronic complications such as pulmonary hypertension also have emerged.[9]

Pneumocystis carinii pneumonia

Pneumocystis carinii pneumonia (PCP) is the first sign of illness in more than half of all persons with AIDS in the United States. This disease is caused by the *Pneumocystis jiroveci* germ, formerly known as *Pneumocystis carinii*. Without preventive medicine, over 80 percent of people with HIV will likely get PCP. Common symptoms include coughing, fever and trouble breathing. Many people who are HIV positive take medication to prevent PCP; frequent blood tests help health care providers decide when such treatment should begin.[10]

Tuberculosis

Tuberculosis (TB) is caused by the bacillus *Mycobacterium tuberculosis*. One-third of the increase in global TB cases over the last five years can be attributed to the HIV epidemic.[11] HIV suppresses the immune system, opening the door to both new active TB disease and activation of latent or dormant TB infection. This means that someone who is infected with both TB and HIV has a 7 to 10 percent chance per year of developing active TB disease, compared to a 10 percent *lifetime chance* in people without HIV.[12]

From 2005 to 2006, the percentage of TB cases with HIV infection decreased 4.4 percent (from 13.0% to 12.4%), among TB patients where HIV status was

reported. But the percentage of TB cases with unknown HIV status increased 10.3 percent (from 28.7% to 31.7%).[13] The simplest way to test for TB infection is to get a TB skin test, widely available at health care clinics or health providers' offices. For HIV-positive individuals co-infected with TB, the CDC and American Thoracic Society recommend a minimum of six months of treatment, even if TB test results are negative.[14] People with HIV infection may test negative even though they have TB infection and may need to be retested. To learn more about tuberculosis, review the TB section of this report.

Mycobacterium avium-M. intracellulare complex (MAIC, MAC or MAI)

Mycobacterium avium-M. intracellulare complex (MAIC) exists throughout the environment and rarely causes lung disease in healthy people. Several different syndromes are caused by MAIC. In the lungs, it may set up infections in previously injured areas, such as bronchiectasis. Also, it causes a chronic form of pneumonia in postmenopausal, nonsmoking white women known as "Lady Windermere Syndrome."[15] However, in persons with impaired immunity (such as those with AIDS), widespread infection occurs which can spread to all organs and is fatal if left untreated.[16] MAIC afflicts about 20 percent to 30 percent of all individuals with AIDS.[17] In 95 percent of AIDS-related MAIC infections, M. avium is the infectious agent.[18] It is usually not the first sickness for those who are HIV positive and is most often seen once a person's CD4 cell count falls below 50 cells per cubic millimeter of blood.[19]

MAIC infection is diagnosed by laboratory testing. There are some drugs available for reducing the chances of developing MAIC syndromes and it is usually treated with a combination of two or more antibiotics, to reduce the likelihood of antibiotic resistance.[20]

Fungal infections

While fungal infections such as candidiasis or coccidioidomycosis (see Other Lung Diseases section of this report) may cause illness in people who do not have AIDS, the infections are more common, more severe and more difficult to treat in AIDS patients. A number of antifungal drugs are used to treat these infections and others are under investigation. Fungal infections of the lung cannot be transmitted from an AIDS patient to healthy people.

Viral and bacterial pneumonia

Viral and bacterial pneumonia are easily contracted by persons with AIDS and HIV. Major causes of viral pneumonia in persons with weak immune systems are members of the herpes virus family, which are stubbornly resistant to treatment. Bacterial pneumonia can be caused by various bacteria strains such as *Haemophilus influenzae,* but can be treated with antibiotics.

Pulmonary hypertension

Treatment with highly active antiretroviral medication has helped many HIV patients survive longer. Unfortunately, use of these drugs can lead to increased rates of organ damage, cardiovascular diseases, complications and opportunistic infections associated with HIV and AIDS.[21] Pulmonary arterial hypertension (PAH) is an emerging complication in HIV patients.[22] PAH is a serious condition involving high blood pressure in the arteries that carry blood from the body to

the lungs, where the blood receives a fresh supply of oxygen. Over time, the increased blood pressure requires the heart to work harder, causing it to weaken and pump less blood than the body needs, resulting in heart failure. There is no cure for PAH, although treatment can be beneficial.[23] To learn more about PAH, review the PAH section of this report.

Want to learn more about HIV/AIDS and lung disease? Please view the fact sheet at **http://www.lungusa.org/hivfactsheet**

How are HIV/AIDS and related lung diseases diagnosed and managed?

It is important to know one's HIV status to avoid spreading the virus and so prompt treatment can be pursued. Many people with HIV do not get tested until late in their infection; many who are tested do not return to learn their test results. The standard diagnostic tests for HIV are the ELISA (enzyme-linked immunosorbent assay) and Western Blot; both look for antibodies to HIV in a blood sample. Other body fluids such as saliva and urine can be screened for HIV antibodies. However, results from these tests can take up to a week. Currently, there are four rapid HIV tests approved by the U.S. Food and Drug Administration.[24]

Want to know more about rapid HIV tests currently available? Please visit **http://www.cdc.gov/hiv/topics/testing/resources/factsheets/rt-lab.htm**

It usually takes many years for HIV infection to weaken the body's immune system to the point of AIDS. Anti-HIV drugs do not cure or reverse the disease but may slow the progress of the virus by interfering with its reproduction and proliferation, thus helping people with HIV infection live longer and healthier lives. Since the introduction of combination antiviral therapy, the number of new AIDS cases and deaths have declined substantially.[25]

Lung diseases related to HIV/AIDS are preventable and can be treated with a variety of drugs. A health care provider will decide which drug regimen is right for each individual patient.[26]

What is new in HIV/AIDS research?

In September 2007, two studies testing a potential HIV vaccine were halted when a review of initial results showed that those volunteers receiving the vaccine were more likely to become infected with HIV. While reasons for this outcome currently are unknown, researchers continue gathering information from the trials even though no new volunteers are being accepted. It is hoped that this attempt, while unsuccessful, can help develop the next generation of HIV vaccines.[27]

CDC researchers are examining the benefits of rapid HIV testing as a routine part of medical care, such as testing when an individual is admitted to an

emergency room. Initial results found that using dedicated HIV counselors to offer testing information resulted in a higher proportion of people willing to be tested (>90%), although fewer people were offered testing (<4% of those eligible). When regular medical staff offered testing, patients were less likely to accept (52.8%). But since many more people were offered testing using this method, the actual number of those tested was higher.[28] Integrating HIV testing into routine medical care can identify those previously undiagnosed with HIV. A combined approach using both HIV counselors and other medical staff may increase the testing capacities and acceptance rate of HIV testing.

What is the American Lung Association doing about lung diseases related to HIV/AIDS?

Studies on HIV/AIDS are currently being conducted with support from the American Lung Association. One study is investigating HIV infection and lung injury. The study results will provide insight into how HIV infection impairs lung function and increases susceptibility to infections such as tuberculosis, and may lead to innovative therapies to prevent HIV-related lung damage.

A second American Lung Association-supported study compares the risk of chronic obstructive pulmonary disease (COPD, which includes emphysema and chronic bronchitis) in HIV-positive and HIV-negative smokers. While patients infected with HIV may have an increased risk of COPD, its presence among HIV-positive individuals has not been compared with HIV-negative control.

Researchers seek to better understand COPD in both HIV-infected and uninfected persons.

Want to learn more about research funded by the ALA on HIV/AIDS-related lung diseases? Please use the search tool available at **http://www.lungusa.org/researchawardsnationwide**

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight lung diseases related to HIV and AIDS. Join the Lung Association to win the battle against lung disease by visiting http://lungaction.org.

Influenza and Pneumonia

What are influenza and pneumonia?

Influenza (flu) is a highly contagious viral infection that is one of the most severe illnesses of the winter season. The reason influenza is more prevalent in the winter is not known; however, data suggest the virus survives and is transmitted better in cold temperatures. Influenza is spread easily from person to person, usually when an infected person coughs or sneezes.

A person can have flu more than once because the virus that causes the disease may belong to different strains of one of three different influenza virus families, A, B or C. Type A viruses tend to have a greater effect on adults, while Type B viruses are a greater problem in children.[1]

Symptoms of influenza include fever, headache, cough, chills, sore throat, nasal congestion, muscle aches, loss of appetite and a general achy and lousy feeling.

Want to learn more about the symptoms of influenza? Please view the disease listing at **http://www.lungusa.org/flu**

Influenza can be complicated by pneumonia, which is a serious infection or inflammation of the lungs. The air sacs fill with pus and other liquid, blocking oxygen from reaching the bloodstream. If there is too little oxygen in the blood, the body's cells cannot work properly, which can lead to death.

Pneumonia can have over 30 different causes which include various chemicals, bacteria, viruses, mycoplasmas[1] and other infectious agents such as pneumocystis (fungi). Certain diseases, such as tuberculosis, also can cause pneumonia. Pneumonia also can be caused by the inhalation of food, liquid, gases or dust. The most common cause of community-acquired (compared to hospital-acquired) pneumonia is the pneumococcus bacterium; infection by this bacterium is known as pneumococcal disease.[2] The pneumococcal bacterium also causes meningitis, bacteremia, otitis media and sinusitis.[3]

Symptoms of pneumonia include fever, wheezing, cough, chills, rapid breathing, chest pains, loss of appetite and malaise, or a general feeling of weakness or ill health.

[1] Mycoplasma is an infectious organism which has characteristics of both bacteria and viruses.

Want to learn more about the symptoms of pneumonia? Please view the disease listing at **http://www.lungusa.org/pneumonia**

Who gets influenza and pneumonia?

People most at risk from these infections and their complications are those whose defenses against disease are not operating well. They include the very young, the very old, those with chronic disease and those whose immune systems have been affected by birth defects, medications (including some drugs used to treat cancer) or AIDS.

About 5 percent to 20 percent of the population gets the flu each year.[4] In the United States, influenza generally strikes between December and March, although it may appear a little earlier.

Along with other respiratory conditions, such as the common cold and acute bronchitis, these disorders are major causes of days lost from work and school.

What are the health impacts of influenza and pneumonia?

Influenza and pneumonia are major causes of illness and death. In 2005, these conditions ranked as the eighth leading cause of death in the United States and the sixth leading cause in people over 65 years of age.[5]

In 2004, 59,664 deaths from these diseases were recorded, for a combined death rate of 19.8 per 100,000. Of these, pneumonia caused the majority of deaths (58,564). Close to 90 percent of influenza and pneumonia deaths occurred in persons aged 65 and over.[6] According to preliminary data, there were 62,804 deaths due to influenza and pneumonia in 2005, an age-adjusted rate of 20.3 per 100,000.[7]

Influenza deaths have increased substantially in the last two decades, in part because of the aging population.[8] Influenza and its complications are responsible for an average of 226,000 hospitalizations and 36,000 deaths in the United States each year.[9] The number of influenza deaths includes associated underlying respiratory and circulatory deaths in order to provide a more specific estimate of the total burden of influenza.[10]

Want to learn more about influenza? Please view the fact sheet at **http://www.lungusa.org/influenzafactsheet**

Influenza and pneumonia are most likely to require hospitalization in those over 65 years of age. Data from 2005 show that persons aged 65 and older accounted for 60 percent of the total number of pneumonia hospital discharges (the diagnosis made upon leaving a hospital stay).[11] The number (36,000) and rate (9.8 per 10,000 persons) of influenza discharges were both highest in those 65 years and older.[12]

Pneumonia can strike anyone at any time of the year. All-cause pneumonia hospital admission rates for children under two years in age in 2004 were 39

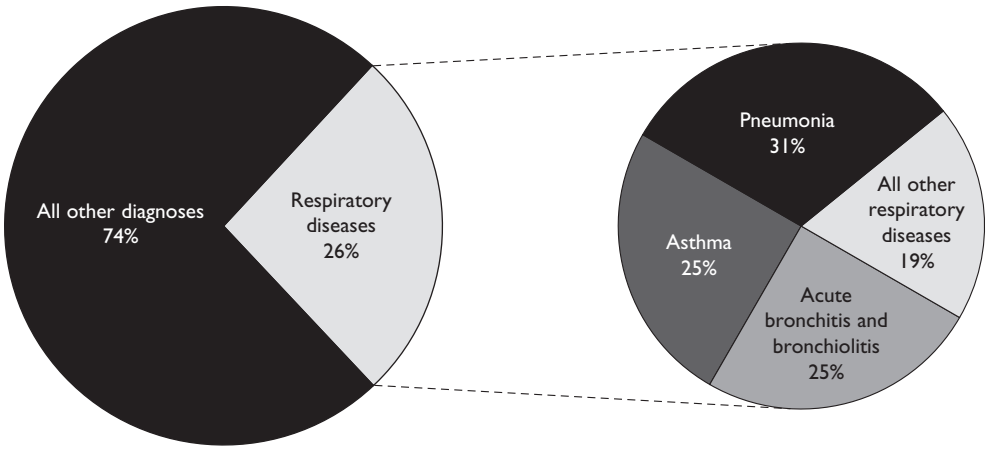
percent lower than during 1997 to 1999, a decrease in approximately 41,000 pneumonia admissions for that year. This decrease was due to the release and broad administration of a new pneumonia vaccine in 2000.[13]

Want to learn more about pneumonia? Please view the fact sheet at **http://www.lungusa.org/pneumoniafactsheet**

From 2000 to 2004, the average annual influenza hospitalization rate was 0.9 per 1,000 children under five years of age. This age group also was responsible for 95 clinic and 27 emergency department visits per 1,000 children during the 2003-2004 flu season. Despite the usefulness of rapid influenza tests, only 28 percent of hospitalizations and 17 percent of outpatient visits had a discharge diagnosis of influenza among children with laboratory-confirmed influenza. Improving these rates will offer the opportunity for improved infection control, increased use of antiviral therapy, and education about vaccination.[14]

Figure 1 shows the percent of all hospitalizations due to respiratory diseases and the type of respiratory disease for children under 15 years of age. Over a quarter (26%) of all hospitalizations in 2005 for this age group was due to respiratory diseases; almost a third (31%) of those were due to pneumonia.[15]

Figure 1: Hospitalizations for Types of Respiratory Diseases, Children Under 15 Years, 2005

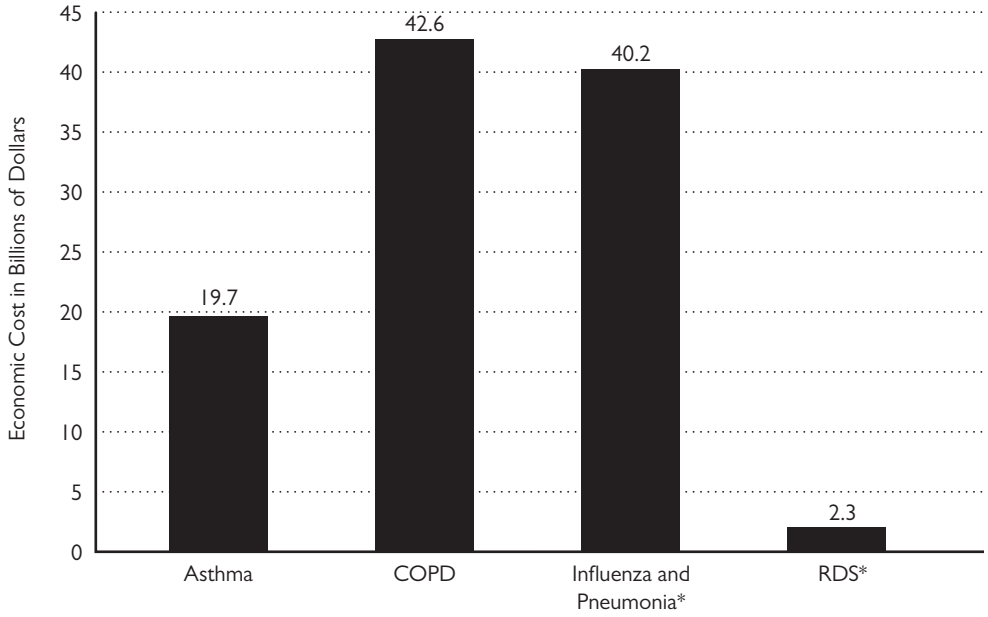


Source: Centers for Disease Control and Prevention. Quickstats: Percentage Distribution of Hospitalizations for Types of Respiratory Diseases Among Children Aged <15 Years—National Hospital Discharge Survey, United States, 2005. *Morbidity and Mortality Weekly Report.* July 20, 2007; 56(28):713.

Want to learn more about pneumonia and influenza trends and data? Please view the Trend Report on Pneumonia and Influenza, which includes information and statistics on morbidity and mortality attributed to pneumonia and influenza available from national surveys and vaccine recommendations to prevent pneumonia and influenza, at **http://www.lungusa.org/pitrends**

Together, pneumonia and influenza cost the U.S. economy more than $40.2 billion in 2005. This figure includes more than $6 billion due to indirect costs (such as time lost from work) and $34.2 billion due to direct costs (such as medical expenses).[16] Figure 2 shows the total economic cost of influenza and pneumonia in the United States compared to other lung diseases.

Figure 2: Economic Cost of Select Lung Diseases, U.S., 2007



Source: U.S. Department of Health and Human Services. National Institutes of Health. National Heart, Lung, and Blood Institute. Morbidity and Mortality: 2007 Chartbook on Cardiovascular, Lung, and Blood Diseases and unpublished data provided upon special request to NHLBI.
Note:
* Unpublished data, 2005.

Can influenza and pneumonia be prevented?

Influenza

Influenza viruses change constantly and different strains circulate around the world every year. The body's natural defenses cannot keep up with these changes. Therefore, a person should get a flu vaccine each year. The flu vaccine is modified on the assumption of which strain will most likely be dominant throughout the season. However, this prediction may not be 100 percent accurate, as has been the case with the 2007-2008 flu season. Therefore the effectiveness of the flu vaccine will vary with each new season.

The Advisory Committee on Immunization Practices (ACIP) recommends influenza vaccination for all persons, including school-age children, who want to reduce the risk of becoming ill with influenza or giving it to others. For anyone at high risk, influenza can be a very serious illness and the ACIP strongly recommends vaccination. Annual immunization is the best way to protect against influenza.[17] The American Lung Association urges anyone at high risk to get vaccinated as early as possible during the influenza season. Vaccination typically begins in October and can continue through March.

In most seasons, influenza virus activity does not peak until February or March.[18]

The flu shot may be given at the same time as other routine immunizations, such as pertussis, and is recommended for children at risk for influenza-related complications, such as those who have asthma. Protection lasts approximately six months. The influenza vaccine is safe for use in pregnancy.[19]

Want to learn more about preventing cold and flu? Please view the guidelines at **http://www.lungusa.org/coldandfluguidelines**

All health care providers including home care providers, household contacts and out-of-home caregivers to high-risk persons should also be immunized against both influenza and pneumonia to prevent transmission to these susceptible groups.

In addition, the ACIP has voted to expand the current flu vaccination recommendation to include all children from 5 to 18 years of age, which increases the number of children by 30 million and brings the total to approximately 250 million people. This change will take effect as soon as feasible, but no later than the 2009-2010 influenza season.[20]

Want to learn more about those at risk and the ACIP recommendations? Please visit **http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5606a1.htm?s_cid=rr5606a1_e**

There are two vaccine options available in the United States for influenza[II]: the flu shot (trivalent inactivated vaccine or TIV) and the flu nasal spray (activated, live attenuated influenza vaccine or LAIV) called FluMist®.

FluMist is approved to prevent influenza illness due to influenza A and B viruses in healthy people aged 2 to 49 years only.[21] In clinical trials, the effectiveness of the FluMist vaccine in preventing influenza was approximately 87 percent among children. In healthy adults aged 18 to 49 years, FluMist was effective in reducing severe illnesses with fever, and upper respiratory problems which may be caused by influenza infection.[22]

Certain people should not receive FluMist as the safety of FluMist in the following groups has not been established. FluMist should not be given to people with a history of asthma. FluMist is not recommended for children under two years of age, children under five with recurrent wheezing or adults over 49 years of age.[23,24] FluMist should not be given to women who are pregnant or people who have weakened immune systems (such as those with HIV) or chronic underlying medical conditions that may make them vulnerable to severe flu infections. High-risk individuals should receive the trivalent inactivated vaccine (TIV).[25, 26]

[II] The 2007-2008 TIV and LAIV strains are A/Solomon Islands/3/2006 (H1N1)-like, A/Wisconsin/67/2005 (H3N2)-like and B/Malaysia/2506/2004-like antigens.

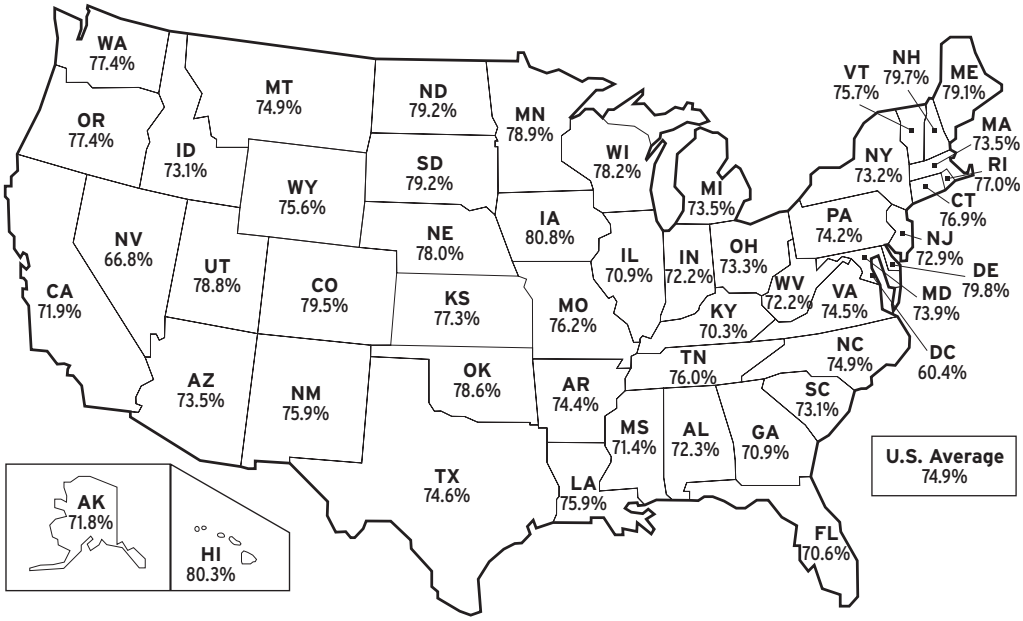
A national health objective for 2010 is to increase influenza and pneumococcal vaccination levels to greater than 90 percent among persons ages 65 and older. That goal, however, is far from being realized. In 2006, 69.6 percent of people aged 65 and older received a flu shot.[27] Medicare covers both flu shots and pneumococcal vaccines for people over 65 years of age.

Initial results from the 2006-2007 influenza season indicate that children 6 to 59 months of age are under-vaccinated. Less than 30 percent of children 6 to 23 months of age were fully vaccinated during that past flu season, while less than 20 percent of children 24 to 59 months old were fully vaccinated. The ACIP also recommends that previously unvaccinated children under the age of nine receive two doses of influenza vaccine at least one month apart to be fully vaccinated.[28]

Diverse communities are less likely to receive these vaccines. In 2006, among people ages 65 and older, non-Hispanic Whites were more likely to report receiving a flu shot (66.2%) than Hispanics (43.1%) and non-Hispanic Blacks (45.3%).[29]

There is great variation across the country in vaccination rates in those over 65. Figure 3 shows the percentage of fee-for-service Medicare beneficiaries aged 65 and older that received flu shots, by state, in 2004. Percentages ranged from a low of 60.4 percent in the District of Columbia to a high of 80.8 percent in Iowa. The United States average was 74.9 percent.[30]

Figure 3: 2004 Fee-for-Service Medicare Beneficiaries, Age 65 or Older Receiving a Flu Shot



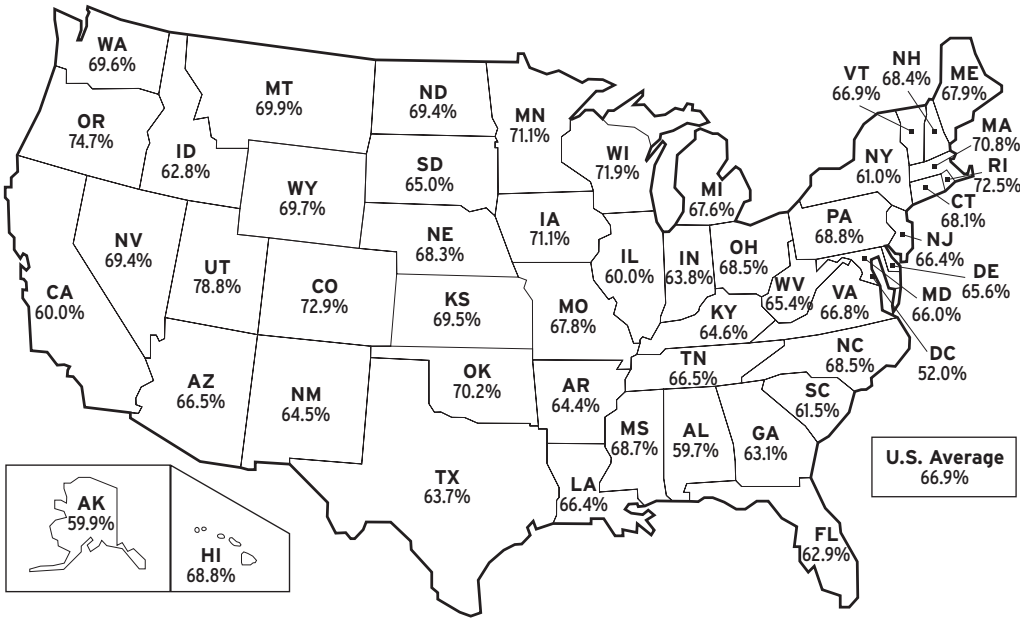
Source: Centers for Medicare and Medicaid Services. Consumer Assessment of Health Providers and Systems (CAHPS), 2004.

Pneumonia

The pneumococcal vaccine protects against 23 types of pneumococcal bacteria populations and is effective in approximately 80 percent of healthy adults. Unfortunately, the vaccine may be less effective in people in high-risk groups. According to the Centers for Disease Control and Prevention (CDC), pneumococcal pneumonia accounts for 25 percent to 35 percent of all community-acquired pneumonia (mostly caused by *Streptococcus pneumoniae* bacterium) and an estimated 40,000 deaths yearly.[31,32]

Older persons are advised to receive the pneumococcal vaccine since pneumonia is a major complication of the flu. Figure 4 displays the percentage of Medicare beneficiaries aged 65 and older that had ever received a pneumococcal vaccination as of 2006, by state. Percentages ranged from a low of 52.0 percent in the District of Columbia to a high of 74.7 percent in Oregon. The U.S. average for that year was 66.9 percent.[33, 34]

Figure 4: 2006 Medicare Beneficiaries, Age 65 or Older Ever Receiving Pneumococcal Vaccination



Source: Centers for Disease Control and Prevention. 2006 Behavioral Risk Factor Surveillance System.
Note:
Data reflects claims paid for by Medicare for non-HMO beneficiaries only. Total immunization rates may be higher in those areas with free or publicly-supported programs.

There is a racial disparity among people ages 65 and older receiving the pneumonia shot which needs to be addressed. In 2006, 59.9 percent of non-Hispanic Whites, 33.5 percent of non-Hispanic Blacks and 31.2 percent of Hispanics reported ever having received a pneumonia vaccine.[35]

How are influenza and pneumonia diagnosed and managed?

A number of laboratory tests are available to confirm the diagnosis of influenza or pneumonia, including sputum and blood cultures, chest x-rays and blood tests.

Influenza

Health care providers usually will make the diagnosis of influenza based on symptoms and findings of a physical examination. Currently, a new office-based rapid test is available.

Drugs that fight viruses (antivirals) are sometimes used in the management of flu. These drugs either shorten the duration of the flu, if taken early at the onset of the flu, or prevent the flu. There are currently four influenza antiviral drugs available in the United States: amantadine, rimantadine, zanamivir and oseltamivir.

According to the ACIP guidelines for the 2007-2008 influenza season, neither amantadine nor rimantadine should be used for treatment or prevention of influenza A infections. Oseltamivir or zanamivir should be prescribed if an antiviral drug is indicated for the treatment of influenza.[36] This recommendation is based on increasing resistance to the older drugs, amantadine and rimantadine. A recent study found that worldwide resistance to amantadine and rimantadine has increased 12 percent since the mid-1990s.[37] Analysis of influenza viruses found globally in 2005 and 2006 indicates that 96.4 percent of A(H3N2) and 15.5 percent of A(H1N1) viruses circulating in the United States were resistant to amantadine and rimantadine.[38]

Zanamivir (called Relenza, an inhalant) and oseltamivir (called Tamiflu, a pill) reduce flu symptoms if taken at the onset of the illness. The Food and Drug Administration (FDA) does not recommend Relenza for patients with underlying respiratory disease, including asthma and chronic obstructive pulmonary disease (emphysema and chronic bronchitis). Relenza has not been shown to shorten the length of influenza for this population and increases their risk of bronchospasm (wheezing) or serious breathing problems.[39] Studies also have shown that oseltamivir might be effective in reducing secondary complications due to the flu such as pneumonia in adults and ear infections in children. These newer drugs can be used to treat strains from both the Type A and B influenza viruses. Oseltamivir also can be used to prevent influenza. The CDC has stressed that these drugs are not substitutes for vaccination.

Over-the-counter medications can minimize discomfort associated with flu symptoms, but these medications do not treat the virus infection. Aspirin should not be used to treat flu symptoms in children under 18 years old because it may play a role in causing Reye Syndrome, a rare but severe liver and central nervous system condition.

Congestion, cough and nasal discharge are best treated with a decongestant, an antihistamine or a combination of these two types of medication. Many over-the-counter flu remedies contain both. However, pediatric specialists do

not recommend their use in children. Also, patients who have chronic medical conditions such as thyroid disease or high blood pressure should check with a health care provider before taking over-the-counter drugs for flu symptoms.

Adequate liquids and nutrition are necessary for rapid recovery from the flu and to prevent dehydration. Bed rest is also a good idea. Until symptoms are gone, it is not advisable to go back to full activity.

Prevention of flu is key to reduce the burden of influenza. Frequent hand washing and mouth covering during coughing and sneezing helps to prevent transmission of the influenza virus.

Want to learn more about good flu health habits? Please view the recommendations at **http://www.lungusa.org/goodfluhealthhabits**

Pneumonia

In August 1999, the FDA cleared for marketing a simple, quick test for a certain form of pneumonia. A swab is dipped into a urine sample and then inserted into a test device, which detects *Streptococcus pneumoniae* antigen.[III] The laboratory test provides results in 15 minutes. The test is intended for use in conjunction with review of a patient's symptoms to rule out other potential causes of pneumonia. Test results can enable health care providers to make a probable diagnosis more quickly and start treatment with the appropriate antibiotics sooner. Conventional methods for diagnosing pneumonia, primarily testing sputum or blood, require two days to several weeks for results, are often complex and are not always reliable.

There are no generally effective treatments for most types of viral pneumonia, which usually heal on their own. Early treatment with antibiotics can cure bacterial pneumonia and speed recovery from mycoplasma pneumonia. However, the disease has become more resistant to these drugs, making treatment of pneumococcal infections more difficult. New guidelines for community-acquired pneumonia (CAP), issued by the Infectious Disease Society of America and the American Thoracic Society, recommend that patients admitted to the hospital from the emergency department with a diagnosis of CAP should receive their first dose of antibiotics while still in the emergency department.[40]

What is bird flu?

An emerging Type A strain is the avian influenza virus or bird flu. Bird flu viruses do not usually infect humans, but several cases of human infection with bird flu viruses have occurred since 1997, especially in Asia. The virus is mainly transmitted to humans by direct contact with live, sick or dead poultry; however, it is thought that a few cases of human-to-human spread have occurred.[41] Due to limited person-to-person transmission, there has not been a widespread epidemic of the bird flu.

[III] A foreign substance that triggers the formation of antibodies that react to make the substance harmless.

Want to learn more about bird flu? Please view the fact sheet at
http://www.lungusa.org/avianinfluenza

The highest number of bird flu cases have been reported in Vietnam and Indonesia. The majority of cases have been reported in children and adults under 40 years of age. Overall mortality is approximately 60 percent and is highest in those 10 to 19 years old.[42]

The bird flu and the risk for human infection is currently an area of research focus. Human infection with bird flu is expected to continue on a sporadic basis due to contact with birds carrying the disease.[43] The virus could cause an influenza pandemic[IV] if it changes into a form easily spread by human-to-human contact. High rates of illness and death could occur worldwide due to the lack of any pre-existing natural immunity in humans or the availability of an effective vaccine. Fortunately, there has been no indication of such a change in the existing strains of the virus.[44] While avian flu has shown resistance to the antiviral medications amantadine and rimantadine, the other two drugs in this category (oseltamivir and zanamivir) should still be effective against the current strains of the virus.[45]

Want to learn more about flu pandemics? Please view the fact sheet at
http://www.lungusa.org/pandemicinfluenza

In April 2007, the FDA approved a vaccine for humans against the H5N1 influenza virus,[46] one type of bird flu that has caused infections in birds and humans.[47] This vaccine could provide limited protection from an H5N1 pandemic while a more specific vaccine is created. However, the H5N1 vaccine will not be available for commercial use because all amounts are going to the National Stockpile to ensure adequate supplies in the event of an outbreak.[48]

What is new in influenza and pneumonia research?

A recent study found that persons 65 years of age and older who received the flu shot had a 27 percent reduction in the risk of hospitalization for pneumonia or influenza and a 48 percent reduction in the risk of death. This was despite the fact that those receiving flu shots also tended to have more serious medical conditions that should increase their risk of hospitalization or death.

Based on other studies that show fewer influenza outbreaks and deaths in the United States and Japan due to immunization programs, researchers recommend focusing on developing new and more effective vaccines for elderly populations and children as well as increasing the percentage of those receiving flu shots.

Another key but disturbing finding is the low rate of vaccination of health care providers. If the elderly were not exposed through direct contacts, fewer cases

[IV] A pandemic occurs when a novel strain of influenza virus emerges and has the ability to infect and easily pass between humans. Because humans have little immunity to the new virus, a worldwide epidemic, or pandemic, can ensue.

of influenza would occur in this susceptible group. The best way to protect the elderly is to reduce influenza in groups of people they have contact with, such as children and health care providers. While this strategy requires more research to validate its effectiveness, increasing flu vaccination of all groups will prevent unnecessary hospitalizations and deaths.[49,50]

What is the American Lung Association doing about influenza and pneumonia?

American Lung Association volunteers and staff work with different public health organizations, Congress, and other policymakers to improve funding for research, surveillance, vaccine supply and public health response to influenza. The Lung Association also works in coalition to educate the public and policymakers to provide funding, develop resources and plan for a future influenza pandemic.

A study conducted by the American Lung Association Asthma Clinical Research Centers Network recently found that flu shots are safe for children and adults with asthma. Influenza causes substantial illness in both children and adults with asthma. The study puts to rest previous concerns about possible side effects of the flu shot in people with asthma. The study found that people with asthma did not have any higher rates of side effects within 14 days after receiving the flu shot compared with those who received a placebo, or inactivated flu shot.[51]

Want to learn more about flu in people with asthma? Please view the fact sheet at **http://www.lungusa.org/influenza-asthma**

To ensure that people understand the seriousness of influenza, the American Lung Association will continue its Faces of Influenza educational initiative to show why protecting families against this serious illness is so important. Actress Jennifer Garner recently partnered with the American Lung Association as another "face" in the initiative, which is made possible through collaboration with sanofi pasteur, the nation's largest manufacturer of influenza vaccines. The site, available at www.facesofinfluenza.org, provides additional resources such as a flu clinic locator and information for both the general public and specific groups, such as health care providers and high-risk individuals.

Thousands of advocates have joined with the ALA to tell Congress that more needs to be done to fight influenza and pneumonia. To join the American Lung Association in the battle against influenza, pneumonia and other lung diseases, visit http://lungaction.org.

Lesser-Known Lung Diseases

The list of lesser-known diseases that primarily or prominently affect the lungs is a lengthy one. Among the more familiar are:

Acute bronchitis

Acute bronchitis is an inflammation of the bronchial tubes, the major airways into the lungs. It may be caused by a variety of bacteria and viruses and may be primary or secondary to an upper respiratory infection, pertussis (whooping cough) or other infection. In 2004, the age-adjusted acute bronchitis mortality rate was 0.06 per 100,000 for men and 0.05 per 100,000 for women. This is a decrease from 1999 when the death rates for men and women were 0.10 and 0.12 per 100,000, respectively.[1]

Bronchiectasis

Bronchiectasis is a condition involving abnormal widening of the bronchial tubes and the formation of small pockets of infection. Bronchiectasis typically occurs as a complication of primary infections such as bronchitis, pneumonia, pertussis (whooping cough) or tuberculosis. While bronchiectasis usually begins in childhood, symptoms often do not appear until after a number of infections. With effective treatment of bronchitis and pneumonia, and vaccination against pertussis, bronchiectasis has become relatively rare in the United States. Currently, almost half of U.S. cases develop in those with cystic fibrosis.[2]

Want to learn more about bronchiectasis? Please view the disease listing at **http://www.lungusa.org/bronchiectasis**

Bronchiolitis

Bronchiolitis is a condition in which bronchioles, the smaller airways within the lungs (branching from the bronchi or main airways), become inflamed. It is most common in early infancy and often occurs due to viral infections, over half of which are caused by the respiratory syncytial virus or RSV (see RSV chapter). In children and adults, the infection is usually mild. But it may be severe and is the cause of many hospitalizations. In infants, bronchioles are narrower and more easily blocked by mucus and inflammation. Symptoms often are present for 4 to 6 days, with most healthy infants recovering in 7 to

10 days. Bronchiolitis may be related to parental smoking.[3] In 2004, 59 deaths due to bronchiolitis were reported.[4]

Coccidioidomycosis

Also called "valley fever," coccidioidomycosis is an infection of the lungs caused by inhaling spores of the fungus *Coccidioides immitis*. This fungus is present in the soil of the Southwestern United States, California, and parts of Central and South America. Recent outbreaks have occurred in prisons in California.

Of the estimated 150,000 U.S. coccidioidomycosis infections per year, approximately 60 percent occur in Arizona. Although the fungus that produces the spores that can lead to coccidioidomycosis only grows in climates similar to Arizona's, this factor alone does not account for the number of cases seen there. Due to the high incidence rate within the state, it is the center of research on this poorly understood illness.[5]

Sixty percent of those infected by the fungus have no symptoms or apparent illness. In others, there is an influenza-like syndrome with fever, weakness, achy joints, cough and chest pain. The infection is rarely fatal in healthy individuals. Pneumonia occasionally may develop. In a very small number of cases, the infection spreads to other areas of the body, such as the meninges (membranes around the brain and spinal cord), bones, skin, and other tissues. These serious conditions may occur months after the initial infection.[6]

Coccidioidomycosis infections outside the lungs appear to be most likely in those with impaired immunity (as from HIV infection or immunosuppressive therapy), in males, pregnant women and non-Whites. A variety of antifungal drugs are used to treat serious cases.[7]

Want to learn more about coccidioidomycosis? Please view the disease listing at **http://www.lungusa.org/cocci**

Hantavirus pulmonary syndrome

Hantavirus pulmonary syndrome (HPS) is a disease that first appeared as a "mystery" illness in the Southwestern United States (Arizona, Colorado, New Mexico) in the spring of 1993. Hantaviruses are harbored by rodents, especially rats and mice. About three-quarters of HPS patients have lived in rural areas. Through March 2007, a total of 465 cases of HPS were reported in the United States, including a number of cases that occurred before 1993 and were identified only after being re-assessed. Death has resulted in 35 percent of cases reported.[8]

HPS occurs most often in men (64% of cases) during the spring and summer. Women account for 36 percent of cases and the average age is 38 years (ranging from 10 to 83). While HPS can strike anyone, Whites currently account for 78 percent of all cases. American Indians make up 19 percent, African Americans

2 percent and Asians 1 percent of cases. About 14 percent of HPS cases have been among Hispanics.[9]

The HPS infection cannot be transmitted from one person to another. It is contracted by inhaling airborne saliva or fecal matter from infected animals, which do not become ill themselves. Transmission can occur in any location infested by infected rodents. HPS at first triggers an illness similar to a severe cold or influenza, accompanied by fever and muscle aches, but rapidly progresses to severe respiratory difficulties and potentially even acute respiratory distress syndrome (see ARDS chapter).[10]

The Centers for Disease Control and Prevention have issued guidelines to help residents, workers, campers and hikers avoid and eliminate rodents in affected areas. Surveillance continues, as does the effort to find effective treatment methods. Patients should take antibiotics while waiting for the confirmation of an HPS diagnosis. There is no established therapy, but ribavirin, an antiviral drug used in other parts of the world against related viruses, has been used experimentally.[11]

Want to learn more about hantavirus pulmonary syndrome? Please view the fact **sheet at http://www.lungusa.org/hpsfactsheet**

Histoplasmosis

A relatively common infection of the respiratory tract, histoplasmosis is caused by inhaling the spores of a fungus. *Histoplasma capsulatum* is common in most of the Central and Eastern United States. The fungus grows in soil, as well as bird and bat droppings, and is spread by breathing in the spores of disturbed soil. Many histoplasmosis infections do not produce symptoms. The illness occurs in two forms. The acute form is much like a mild case of influenza and is rarely serious. The chronic form, which is much less common, may resemble tuberculosis. Rarely, the disease will spread to other organs, most often in the very young, the very elderly and persons with impaired immunity (as from HIV infection or immunosuppressive therapy). This latter form of the disease can be life-threatening.[12]

Interstitial lung disease

Interstitial lung disease (ILD) is a general term that includes a variety of chronic lung disorders. When a person has ILD, the lung is affected in three ways. First, the lung tissue is damaged in some known or unknown way. Second, the walls of the air sacs in the lung become inflamed. Finally, fibrosis (scarring) begins in the interstitium (tissue between the air sacs), causing the lungs to become stiff.

Breathlessness during exercise can be one of the first symptoms of an interstitial lung disease. A dry cough also may be present. People with different types of ILD may have similar symptoms but with different levels of severity. As their chest x-rays may look alike, further testing is usually recommended to identify the specific type of ILD a person has. Some types of ILD have known causes

while others (idiopathic) do not have a known cause.

Certain types of interstitial lung disease improve if treated with medication when inflammation occurs. Some people may need oxygen therapy as part of their treatment.

From 1992 to 2003, the age-adjusted mortality rate for one type of ILD, idiopathic pulmonary fibrosis (IPF), increased by 54 percent (from 40.2 to 61.9 deaths per 1,000,000) in men and 41.3 percent (from 39.0 to 55.1 deaths per 1,000,000) in women. This upward trend is expected to continue. Mortality rates for men older than 65 years and women of all ages are expected to be even higher in 2008 than in 2003. The mortality rate for those with IPF is significantly higher for men, increases with age, has increased over time and is increasing at a greater rate in women than men. There is no effective treatment for idiopathic pulmonary fibrosis and the median survival after diagnosis is low at three to five years. The lack of knowledge and effective treatment concerning this disease and the increasing mortality rate associated with it make a strong argument for focusing future research on IPF in hopes of learning more about it.[13]

Research on the causes of idiopathic pulmonary fibrosis has identified some factors but continues to seek other explanations. Until a therapy changes the natural history of the disease, the cause will remain unknown.[14] Research suggests it may be caused by exposure to both environmental and occupational risk factors.[15]

Want to learn more about interstitial lung disease and pulmonary fibrosis? Please view the disease listing at **http://www.lungusa.org/interstitiallungdisease**

Pertussis (whooping cough)

Pertussis, commonly known as whooping cough, is a highly contagious disease that can last for weeks and typically causes severe coughing fits. It is caused by the bacteria *Bordetella pertussis* and can be prevented with a vaccine.[16] After the introduction of the vaccine for pertussis in 1940, incidence for the disease decreased by over 99 percent to a low of 1,010 cases in 1976. Recently, the trend has reversed with a peak of 25,000 cases in 2005 and more than 15,000 in 2006. Two-thirds of reported cases in 2005 were in adolescents or adults.[17,18] Reasons for this increase include under-vaccination in infants, under- and misdiagnosis of pertussis in the past, decreased immunity from past vaccinations, and increased recognition of cases in adolescent and adult populations.[19]

Pertussis is most severe in children under one year of age. From 2000 to 2004, 90 percent of the total 100 deaths related to pertussis occurred in infants less than four months old.[20]

The CDC's Advisory Committee on Immunization Practices (ACIP), the Committee on Infectious Diseases of the American Academy of Pediatrics and the American Academy of Family Physicians all recommend that children (6 weeks to 6 years old) routinely receive five doses of a combination vaccine, DTaP

(diphtheria and tetanus toxoids plus a cellular pertussis vaccine) at the ages of 2, 4, 6, 15 to 18 months, and 4 to 6 years. ACIP also recommends that children 11 and 12 years of age receive a single dose of Tdap (tetanus, diphtheria and pertussis) instead of the usual diphtheria and tetanus booster. Recommendations also call for older adolescents (13 to18 years old) to receive a single dose of Tdap if they have not yet received a Tdap vaccination. Adults under 65 years of age are encouraged to receive one Tdap vaccination instead of a Td (tetanus and diphtheria) booster.[21,22] Tdap is comprised of two vaccines and is licensed for use in adolescents and adults ages 10 to 64 years.[23]

Severe acute respiratory syndrome

Severe acute respiratory syndrome (SARS) first appeared worldwide in 2003. It is caused by a virus from the coronaviruses group and is characterized by a fever higher than 100.4 degrees Fahrenheit, as well as chills, muscle soreness, headache and a general feeling of discomfort.[24] Most patients go on to develop pneumonia.[25]

Approximately 10 percent to 20 percent of SARS cases progress to a level of respiratory difficulty so severe that a mechanical respirator is required. In the 2003 outbreak, 8,098 probable cases of SARS were reported worldwide with 774 (9.6%) deaths resulting, over half of which were in individuals 65 years or older. There were eight confirmed cases in the United States, resulting in zero deaths. All eight of these individuals had traveled to parts of the world where SARS is more common.[26,27] As with other respiratory illnesses, the American Lung Association highly recommends that a health care provider be consulted for proper diagnosis and treatment if these symptoms are present. The most recent reported cases of SARS occurred in China in 2004 and were caused by a laboratory-acquired infection.[28]

Three tests exist for detecting SARS: DNA, blood,and viral. Each test has its limitations. Several groups of researchers have identified the genome of the virus and have shown that there are different types of the virus in different parts of the world. This fact may explain the variations in deadliness—for example, SARS appears to be less lethal in the United States. A variation in an immunological gene common in people of Southeast Asian descent, but rare in other populations, may increase vulnerability to SARS and would explain why most cases have been seen in China and Southeast Asia. Research continues on treatment, detection and vaccination for SARS.[29]

Want to learn more about SARS? Please view the disease listing at **http://www.lungusa.org/sars**

Lung Cancer

What is lung cancer?

Lung cancer is the uncontrolled growth of abnormal cells in one or both of the lungs. While normal lung tissue cells reproduce and develop into healthy lung tissue, these abnormal cells reproduce faster and never grow into normal lung tissue. Lumps of cancer cells (tumors) then form and disturb the lung, making it difficult for it to work properly.

There are two major types of lung cancer: small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). Sometimes a lung cancer may have characteristics of both types, which is known as mixed small cell/large cell carcinoma.

Non-small cell lung cancer is much more common and accounts for 87 percent of all lung cancer cases.[1] It usually spreads to different parts of the body more slowly than small cell lung cancer. There are three main types of non-small cell lung cancer. They are named for the type of cells in which the cancer develops: squamous cell carcinoma, adenocarcinoma and large cell carcinoma.

Small cell lung cancer, also called "oat cell cancer," accounts for the remaining 13 percent of all lung cancers.[2] This type of lung cancer grows more quickly and is more likely to spread to other organs in the body.

Lung cancer symptoms may include a persistent cough, sputum streaked with blood, chest pain, and recurring pneumonia or bronchitis.[3] Unfortunately, symptoms often do not appear and diagnosis is not made until the disease is in an advanced stage.

Want to learn more about lung cancer? Please view the disease listing at **http://www.lungusa.org/lungcancer**

Smoking, a main cause of small cell and non-small cell lung cancer, contributes to 80 percent and 90 percent of lung cancer deaths in women and men, respectively. Men who smoke are 23 times more likely to develop lung cancer. Women are 13 times more likely, compared to never-smokers.[4] Fortunately, lung cancer is preventable. To learn more about the impact of tobacco on the lungs and the development of lung cancer, please refer to the Tobacco Control

section of this report.

Nonsmokers who breathe in smoke from others' cigarettes also are at increased risk of lung cancer. Nonsmokers have a 20 to 30 percent greater chance of developing lung cancer if they are exposed to secondhand smoke at home or at work.[5]

Exposure to radon is estimated to be the second leading cause of lung cancer, accounting for an estimated 15,000 to 22,000 lung cancer deaths each year (9% to 14% of the total). Radon is a tasteless, colorless and odorless gas that is produced by decaying uranium and occurs naturally in soil and rock. The majority of these deaths occur among smokers since there is a greater risk for lung cancer when smokers also are exposed to radon.[6]

The main source of high-level radon pollution is uranium-containing soil such as granite, shale, phosphate and pitchblende that surrounds buildings. Radon enters a home through cracks in walls, basement floors, foundations and other openings. It also may contaminate the water supply, especially in private wells.[7]

A study was carried out over a five-year period to determine the risk posed by residential radon exposure. The participants included over 1,000 women throughout Iowa, the state with the highest average radon concentrations, who lived in their current home for at least 20 years. Of the participants, 413 had developed lung cancer, while the remaining 614 were controls who did not have lung cancer. The outcomes suggested that cumulative radon exposure in the residential environment is a significant risk factor for lung cancer in women.[8]

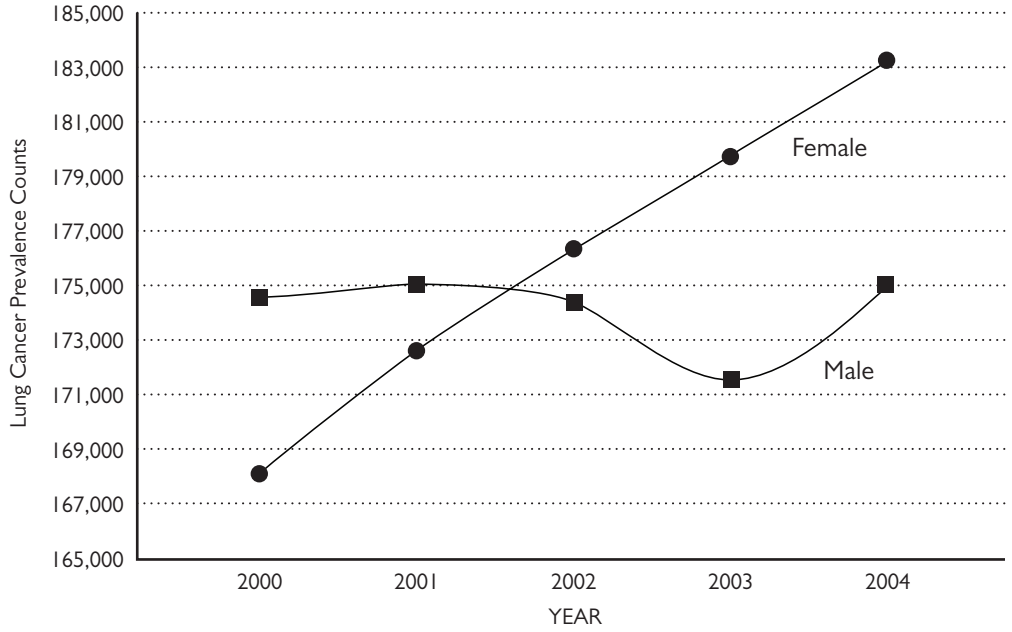
Want to learn more about radon and lung cancer? Please view the fact sheet at **http://www.lungusa.org/radonfactsheet**

Lung cancer also can be caused by occupational exposures, including asbestos, uranium, and coke (an important fuel in the manufacture of iron in smelters, blast furnaces, and foundries). The combination of asbestos exposure and smoking greatly increases the risk of developing lung cancer.[9] Nonsmoking asbestos workers are five times more likely to develop lung cancer than nonsmokers not exposed to asbestos; if they also smoke, the risk factor jumps to 50 or higher.[10] Environmental exposures also can increase the risk of lung cancer death.[11]

Who has lung cancer?

In 2004, 358,128 Americans were living with lung cancer. Figure 1 displays the prevalence of lung cancer for men and women since 2000, and shows that women surpassed men in lung cancer prevalence in 2002. In 2004, women accounted for 183,248 lung cancer cases in the United States while men accounted for 174,880 cases.[12]

Figure 1: Lung Cancer Prevalence Counts, U.S., 2000–2004*



Source: National Cancer Institute: SEER Cancer Statistics Review, 2000–2004
Note:
* **Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

The majority of living lung cancer patients have been diagnosed within the last five years. Lung cancer is mostly a disease of the elderly. From 2000 to 2004, the median age at diagnosis was 70 years.[13]

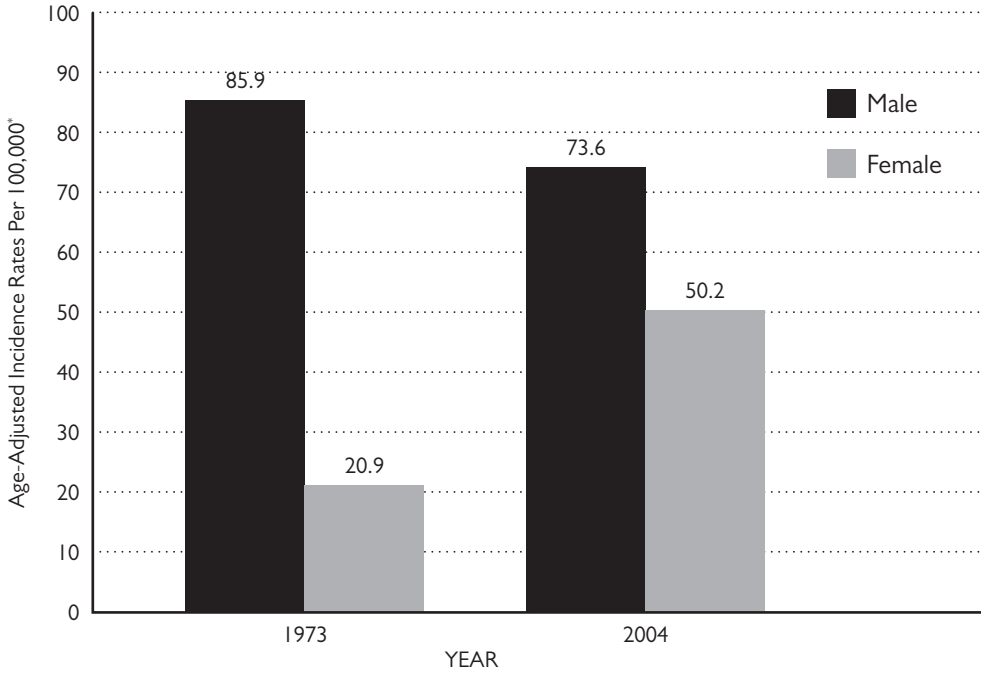
During 2007, an estimated 213,380 new cases of lung cancer were diagnosed, representing about 15 percent of all cancer diagnoses.[14]

In 2004, Kentucky had the highest age-adjusted lung cancer incidence rates (rates of new cases) in both men (133.2 per 100,000) and women (75.5 per 100,000). Utah had the lowest age-adjusted cancer incidence rates in both men and women (37.5 per 100,000 and 20.6 per 100,000, respectively). These state-specific rates were parallel to smoking prevalence rates.[15]

Want to learn more about lung cancer? Please view the fact sheet at **http://www.lungusa.org/lcfactsheet**

Each year more men are diagnosed with lung cancer, but more women are living with the disease. The rate of new cases in 2004 showed that men develop lung cancer more often than women (73.6 and 50.2 per 100,000 respectively). However, as Figure 2 shows, the rate of new lung cancer cases (incidence) over the past 31 years has dropped for men (14% decrease), while it has risen for women (140% increase). In 1973 rates were low for women, but began to rise for both men and women. In 1984, the rate of new cases for men peaked (102.1 per 100,000) and then began declining. The rate of new cases for women increased further and did not peak until 1998 (52.8 per 100,000) but has remained stable since then.[16]

Figure 2: Rate of New Lung Cancer Cases by Gender, U.S., 1973 & 2004



Source: National Cancer Institute: SEER Cancer Statistics Review, 1973–2004
Note:
*Rates are per 100,000 persons and are age-adjsuted to the 2000 U.S. standard population.

Lung cancer in people who have never smoked is a major public health problem and continued research is needed. Women, compared to men, appear to have higher prevalence rates of lung cancer that is not associated with smoking; 25 percent of lung cancer occurs in women who are nonsmokers.[17] One study reported that the age-adjusted rates of new nonsmoking-associated lung cancer cases in women ages 40 to 79 years range from 14.4 to 20.8 per 100,000 person-years[1,18,19], compared with 4.8 to 13.7 per 100,000 person-years in men. Differences in genetics, biology and hormones could explain this finding.[20] However, another study showed that the death rate from lung cancer among lifelong nonsmokers aged 35 to 84 years was 14.7 per 100,000 person-years among women and 17.1 per 100,000 person-years among men. The study also found little evidence that the lung cancer death rate among people who have never smoked is increasing over time.[21] More research is necessary to explain these conflicting results.

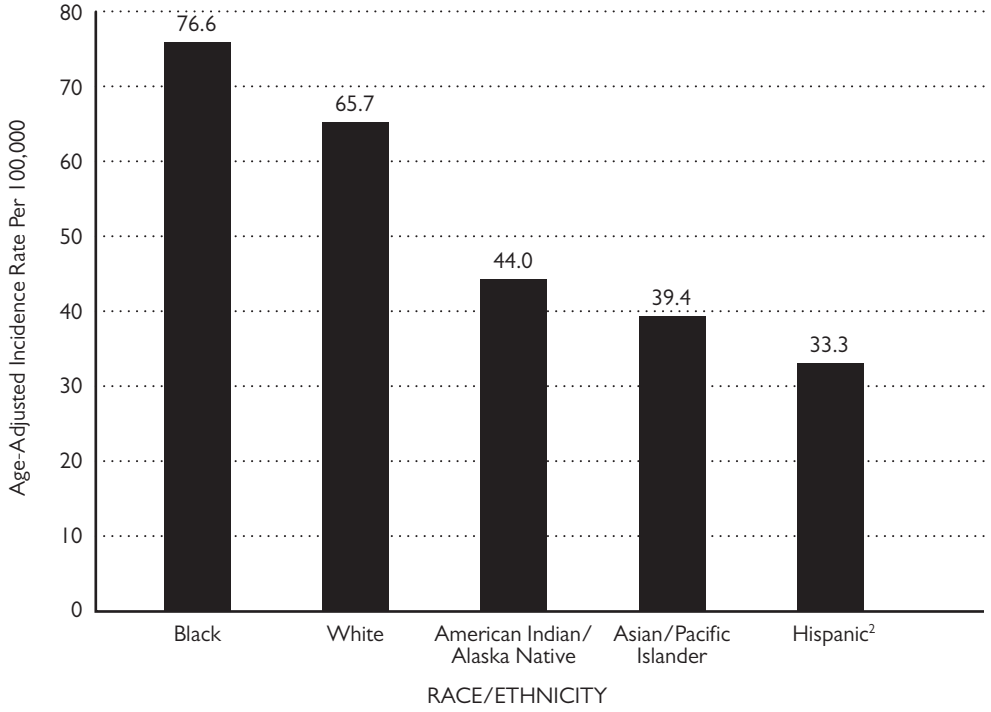
Want to learn more about lung cancer trends and data? Please view the Lung Cancer Trend Report, which delineates data on lung cancer mortality, prevalence, incidence, hospitalizations, and survival, at **http://www.lungusa.org/lctrends**

[1] Average number of events per cumulative amount of time observed. Person-years is used for counting time when individuals are observed over different periods of time. For example, the number of person years for two people being observed for five years each is the same as that of ten people observed for one year or ten person-years.

Blacks are more likely to develop and die from lung cancer than persons of any other racial or ethnic group. The age-adjusted lung cancer incidence rate among Black men is approximately 38 percent higher than for White men, even though their overall exposure to cigarette smoke, the primary risk factor for lung cancer, is lower. Equally disturbing is the fact that the lung cancer incidence rate for Black women is roughly equal to that of White women, despite the fact that they smoke fewer cigarettes.[22,23]

Figure 3 displays lung cancer age-adjusted incidence rates by race/ethnicity between 2000 and 2004. Over this five-year period, Hispanics, Asians/ Pacific Islanders and Native Americans were less likely to develop lung cancer than Blacks or Whites.[24]

Figure 3: Lung Cancer Age-Adjusted Incidence Rates by Race/Ethnicity, 2000–2004[1]



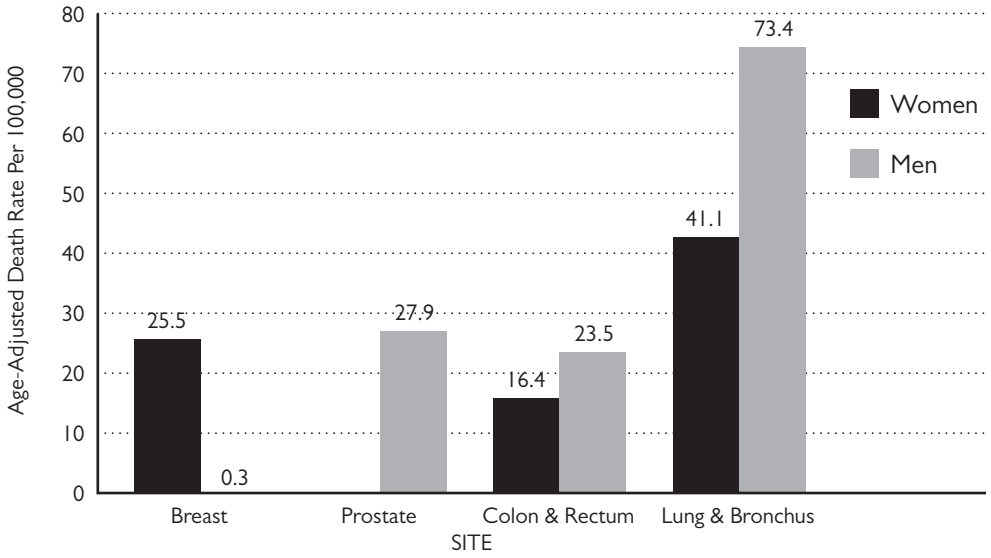
Source: National Cancer Institute, SEER Cancer Statistics Review, 2000–2004.
Notes:
1. Rates are per 100,000 age-adjusted to the 2000 U.S. Standard Population. Incidence rates obtained from 17 SEER areas.
2. Hispanics are not mutually exclusive from Whites, Blacks, Asian/Pacific Islanders and American Indians/ Alaska Natives.

Want to learn more about lung cancer in diverse communities?
Please view the *State of Lung Disease in Diverse Communities 2007* report at
http://www.lungusa.org/solddc-lc

What is the health impact of lung cancer?

Lung cancer is the leading cause of cancer deaths among both men and women in the United States. In 2007, about 160,390 Americans were expected to die of lung cancer, accounting for approximately 29 percent of all cancer deaths.[25] Figure 4 displays cancer death rates by gender and type of cancer from 2000 to 2004. Lung cancer death rates were higher than death rates due to cancer of other common cancer sites among both men and women. In 2004, there were 89,630 deaths due to lung cancer in men and 68,461 in women.[26]

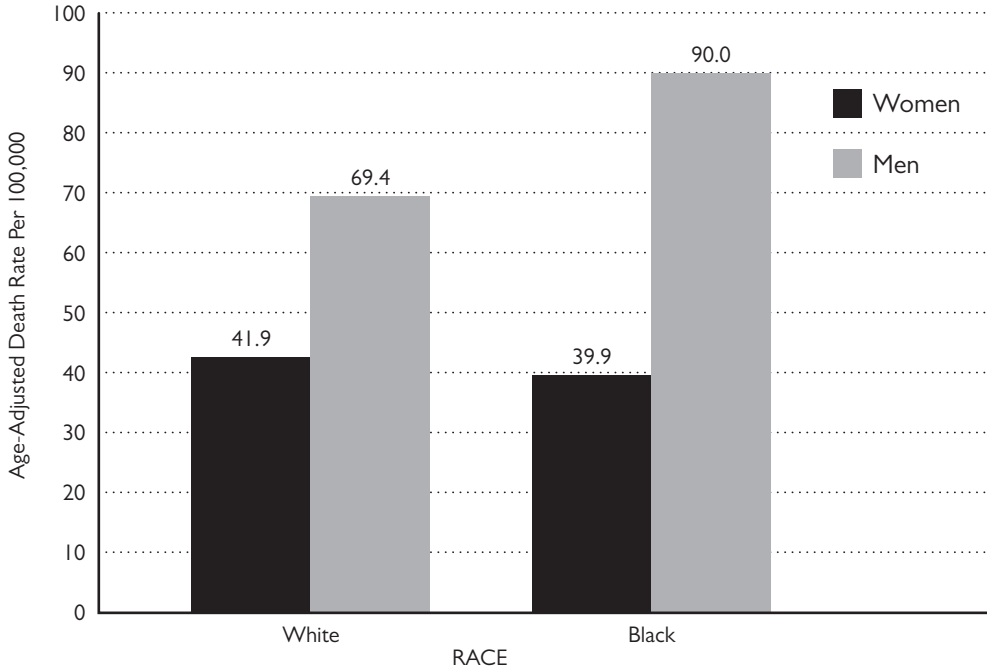
Figure 4: Cancer Death Rates by Gender and Site, U.S., 2000–2004*



Source: National Cancer Institute, SEER Cancer Statistics Review, 2000–2004.
Note:
* Rates are per 100,000 persons, age adjusted to the 2000 U.S. population and coded by ICD-10 Revision (C33-C34).

The age-adjusted death rate for lung cancer is higher for men (73.4 per 100,000 persons) than for women (41.1 per 100,000 persons).[27] It also is higher for Blacks (59.8 per 100,000 persons) compared to Whites (53.6 per 100,000 persons). Black men have a far higher age-adjusted lung cancer death rate than White men, while Black and White women have similar rates.[28] Figure 5 shows this disparity.

Figure 5: Lung Cancer Death Rates by Gender and Race, U.S., 2004*



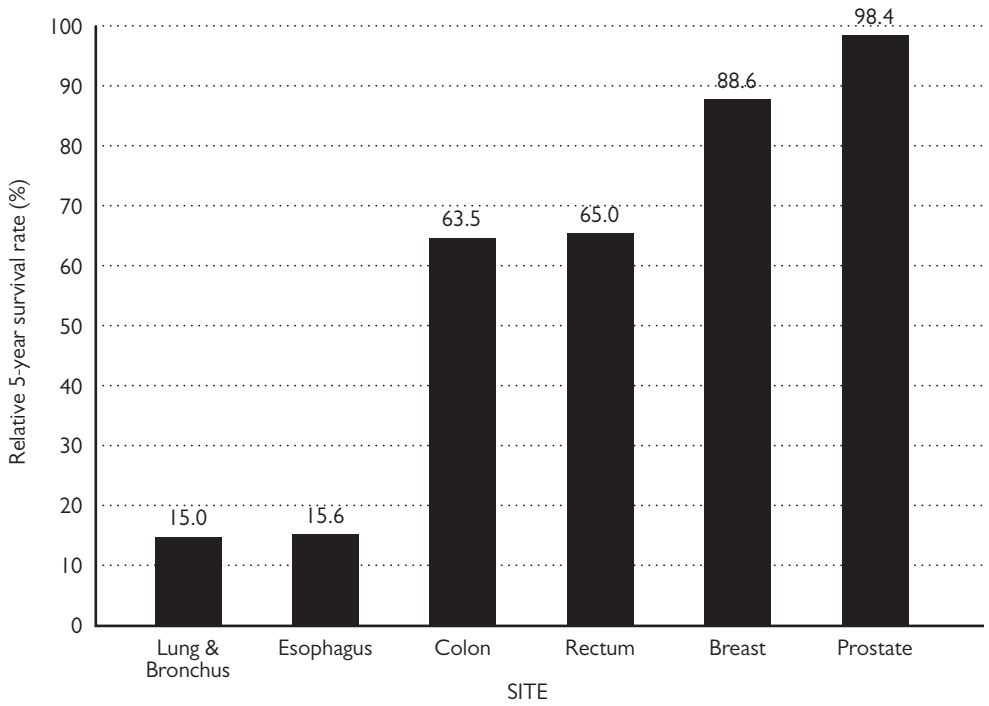
Source: Centers for Disease Control and Prevention. National Vital Statistics Report. Deaths: Final Data for 2004. Volume 55 No 19, August 21, 2007.
Note:
* Rates are per 100,000 persons, age-adjusted to the 2000 U.S. population and coded by ICD-10 Revision (C33-C34).

Before the 1940s, smokers were overwhelmingly male. That has changed—and so have the lung cancer statistics. Currently, approximately 45 percent of adult smokers are female. In 2004, 43.3 percent of lung cancer deaths occurred in women compared to 26 percent of deaths in 1979.[29] Lung cancer surpassed breast cancer as the leading cause of cancer death in women in 1987.[30]

Between 1997 and 2001, an average of 123,836 Americans (79,026 men and 44,810 women) died of smoking-attributable lung cancer each year.[31] Exposure to secondhand smoke causes approximately 3,400 lung cancer deaths among nonsmokers every year.[32]

Figure 6 displays five-year survival rates for selected cancer sites. The lung cancer five-year survival rate (15%) is lower than many other leading cancer sites, such as the colon (63.5%), breast (88.6%) and prostate (98.4%).[33]

Figure 6: 5-Year Survival Rates by Selected Cancer Sites, U.S., Cases Diagnosed 1996–2003*



Source: National Cancer Institute, SEER Cancer Statistics Review, 1996–2004.
Note:
* Rates are from the 17 SEER areas (California excluding SF/SJM/LA, Kentucky, Louisana and New Jersey contribute cases for diagnosis years 2000–2003. The remaining 13 SEER areas contribute cases for the entire period.)

The prognosis for a patient with lung cancer depends, to a large extent, on the stage of the cancer. Staging is used to determine whether the cancer has spread and, if so, to what other parts of the body. Stages include localized (within lungs), regional (spread to lymph nodes) and distant (spread to other organs). The five-year survival rate is 49 percent for cases detected when the disease is still localized. Unfortunately, only 16 percent of lung cancer cases are diagnosed at an early stage. For distant tumors, the five-year survival rate is only 3 percent. About 6 out of 10 people with lung cancer die within one year of being diagnosed.[34]

The financial costs of cancer are staggering. According to the National Institutes of Health, cancers cost the United States an overall $206 billion in 2006.[35] It is estimated that approximately $9.6 billion per year is spent in the United States on lung cancer treatment alone.[36]

How is lung cancer diagnosed and managed?

All cancer patients benefit from early intervention when the growth is localized and has not spread to distant parts of the body. Since most symptoms do not appear until advanced stages, lung cancer is difficult to diagnose in early stages.

When a person undergoes a medical exam, the health care provider asks about the person's medical history, including exposure to hazardous substances. The

provider also will give the patient a physical exam. If the patient has a cough that produces sputum (mucus), it may be examined for cancerous cells. Other diagnostic tests include chest x-ray and fiberoptic examination of the airways. Newer tests such as low dose spiral computed tomography (CAT or CT) scans and molecular markers in sputum have produced promising results in detecting lung cancers at earlier, more treatable stages.[37]

If lung cancer is found relatively early, treatment—surgery, radiation, drug therapy or a combination of these approaches—is often effective. Choice of treatment and prognosis also may depend on the specific type of tumor. Many clinical trials are underway to study new lung cancer treatments.[38]

In 2002, the National Cancer Institute launched a study to determine if screening high-risk people with spiral CT scans before they have symptoms can reduce death from lung cancer. The National Lung Screening Trial has enrolled around 50,000 current or former smokers and monitored them at more than 30 sites throughout the United States.[39] Results from the trial will not be available until after it concludes in 2009.[40]

Spiral CT scan screening for lung cancer has some limitations. The technique requires specialized knowledge. Research has indicated that 25 to 60 percent of scans may show abnormalities in both smokers and former smokers. While most of the abnormalities are not lung cancer, they can mimic lung cancer on the CT scans. As a result, additional testing is required. That can cause the patient added anxiety and unnecessary biopsies or surgery and their related risks. While complications from biopsies and surgery rarely occur, they can include partial collapse of the lung, bleeding, infection, pain and discomfort. Furthermore, patients and control groups have not yet been followed to determine whether, in fact, the spiral CT scan technique will lead to fewer lung cancer deaths. It is hoped that the trial will determine whether the benefits of potential, earlier lung cancer detection outweigh these limitations and if widespread use is cost-effective.[41]

What is new in lung cancer research?

Scientists currently are exploring the link between lung disease and lung cancer in nonsmokers.

A significant risk factor for life-long nonsmokers is a history of physician-diagnosed emphysema or chronic bronchitis and emphysema, the base elements of chronic obstructive pulmonary disease (COPD). In a 10-year study, nonsmokers were 1.7 times more likely to have lung cancer listed as the cause of death if they had ever been diagnosed with emphysema, and 2.4 times more likely if ever diagnosed with both chronic bronchitis and emphysema. A diagnosis of chronic bronchitis alone did not increase this risk.[42]

Another study was conducted among 10,474 U.S. veterans enrolled in primary care clinics to determine whether the use of inhaled corticosteroids among patients with COPD decreased the risk of lung cancer. Although the findings may need additional support, it was suggested that inhaled corticosteroids may play a role in decreasing the risk of lung cancer in patients with COPD.[43]

Tobacco use is the main cause of lung cancer and tends to mask other risk factors that are not as widespread or do not contribute as significantly to lung cancer development. A study was conducted between 1998 and 2002 to determine the association between lung cancer and occupation, independent of smoking. The study consisted of 1,039 control cases and 223 people that had never smoked. The findings suggest that women in suspected high-risk occupations[II] have an increased risk of lung cancer. Both men and women employed in occupations with exposure to nonferrous metal dust and fumes, silica and organic solvents also had an increased risk of lung cancer.[44]

Observational data in the 1980s led to the belief that beta-carotene (an A vitamin) could protect against lung cancer, even in smokers. Research on this topic has been extensive since that time, along with work on other nutritional factors. However, a review of the best studies from the field found that no protective effect was offered by beta-carotene, vitamin E, retinol or any combination of the three. Some trials even reported increased rates of lung cancer, total deaths and cardiovascular deaths due to the use of beta-carotene, alone or with vitamin E or retinol.[45]

A study in the *New England Journal of Medicine* showed that erlotinib, a medication prescribed to treat patients with advanced non-small cell lung cancer, extended survival by an average of two months in tests on about 700 patients. Patients were more likely to respond to erlotinib if their tumors contained a certain protein or had many copies of a particular gene. The study also confirmed that patients most likely to benefit from the drug included women, nonsmokers, Asians and those with an adenocarcinoma (cancer associated with glands).[46]

Another study found that phytoestrogens (compounds from plants) found in soy products, grains, carrots, spinach, broccoli, and other fruits and vegetables may protect against certain solid lung tumors.[47]

What is the American Lung Association doing about lung cancer?

While most of its education and advocacy efforts focus on prevention, there are several ways the American Lung Association addresses the needs of those living with lung cancer. The American Lung Association Lung HelpLine, staffed by registered nurses, respiratory therapists and quit-smoking specialists offers free counseling and support to callers, including those seeking information about lung cancer. In addition, the American Lung Association has helped millions through its Better Breathers Clubs. These support groups are located throughout the United States and meet regularly to provide peer support and education needed to understand and better manage their disease. These clubs are for adults with all chronic lung diseases, their families and their caregivers.

[II] Agriculture- insecticide application, mining and quarrying- zinc-lead and metal, food industry- butchers and meat workers, leather industry- tanners and processors, wood and wood products- carpenters and joiners, printing- rotogravure workers, printing pressmen, machine room workers, binders and other, chemical production, rubber industry, ceramic- ceramic, pottery and glass workers, metals, motor vehicle manufacture and repair- mechanics, welders, etc, transport- railroad workers, bus and truck drivers, operators of excavator machines or heavy equipment and filling station attendants and other- laundry and dry cleaners.

Often these groups are run by a respiratory therapist who can educate group members and their families about ways to live well with lung cancer and find additional resources. Groups may invite medical professionals to share their expertise on topics including nutrition, exercise, breathing techniques, new treatments, stress and depression, and medical equipment. The education patients receive in these groups may help them to avoid preventable hospitalizations and emergency room visits. Many hospitals may offer similar support groups for people with chronic lung disease.

The American Lung Association also provides information on treatment options through the NexCura profiler on lung cancer. The lung cancer NexProfiler helps asthma patients and their physicians make better-informed treatment decisions using information from evidence-based, peer-reviewd medical literature.

Need help with treatment decisions for lung cancer? Please view the lung cancer NexProfiler at **http://www.lungusa.org/lctreatment**

The American Lung Association is partnering with The Wellness Community (TWC) to help people living with lung cancer and their loved ones manage treatment options and side-effects through education and support. TWC is an international non-profit organization dedicated to providing emotional support, education and hope for people affected by cancer. TWC programs include weekly cancer support groups, diagnosis-specific support groups, family/caregiver support groups, bereavement groups, online support groups, nutritional/exercise programs, physician lectures, mind/body programs and stress reduction workshops. The American Lung Association is distributing TWC Frankly Speaking About Lung Cancer materials to callers via its Lung HelpLine and several Lung Associations are expanding the availability of the TWC education workshop, Frankly Speaking About Lung Cancer. Through this partnership, the Lung Association and TWC hope to reach and better serve diverse communities of lung cancer survivors nationwide. For more information about The Wellness Community, visit http://www.thewellnesscommunity.org. For questions about lung cancer, please contact the American Lung Association at 1-800-586-4872 (1-800-LUNG-USA).

The American Lung Association and the LUNGevity Foundation have joined to provide resources to researchers seeking new treatments and a cure for lung cancer. As part of this partnership, the Lung Cancer Discovery Award was created in 2004 to provide funding for investigators and to support clinical, laboratory, epidemiological and other lung cancer research.

Want to learn more about the Lung Cancer Discovery Award? Please view the 2008 award announcement at **http://www.lungusa.org/lcdiscoveryaward**

The American Lung Association also works to increase federal funding for a broad range of lung disease-related biomedical research, treatment and prevention programs conducted by the National Institutes of Health, Centers for

Disease Control and Prevention, Department of Veterans Affairs and other federal agencies.

American Lung Association volunteers and staff also advocate for policies at the federal, state and local levels that can reduce lung cancer by decreasing the number of Americans who smoke and protecting everyone from exposure to secondhand smoke. Such policies include comprehensive state and local smokefree laws; granting the U.S. Food and Drug Administration regulatory control over the manufacturing, distribution and advertising of tobacco products; increasing funding for comprehensive tobacco control and cessation programs at the state level; and increasing cigarette excise taxes. To join the American Lung Association in the battle to reduce the number of lung cancer deaths, please go to http://www.lungaction.org.

The American Lung Association also advocates for clean air through enforcement of the Clean Air Act, tighter air pollution standards and reduced radon exposure, a leading cause of lung cancer.

In addition to its advocacy efforts, the American Lung Association offers programs to help smokers who want to quit, including Freedom From Smoking® and Not On Tobacco (N-O-T), a program to help teenagers quit smoking.

Want to learn more about smoking cessation through the American Lung Association's Freedom from Smoking® or Not On Tobacco programs? Please view the online programs at **http://www.ffsonline.org/** or **http://www.lungusa.org/not**

Obstructive Sleep Apnea
(Sleep-Disordered Breathing)

What is obstructive sleep apnea?

Sleep-disordered breathing (SDB) is a group of disorders characterized by breathing difficulties while sleeping, of which obstructive sleep apnea (OSA) is the most common type.[1] OSA is defined as repeated narrowing of the throat, either partially or totally blocking the airways during sleep. This blocking of the airways can cause a person to stop breathing or have problems with breathing for 10 to 20 seconds or longer many times a night.

Sleep apnea may or may not be evident, to the patient or to others. Possible symptoms of OSA include loud snoring, choking or gasping during sleep, unrestful sleep and fighting sleepiness throughout the day. Family members will often notice symptoms before the sufferer does.[2]

Basic factors, such as airway anatomy (e.g., large tonsils), nasal blockage, presence and distribution of body fat, and muscle tone may contribute, alone or in combination, to the presence and severity of this disorder.

Being even moderately overweight is the most common risk factor, especially a body mass index or BMI (weight in kilograms divided by height in meters squared) greater than 28. Other risk factors include collar size of snoring patients (greater than 17 inches for men, 15 inches for women), physical nasal obstruction, underactive thyroid and excessive fat around the neck area.[3]

Sleep apnea also seems to run in some families, suggesting a possible genetic basis. It is worsened by the use of alcohol and sleeping pills.[4]

Want to learn more about obstructive sleep apnea? Please view the disease listing at **http://www.lungusa.org/sleepapnea**

Who has obstructive sleep apnea?

Estimates suggest that more than 12 million Americans have sleep apnea.[5] It occurs in all age groups and both sexes, but it is more common in men than women, evidently due to hormonal differences (sleep apnea is rarely seen in pre-menopausal women). OSA may occur in children with enlarged tonsils and

adenoids or who snore.[6] Sleep apnea causes daytime sleepiness in an estimated 1 out of 25 (4 percent) middle aged men and 1 out of 50 (2 percent) middle aged women.[7]

African Americans, Hispanics and Pacific Islanders tend to be at increased risk of sleep apnea compared to Caucasians. According to a study that looked at risk factors for sleep-disordered breathing, African-American children, especially those living in a neighborhood of poor socioeconomic status, were more likely than children of other races to develop obstructive sleep apnea.[8] One study found shared and unshared genetic factors that may impact the risk of both obesity and sleep apnea in African Americans.[9] Increased risk of OSA among African Americans is independent of obesity or respiratory conditions as risk factors.[10]

Want to learn more about obstructive sleep apnea and diverse communities? Please view the *State of Lung Disease in Diverse Communities: 2007* report at **http://www.lungusa.org/solddc-sleepapnea**

What is the health impact of obstructive sleep apnea?

Sleep apnea is considered a public health problem because so many individuals lose so much sleep due to OSA that their lack of alertness poses a serious hazard. Sleep apnea also may cause impaired mental functioning, delayed reaction times and difficulty maintaining concentration.

New research suggests an independent and additional link between sleep apnea and metabolic disorders, including insulin resistance and high blood cholesterol. Sleep apnea may act as the first piece in a domino chain of undesired health outcomes (including hardening of the arteries, plaque buildup in the arteries, heart attack and stroke), while acting through both the metabolic and cardiovascular systems independent of underlying obesity. In the presence of other cardiovascular risk factors such as hypertension or high cholesterol, the impact of sleep apnea may be greater. The evidence that OSA is associated with increased risk of stroke and heart attack can be explained by atherosclerosis as OSA triggers the heart disease.[11]

Untreated, sleep apnea can cause high blood pressure and other heart diseases, depression, irritability, learning and memory difficulties, weight gain, impotence and headaches. Moreover, untreated sleep apnea may be responsible for injuries on the job and deadly car collisions.[12,13] One study found that more than 800,000 drivers were involved in vehicle crashes related to sleep apnea in 2000, at a cost of nearly $16 billion and 1,400 lives.[14]

How is obstructive sleep apnea diagnosed and managed?

Diagnosis of OSA occurs through a sleep study, or polysomnography. During the sleep study, a patient will spend a night in a sleep laboratory and have various body functions measured. Simpler home tests are being evaluated.

Several treatment options exist and research into additional options continues. Therapy for sleep apnea is tailored to the individual patient based on medical history, physical examination and the results of sleep studies.

Behavioral changes such as avoiding alcohol, smoking and medicines that cause sleepiness, weight loss if overweight and sleeping on the side, not the back are advised in addition to continuous positive airway pressure (CPAP), which is the most common effective treatment for sleep apnea. Nasal CPAP prevents the airways from closing by delivering air through a mask that forces the air out through the nasal passages. CPAP should be used for the entire sleep duration every night. This device enables a person with sleep apnea to have a good night's sleep and prevents both the drop in oxygen that occurs with collapse of the airway and daytime sleepiness.[15] Treating all U.S. drivers suffering from OSA with CPAP cost approximately $3.2 billion while saving 980 lives and $11.1 billion in collision costs each year.[16]

Sometimes supplementary oxygen is used and obese patients are generally given nutritional counseling to reduce their weight and improve their sleep apnea.

Surgery has been used to increase the size of and stabilize the upper airway. This approach is less effective than CPAP but may be preferred by certain patients.

What is new in obstructive sleep apnea research?

One treatment option, nasal insufflation, uses warm, humid, high-volume airflow delivered through a nasal cannula (small rubber tubing that wraps around the ears with two small prongs that fit loosely in the nostrils) to increase pressure in the nasal cavity without causing the discomfort that can be associated with CPAP. Initial trials testing this treatment have yielded improved sleep quality and fewer sleep disturbances for sleep-disordered breathing individuals. In addition, the treatment would appear to be better tolerated than CPAP by patients. This method is less intrusive, which may improve adherence to treatment.[17]

SDB, the larger category of sleep disorders under which OSA f

research will have to focus on the connections between these disorders to better diagnose and treat each disorder.[18]

In other research developments, a study suggests that the wake-promoting drug modafinil may be a useful additional treatment for managing residual daytime sleepiness in patients with sleep apnea who are regular users of nasal CPAP.[19]

What is the American Lung Association doing about obstructive sleep apnea?

The Lung Association is currently funding two separate studies on OSA. One, through Columbia University, is researching whether CPAP can reduce the risk of heart complications. In another, researchers at New York University are studying methods to increase patient compliance with CPAP therapy.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight obstructive sleep apnea. Join us to win the battle against lung disease by visiting http://lungaction.org.

Occupational Lung Diseases

What are occupational lung diseases?

Occupational lung disease is the number one cause of work-related illness in the United States in terms of frequency, severity and preventability.

Many occupational lung diseases are related to a specific occupation or exposure to hazardous materials, such as asbestosis, coal workers' pneumoconiosis (black lung), silicosis (exposure to fine sand as in ceramic workers), berylliosis, byssinosis (brown lung, exposure to raw cotton) and farmer's lung. Workplace exposures can cause or worsen adult-onset asthma, chronic obstructive pulmonary disease (COPD, which includes emphysema and chronic bronchitis) and lung cancer.

Occupational lung cancer is the most frequent occupational cancer and is caused by exposure to substances such as asbestos, arsenic, chloroethers, chromates, ionizing radiation, nickel and polynuclear aromatic hydrocarbons. The National Institute for Occupational Safety and Health estimates that millions of workers are exposed to substances that have been tested and found to be cancer-causing, although only two percent of all chemicals in commerce have undergone such testing.[1]

These occupational exposures account for about 10.3 percent of lung cancer cases worldwide.[2] An estimated 14 percent of COPD is due to occupational exposure.[3]

Want to learn more about lung cancer? Please view the disease listing at **http://www.lungusa.org/lcfacts**

Occupational or work-related asthma is the most common form of occupational lung disease. An estimated 15 percent to 23 percent of new adult asthma cases in the United States are due to occupational exposures. These exposures in the workplace also can worsen pre-existing asthma.[4] Symptoms usually occur while the worker is exposed at work but, in some cases, they develop several hours after the person leaves work and then subside before the worker returns to the job. In later stages of the disease, symptoms may occur away from work after exposure to common lung irritants such as air pollution or dust.

Occupational asthma is usually reversible, but permanent lung damage can occur if exposure continues. According to one study, men working in forestry and with metals and women in the service industries (waitresses, cleaners and dental workers) have the highest risk for occupational asthma.[5]

Want to learn more about asthma? Please view the fact sheet at **http://www.lungusa.org/asthmainadultsfactsheet**

Asbestosis is a disease that worsens over time. It involves a scarring of lung tissue as a result of exposure to asbestos. Asbestos was previously widely used as an insulator and fire retardant until it became known that its microscopic fibers cause disease, including cancer.[6,7]

An estimated 1.3 million employees in construction and general industry face significant asbestos exposure on the job.[8] Between 1999 and 2004, there were 3,211 deaths due to asbestosis in the United States.[9] According to a study by the Environmental Working Group, almost 10,000 deaths per year in the United States, or close to 30 deaths per day, are due to asbestos-related diseases, including mesothelioma (cancer of the lung lining), asbestosis, lung cancer and gastrointestinal cancer, and the number may be increasing.[10] Smoking combined with asbestos exposure increases the risk of lung cancer.[11]

Want to learn more about asbestos and lung disease? Please view the asbestos page at **http://www.lungusa.org/asbestos**

Mesothelioma, an otherwise rare cancer of the lining of organs, is caused by asbestos exposure in 70 percent to 80 percent of cases.[12] Over the next decade, mesothelioma may be responsible for 35,000 U.S. deaths. Mesothelioma takes a long time to develop, with symptoms appearing 30 to 50 years after asbestos exposure.[13] An estimated 2,000 to 3,000 new cases occur each year in the United States. Mesothelioma affects men five times more often than women and is more common in Whites. The average survival period is just one year because by the time a patient shows symptoms, the disease has advanced to a late stage.[14]

Want to learn more about mesothelioma? Please view the fact sheet at **http://www.lungusa.org/mesotheliomafactsheet**

Byssinosis (brown lung disease) is a chronic condition involving obstruction of the small airways, severely harming lung function. It is caused by exposure to dusts from hemp, flax and cotton processing. In the United States, byssinosis is almost completely limited to workers who handle unprocessed cotton.

Coal workers' pneumoconiosis (black lung disease) is a chronic condition caused by inhaling coal dust that becomes imbedded in the lungs, causing them to harden and making breathing very difficult. An estimated 2.8 percent of coal miners are affected and about 0.2 percent have scarring in the lungs, the worst form of the disease.[15] Between 1999 and 2004, an average of 355

people died from black lung disease each year (an age-adjusted death rate of 1.2 per 1,000,000).[16]

Silicosis is caused by exposure to free crystalline silica, which comes from chipping, cutting, drilling or grinding objects such as or containing soil, sand, granite or other minerals. Quartz is the most common form of crystalline silica. Inhaling this dust can cause swelling in the lungs, either gradually over many years or in a very short amount of time. Severe forms of the disease include fluid buildup in the lungs and sometimes lung tissue scarring (fibrosis).[17]

Approximately two million U.S. workers are estimated to be occupationally exposed to free crystalline silica dusts, including more than 100,000 in high-risk jobs such as abrasive blasting, foundry work, stonecutting, rock drilling, quarry work and tunneling.[18] Glass workers and sand blasters also are exposed to silica dust. Wearing protective equipment can limit the amount of silica dust inhaled.[19] Evidence shows that workers who do not actually have silicosis but who have experienced long exposures to silica dust may be at increased risk of developing tuberculosis. The American Thoracic Society recommends that tuberculosis tests be given to persons with silicosis and to those without silicosis who have at least 25 years of occupational exposure to crystalline silica.[20]

Want to learn more about tuberculosis? Please view the disease listing at **http://www.lungusa.org/tuberculosis**

Hypersensitivity pneumonitis (farmer's lung) is caused by repeated exposure to organic dusts, fungus, mold or other foreign substances. Other causes include breathing in dust from moldy hay, bird droppings, contamination in humidifiers or air conditioners and certain chemicals. Hypersensitivity pneumonitis causes the lung's air sacs to become inflamed. Parts of the lungs then may develop fibrous scar tissue, which causes breathlessness.[21] Deaths where hypersensitivity pneumonitis was the underlying cause, although still quite few, have been generally increasing from 10 in 1979 to 53 in 2004.[22]

Want to learn more about hypersensitivity pneumonitis? Please view the disease listing at **http://www.lungusa.org/hypersensitivitypneumonitis**

Sick building syndrome can be the diagnosis when a large number of people in a building experience symptoms that do not fit the pattern of any particular illness and are difficult to trace to any specific source.

Many buildings are now sealed tightly due to rising energy costs, while modern ventilation systems mostly recycle indoor air. Workers breathe the same air again and again, which may also be made more harmful by pollutants from furnishings, appliances or building materials. If a ventilation system is not carefully designed or maintained, fresh air may not reach the workers. In fact, according to the National Institute of Allergy and Infectious Disease, poorly ventilated office spaces aid in the transmission of the organism that causes pneumonia, a disease that strikes three million people annually. Productivity losses due to sick building syndrome are estimated to cost $50 million annually.[23]

Risk Factors for Occupational Lung Diseases

Occupational lung diseases are caused primarily by long-term exposure to irritating or toxic agents in the workplace (mineral and/or organic dusts, smoke, fumes, gases, mists, sprays and vapors). It is possible, however, to develop occupational lung diseases from several or single exposures, the latter usually due to industrial accidents such as chlorine spills.

Smoking can increase the severity of occupational lung diseases. Smokers who also are exposed to cancer-causing agents, such as asbestos (as mentioned earlier) and radiation, greatly increase their chances of developing lung cancer and other lung diseases.

The mechanism through which exposure to air pollution increases the risk of disease and death is not fully understood, but the exposure impacts both the lung and circulatory systems. One study recorded problems with blood vessel widening in healthy men 24 hours after exposure to diesel exhaust. This research built on and supported a similar study that found blood vessel expansion immediately after diesel exhaust exposure. Such research offers insight into the possible connection between lung disease and exposure to air pollution or other occupational hazards.[24]

Although occupational lung diseases may not be cured, they can be prevented. Improving ventilation, wearing protective equipment, changing work procedures and educating workers about on-the-job hazards are the key factors for prevention.

Who has occupational lung diseases?

According to the U.S. Department of Labor, 4.1 million workplace injuries and illnesses occurred (a rate of 4.4 per 100 workers) in 2006, a decline from 4.2 million in 2005. In 2006, there were about 228,000 newly reported cases of occupational illness in private industry, of which 17,700 involved respiratory conditions. Overall, 1.9 per 10,000 full-time workers developed nonfatal occupational respiratory illnesses in 2006.[25]

Many schools still regularly use pesticides and others may be affected by pesticide drift from surrounding farms. Both of these factors create the potential for pesticide exposure among students and school staff, which can lead to a range of illnesses. From 1998 to 2002, the incidence rate for pesticide exposure-related illness was 7.4 and 27.3 cases per million children and full-time employees, respectively. The rate greatly increased in children over this time period, from 5.6 per million in 1998 to 7.8 per million in 2002. From 1998 to 2002, there were 2,593 pesticide-related acute illnesses reported; only 3 cases were highly severe (0.1%), while 275 were moderate (11%) and 2315 were classified as low severity (89%). Of the 278 cases deemed moderate or high severity, 135 reported respiratory symptoms associated with their pesticide-related illness. Further research on the impact of exposure, types of chemicals and other factors could lead to improvements in pesticide-use policies.[26]

Want to learn more about occupational lung diseases? Please view the fact sheet at **http://www.lungusa.org/oldfactsheet**

Certain racial and ethnic groups are traditionally employed in lower-wage sectors of the workforce where they can be exposed to occupational respiratory hazards. They are more likely to be employed in industries such as agriculture, mining (coal, silica), textiles, demolition, manufacturing (asbestos) and service maintenance (cleaning supplies). All of these occupations have been associated with lung disease.

In 2006, Blacks made up 21.7 percent of the nation's 63,000 textile workers. Blacks also account for 18.7 percent of the 2.1 million building cleaners, 6.6 percent of the 9.5 million construction workers and 11.5 percent of the 68,000 agricultural graders and sorters.[27]

Currently, Hispanics represent 14.5 percent of the total U.S. population but account for 49.5 percent of textile workers, 26.8 percent of building cleaners, 29.3 percent of construction workers and 44.5 percent of agricultural graders and sorters.[28]

Native Americans have been disproportionately employed in uranium mines. One study found that over the 25-year period following the end of mining for the Navajo Nation, uranium mining was greatly linked to lung cancer among Navajo men in New Mexico and Arizona due to exposure to radon byproducts. When uranium decays, it produces radium; when the radium then decays, it produces radon. Sixty-seven percent of the lung cancers among Navajo men occurred in former uranium miners. The risk of developing lung cancer is over 28 times greater for Navajo miners exposed to uranium than those not exposed. This represents a unique example of how occupational exposure to risk factors accounts for the majority of lung cancer seen in a population.[29]

Want to learn more about occupational lung diseases in diverse communities? Please view the *State of Lung Disease in Diverse Communities 2007* report at **http://www.lungusa.org/solddc-old**

What are the health impacts of occupational lung diseases?

Occupational lung diseases are a leading cause of lost work productivity. A total of 2,591 work-related respiratory illnesses with days away from work (2.4 per 100,000 workers) occurred in private workplaces in 2000. The highest total for days away from work due to respiratory illnesses was in the service sector (750), though the mining industry had the highest rate at 6.9 per 100,000 workers.[30]

The direct costs (medical expenses, etc.) of occupational injuries and illnesses are estimated at $45.8 billion, and indirect costs (lost wages, etc.) may range up to $229 billion.[31]

According to the U.S. Department of Energy, improving buildings and indoor environments could reduce health care costs and sick leave and increase worker performance, resulting in an estimated productivity gain of $30 billion to $150 billion annually. For the United States, the corresponding annual health care savings, plus productivity gains, include:

- $6 billion to $19 billion from reduced lung disease,
- $1 billion to $4 billion from reduced allergies and asthma,
- $10 billion to $20 billion from reduced sick building syndrome symptoms and
- $12 billion to $125 billion from direct improvements in worker performance unrelated to health.[32]

What is the American Lung Association doing about occupational lung diseases?

The American Lung Association supports researchers studying the causes of and cures for occupational lung diseases.

One such research project is studying proteins that are involved in wound repair in the lungs. Toxins and pollutants are constantly contacting the epithelium, a layer of cells inside the lung that seal out such hazards. Studying how the lungs repair this cell damage will increase understanding of injury response and lung disease prevention.

Want to learn more about research funded by the American Lung Association on occupational lung diseases? Please use the search tool available at **http://www.lungusa.org/researchawardsnationwide**

Other researchers supported by the American Lung Association are pursuing a variety of leads (a dozen unique studies) concerning lung cancer treatment, from new drugs to different treatment methods. A laboratory at the University of Iowa is hoping to improve knowledge of treatment for asbestosis and other pulmonary fibrosis diseases by studying the role of certain cells in the development of asbestosis. A host of other studies also are focusing on pulmonary fibrosis and obstructive lung diseases.

Thousands of advocates have joined the American Lung Association to tell Congress that more needs to be done to fight occupational lung diseases. Join us to win the battle against lung disease by visiting http://lungaction.org.

Pulmonary Arterial Hypertension (PAH)

What is pulmonary arterial hypertension?

Pulmonary hypertension (PH) refers to high blood pressure in the arteries of the lungs. Pulmonary arterial hypertension (PAH) is one form of PH in which the pulmonary arteries that carry blood from the heart to the lungs, where it picks up oxygen, constrict abnormally, forcing the heart to work faster and causing blood pressure within the lungs to rise. There are several types of PAH. It can occur in response to a variety of associated disorders and taking certain medicines. There also is a form with no known cause, called idiopathic pulmonary arterial hypertension or IPAH.[1]

PAH is progressive and life-threatening because the pressure in a patient's pulmonary arteries rises to dangerously high levels, putting a strain on the heart. At rest, blood pressure in a normal pulmonary artery is 15 mmHg (15 millimeters of mercury), and rises during exercise. In a person who has PAH, the average blood pressure in a pulmonary artery is more than 25 mmHg at rest and more than 30 mmHg during exercise.[2]

The most common symptoms of PAH include shortness of breath, excessive fatigue, dizziness, fainting, weakness, ankle swelling, chest pain and bluish lips, hands or feet.[3]

Certain factors appear to increase the chances of developing PAH. They include use of appetite suppressant drugs (especially fenfluramine and dexfenfluramine), chronic use of cocaine or amphetamines, HIV infection, liver disease and connective tissue diseases such as scleroderma or lupus erythematosus.[4]

Studies estimate that the use of certain appetite suppressant drugs increases the risk of getting PAH more than six times.[5] Fenfluramine and dexfenfluramine were taken off the market in September 1997 after being linked to heart valve damage.[6] Some other possible causes of PAH may include a genetic predisposition, immune system disease or chemical exposures.[7]

Want to know more about PAH? Please view the fact sheet at **www.lungusa.org/pahfactsheet**

Who has pulmonary arterial hypertension?

PAH affects men and women of all ages and all ethnic and racial backgrounds. While the true incidence of PAH is unknown, it is a relatively rare disease, affecting 1 in 100,000 to 1,000,000 people.[8] PAH is likely to get worse during labor and delivery, resulting in a high maternal death rate. PAH also is found more often in people with a family history of pulmonary hypertension or sudden death.

IPAH most commonly occurs in women in their mid-30s.[9] The average age at diagnosis is 36 years old. About twice as many cases are reported in women as in men.[10]

Persistent pulmonary hypertension of the newborn (PPHN), another type of PAH, is a condition involving acute or sudden respiratory failure. It is seen more commonly in full-term infants who have underlying diseases such as respiratory distress, sepsis or lung hypoplasia (below normal size or immature). PPHN affects approximately 1 in 1,250 live-born full-term infants.[11]

What is the health impact of pulmonary arterial hypertension?

In 2004, 314 deaths were caused in the United States by IPAH; 241 were female and 73 were male.[12]

The prognosis for PAH patients is quite poor. Currently, approximately 50 percent of people diagnosed with PAH die within five years.[13] The average period of survival is only about three years for those who do not receive treatment. Prognosis is worse for patients who have heart failure, severe PAH or are over the age of 45 when diagnosed.[14] However, many patients report that some lifestyle changes allow them to go about many of their daily tasks.

Are you suffering from PAH? To find a PAH support group in your area, visit **www.phassociation.org/connect**

Even with treatment, the pressure in the lungs caused by PAH will continue to worsen and cause the right ventricle or right side of the heart to fail. As the right ventricle gets larger, the patient can develop irregular heart rhythms, which can lead to sudden death. As their PAH progresses, patients get weaker and more easily fatigued, so that their quality of life is affected.

How is pulmonary arterial hypertension diagnosed and managed?

Diagnosis may be delayed for several years since initial symptoms of PAH may be subtle and it is difficult to detect PAH in a routine medical examination. Even when the disease has progressed, the symptoms may be confused with other conditions that affect the heart and the lungs. Additionally, there is no specific test for PAH. Health care providers looking for possible PAH may do a variety of tests, including chest x-ray, electrocardiogram, echocardiogram, stress test, spirometry and cardiac catheterization.[15]

PAH is treated with a number of drugs. None of the drugs can cure or halt PAH progression, but they may relieve symptoms and slow the disease. Some patients take diuretics, although caution should be used with these drugs. Anticoagulants or blood thinners also may be used to keep blood from clotting internally; warfarin is the recommended type. Another drug, digoxin, helps the heart beat more regularly and strongly and can be helpful for some PAH sufferers.[16]

Many of the drugs used to treat PAH are vasodilators, which help to reduce blood pressure in the lungs by enlarging the blood vessels and decreasing cell growth. These drugs include prostanoids, endothelin receptor antagonists and phosphodiesterase-5 inhibitors. Calcium channel blockers also are used, but only help a small number of PAH patients.[17]

Although some patients do well with medication, others may need and be able to receive a heart-lung transplant. It is the only true cure for the heart problems associated with PAH. As technology advances, these transplants are becoming more successful.

The diagnosis of persistent pulmonary hypertension of the newborn is usually made within 24 hours after birth. Therapy for PPHN can include 100 percent supplemental oxygen, assisted ventilation, surfactant, sedation, inhaled nitric oxide or an artificial heart-lung machine (extracorporeal membrane oxygenation or ECMO). Unfortunately, inhaled nitric oxide and ECMO are expensive and many newborns are born in facilities that do not have these options available.[18] Infants with PPHN treated with a drug called sildenafil were more likely to survive than those given a placebo, although more research is needed before this treatment can be recommended.[19]

Want to know more about treatment options for PAH? Please visit PAH/PPH Treatment Options at **http://www.uptodate.com/patients/index.html**. Search under "PAH".

What is new in pulmonary arterial hypertension research?

The National Heart, Lung and Blood Institute conducts new clinical and other research on PAH. These efforts hopefully will lead to a better understanding of the disease.

Researchers are seeking quicker ways to diagnose PAH. In the United States, PAH patients are being referred to health centers too late. Although survival rates have increased, they remain low.[20] A recent pilot study looked into different options for diagnosing PAH. A new non-invasive tool to measure the pulmonary artery distensibility (stiffness) using magnetic resonance imaging (MRI) may be useful.[21]

What is the American Lung Association doing about pulmonary arterial hypertension?

Currently, the American Lung Association is working with leading researchers to identify new interventions for PAH. Studies being conducted include *Role of Uric Acid in Primary Pulmonary Hypertension, Exploring Hereditary Basis for Developing Pulmonary Hypertension, Uncovering Enzyme's Role in Pulmonary Hypertension* and *Seeking Strategies to Stop Process That Leads to Pulmonary Hypertension*. These studies are aimed at better understanding PAH and identifying successful treatment strategies.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight PAH. Join us to win the battle against lung disease by visiting http://lungaction.org.

Respiratory Distress Syndrome and Bronchopulmonary Dysplasia (RDS & BPD)

What are RDS and BPD?

Respiratory distress syndrome (RDS) is a life-threatening lung disorder in which a baby's lungs are not fully formed and cannot function outside the womb. This condition primarily affects premature babies. Bronchopulmonary dysplasia (BPD) is a chronic lung disease that is seen most often in severely premature babies (birth weight lower than 1,000 grams at birth) who developed RDS. About one out of three of these severely premature babies is diagnosed with the disease.[1]

RDS is caused by a lack of pulmonary surfactant, a chemical that keeps the air sacs in mature lungs from collapsing and allows them to inflate with air more easily. In respiratory distress syndrome, the immature lungs do not produce enough surfactant and the air sacs collapse, preventing the infant from breathing properly. Symptoms usually appear shortly after birth and become more severe over time. This condition used to be known as "hyaline membrane disease," due to the glassy appearance of membranes in the lungs.

Risk factors for RDS are premature birth, diabetes in the mother, and stress during delivery that produces acidosis[1] in the newborn at birth. RDS infants may develop several complications, including infection of the bloodstream (sepsis) and other problems related to premature birth, such as bleeding into the brain. These and other complications can cause convulsions, shock-like states and, in some cases, death.

BPD is now less common in babies who weigh more than 1.2 kilograms at birth or are born after 30 weeks of pregnancy. It involves abnormal development of lung tissue and is characterized by inflammation and scarring in the lungs. Babies with RDS often require supplementary oxygen and breathing assistance from mechanical ventilators. BPD is thought to be the result of how a baby's lungs respond to factors such as delivery room care, high pressure oxygen therapy, pressure from mechanical ventilators and infections. Another name for BPD is neonatal chronic lung disease.[2]

[1] Increased acidity

In addition to RDS, BPD also can arise from other adverse conditions that a newborn's fragile lungs have difficulty coping with, such as trauma, pneumonia and other infections. All of these can cause the inflammation and scarring associated with BPD, even in a full-term newborn or, very rarely, in older infants and children.

Want to learn more about RDS and BPD? Please view the fact sheets at **http://www.lungusa.org/bpdfactsheet** and **http://www.lungusa.org/rdsfactsheet**

Variations in genes involved in lung function may increase the risk of RDS and BPD in preterm infants. In a twin study, genetics were associated with 35 percent to 65 percent of the risk for RDS and BPD among preterm and very preterm infants. Analysis of genetic impact is critical because the aim in the future is to design specific therapies for these diseases.[3]

Both RDS and BPD are characterized by rapid breathing and a blue coloring around the lips and nails due do the low amount of oxygen in the blood. Babies with RDS also often have nasal flaring and will make a grunting noise with each breath, while those with BPD usually have shallow breathing, sucked-in ribs and chest, coughing, wheezing, poor posture of the neck, shoulders and trunk, and may attempt to push more air into the lungs by raising or stretching the neck.[4]

Who has RDS or BPD?

Despite the progress made in prenatal care, RDS continues to be a major reason for increased morbidity among preterm infants. Surviving premature RDS infants are also at risk for chronic lung diseases and nervous system disorders.

RDS affects an estimated 10 percent of all premature infants born alive in the United States: 16,268 infants in 2005.[5] Babies born full-term rarely develop RDS;[6] most cases are seen in premature babies with under 28 weeks gestation.[7]

About 12,000 babies in the United States get BPD each year. Most babies with BPD weigh about 3.5 pounds or less at birth. Of the estimated 60,000 infants (1.5% of newborns) born weighing less than 3.3 pounds yearly in the United States, about 20 percent will develop BPD.[8] For unknown reasons, White male infants seem to be at greater risk for developing BPD.

Recently, BPD also has been seen in adults with acute respiratory distress syndrome.

What are the health impacts of RDS and BPD?

A generation ago, most babies born with RDS did not survive. Annual RDS deaths decreased from 25,000 in the 1960s to 875 in 2004, representing 3.1 percent of infant fatalities. In 1979, the syndrome was still the second-ranking cause of infant deaths (after birth defects); by 2004, it had dropped to seventh. In 2004, the RDS mortality rate was 21.3 per 100,000 live births.[9] According to

preliminary data, there were 861 infant deaths due to RDS in 2005, a rate of 20.8 per 100,000 live births.[10]

In 2004, 293 Black infants (47.6 per 100,000) died from RDS compared to 558 non-Hispanic White infants (17.3 per 100,000). This rate was 2.75 times greater than Whites.[11] As of 2003, RDS was the sixth leading cause of death among Black infants and the seventh leading cause of death for Hispanic infants.[12] There were 19,000 hospitalizations in 2004 due to RDS.[13] Table 1 below displays RDS incidence and mortality by race and ethnicity.

Want to learn more about RDS and BPD in diverse communities? Please view the *State of Lung Disease in Diverse Communities: 2007* report at **http://www.lungusa.org/solddc-rds**

Table 1: Respiratory Distress Syndrome Incidence and Mortality[I]*

	Incidence (2005)[2]		Mortality[I]	
Race/Ethnicity	Number	Rate	Number	Rate
Total	16,268	3.9	875	21.3
White	12,501	3.9	558	17.3
Black	2,970	4.7	293	47.6
Hispanic[II]	1,779	1.8	166[3]	16.9[3]
American Indian/ Alaska Native	236	5.3	7 [III]	§
Asian American/ Pacific Islander	561	2.4	14 [III]	§

Sources:
1. Centers for Disease Control and Prevention. National Center for Health Statistics. National Vital Statistics Reports. Deaths: Final Data for 2004. August 21, 2007; 55(19).
2. National Center for Health Statistics. VitalStats. Available at http://www.cdc.gov/nchs/VitalStats.htm. Accessed on January 7, 2008.
3. Centers for Disease Control and Prevention. National Center for Health Statistics. National Vital Statistics Reports. Deaths: Preliminary Data for 2005. September 2007.

Notes:
I. Infant incidence rates are per 1,000 while mortality rates are per 100,000 population.
II. Hispanics are not mutually exclusive from Whites, African Americans, Asian/Pacific Islanders and American Indians/Alaska Natives. Mortality data are preliminary for 2005.
III. Mortality number is from 2002. Latest data available for this group.
§ Unreliable: Based on fewer than 20 deaths.
*** Comparisons should only be made between groups and diseases using rates, not number of cases, as these do not take into account differences which may exist in population size or demographics.**

Because more babies weighing less than three pounds now live, more babies get BPD today than 30 years ago.[14] Although most of these infants eventually outgrow the more serious symptoms, in rare cases BPD—in combination with other complications from premature birth—can be fatal.

The time an infant with BPD spends in the neonatal intensive care unit (NICU) can range from several weeks to a few months. The National Institutes of Health estimates that the average length of intensive in-hospital care for babies with BPD is 120 days. Even after a baby leaves the hospital, he or she may require continued medication, breathing treatments or even oxygen at home.

Although most children are weaned from supplemental oxygen by the end of their first year, a few with serious cases may need a ventilator for several years or, in rare cases, their entire lives. BPD is associated with developmental delays and cerebral palsy.[15] Autopsy results indicate that very preterm infants who have died from BPD have fewer alveoli (air sacs).[16]

Want to learn more about BPD? Please view the disease listing at **http://www.lungusa.org/bpd**

In 2005, the total economic cost of RDS was estimated to be $2.3 billion annually.[17] The overall cost of treating BPD in the United States is estimated to be $2.4 billion.[18]

How are RDS and BPD diagnosed and managed?

Researchers have made much progress in lifesaving discoveries for RDS. If complications during pregnancy indicate that a premature birth is likely, health care providers can test the amniotic fluid for surfactant in order to track fetal lung development. Delivery then can be delayed for as long as possible to allow the baby's lungs to fully form.

If the birth cannot be delayed beyond 34 weeks, the mother may be given corticosteroid therapy before birth—notably, dexamethasone—to enhance lung maturation of the fetus.

Health care providers also can deliver the baby and give surfactant to the infant and/or provide partial liquid ventilation in infants with severe RDS using mechanical respirators designed to prevent the alveoli from collapsing.[19]

Two forms of replacement surfactant have been approved. One is derived from cattle; the other is synthetic. The surfactant is given either as soon as the premature baby is born or when it becomes apparent that RDS is present. Surfactant therapy is usually not required beyond the first day of life. These therapies have led to a dramatic decrease in mortality associated with RDS, from nearly 100 percent to less than 10 percent.[20]

Inhaled nitric oxide is known to improve gas exchange and reduce pulmonary inflammation. A study of 207 premature infants found the use of low-dose inhaled nitric oxide, when started soon after birth, reduced the incidence of chronic lung disease among premature infants with the RDS. The use of nitric oxide also may decrease the risk of severe bleeding and oxidative stress, which are important neonatal complications associated with prematurity.[21]

BPD is typically diagnosed if an infant still requires additional oxygen and continues to show signs of respiratory problems after 28 days of age. Chest X-rays may be helpful in making the diagnosis. In babies with RDS, the X-rays may show lungs that look like ground glass. In babies with BPD, the X-rays may show lungs that appear spongy. Further training programs for health care providers are needed to increase expertise in lung function of infants.[22]

Treatment for BPD is supportive. Health care providers treat the symptoms, help the baby breathe, and make sure it has enough oxygen, is warm, treated for infections, and given the right amount of fluids and nourishment. This approach gives the baby's lungs time to fully mature.

Babies initially diagnosed with BPD receive intense supportive care in the hospital, usually in a NICU, until they are able to breathe well enough on their own without the support of a mechanical ventilator. Some babies also may receive continuous low-pressure (jet) ventilation, an option intended to minimize the lung damage from ventilation that contributes to BPD. Not all hospitals use this procedure to treat BPD, but some hospitals with large NICUs do.

Infants with BPD also are treated with medications that help support lung function. These include bronchodilators (such as albuterol) to help keep the airways open and diuretics (such as furosemide) to reduce the buildup of fluid in the lungs.

Antibiotics sometimes are needed to fight bacterial infections because babies with BPD are more likely to develop pneumonia.

Over a period of years, the health of children with BPD will improve as lung growth makes up for the early lung damage.

What is new in RDS and BPD research?

New research has focused on determining the best treatment options for patients with RDS. A recent study compared early surfactant administration with brief mechanical ventilation versus selective surfactant and continued ventilation for preterm infants with or at risk for respiratory distress syndrome. The study found that early surfactant replacement therapy is associated with less need for mechanical ventilation and a lower incidence of BPD.[23,24]

Nutrition is important for normal lung development and maturation. Several studies have shown that general undernutrition (a lack of protein, specifically) may increase risk of lung injury that can lead to BPD.[25] Vitamin A supplements have been shown to decrease BPD incidence and death because it is a nutrient important for cell growth. However, widespread use of this treatment has not occurred because vitamin A must be injected several times into the muscle of the child.[26] Other nutrients[II] may provide premature infants with added protection against BPD.[27]

Recent studies have focused on efforts to prevent BPD. Findings suggest that adding dexamethasone, a corticosteroid, to surfactant therapy for RDS may be helpful. Although some current treatments offer promise, no preventive therapy for BPD has been proven safe and effective, except for vitamin A. Additional studies are needed.[28]

[II] Inositol, sulfur-containing amino acids and selenium.

What is the American Lung Association doing about RDS and BPD?

The American Lung Association is funding a study being conducted in which researchers are seeking to better understand the role of genetic transcription factors in the development of BPD. The study also is trying to determine whether a new antibiotic will be a successful treatment option for BPD in premature infants. Researchers are working to identify a safe alternative to steroids, which have been used in BPD treatment but can increase the risk of cerebral palsy and developmental delay.

Smoking or exposure to indirect smoke during pregnancy increases the risk of infant prematurity, which is the major cause of RDS.[29] The American Lung Association strongly advocates against smoking, especially during pregnancy. Visit http://www.lungusa.org to get help quitting, including information on how to sign up for an American Lung Association Freedom From Smoking® Clinic in your area or for the online clinic, which is free of charge at http://www.ffsonline.org.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight RDS and BPD. Join us to win the battle against lung disease by visiting: http://lungaction.org.

Respiratory Syncytial Virus (RSV)

What is respiratory syncytial virus?

Respiratory syncytial virus (RSV) is a very contagious virus that causes infection of the lungs and breathing passages. RSV also can affect the mouth, nose and throat.

After each RSV infection, the body forms some immunity to the virus, but that immunity is never complete. Re-infections can occur several times during a lifetime, causing mild infections in healthy adults, but more severe illnesses (like pneumonia) at any age, especially in infancy, among the elderly and those with chronic lung or heart diseases or compromised immune systems.[1, 2]

RSV infections occur throughout the year, but there are typically widespread outbreaks during the winter months, peaking in January and February.[3]

RSV passes from person to person through infected nasal and oral fluids. It can enter the body when eyes, mouths or noses are touched. It also may be spread by droplets from a cough or sneeze.[4]

Symptoms of RSV can be mild and include cough, stuffy or runny nose, and fever in adults and children.[5] Additional symptoms in children can include decreased interest in surroundings, slowness, irritability, poor appetite, bluish color of the lips or fingernails, abnormally rapid breathing and suspended breathing (apnea).

Want to learn more about RSV? Please view the disease listing at **http://www.lungusa.org/rsv**

Who has RSV?

Respiratory syncytial virus affects people of all ages, but is the most common cause of severe lower respiratory tract disease among infants and young children under two years of age.[6]

Although RSV is most common in infants and young children, it can cause respiratory illness throughout life, especially among those at high risk for lung infections.[7] Boys are affected 1.7 times more often than girls.[8]

American Indians and Alaska Natives have a higher risk of hospitalizations associated with RSV infection which may indicate a racial disparity that needs to be addressed.[9]

Want to learn more about RSV and diverse communities? Please view the *State of Lung Disease in Diverse Communities: 2007* report at **http://www.lungusa.org/solddc-rsv**

What is the health impact of RSV?

During their first RSV infection, between 25 percent and 40 percent of infants and young children have signs or symptoms of bronchiolitis or pneumonia, and 0.5 percent to 2 percent require hospitalization. Most children recover from the illness in 8 to 15 days.[10]

It is estimated that 75,000 to 125,000 children are hospitalized due to RSV annually and approximately 0.2 percent to 7 percent of these die each year.[11, 12]

RSV infection poses a disease burden similar to influenza to the elderly and high-risk adults. RSV accounts for 10,000 deaths annually in the United States in those over 65 years of age.[13] A study found that 78 percent of RSV-associated respiratory and circulatory deaths occurred among people aged 65 years or older.[14] Another study investigated the rates of RSV in groups of elderly patients over four winters. Findings indicated that an effective RSV vaccine would offer much benefit to high-risk populations such as the elderly.[15]

RSV causes an estimated 34 hospitalizations per 1,000 births for American Indian and Alaska Native infants and 27 per 1,000 for the general U.S. infant population.[16] Compared to the U.S. average, American Indian and Alaska Native infants are approximately 26 percent more likely to be hospitalized due to RSV. The risk for these groups is not the same, but varies drastically by region and tribe. American Indian and Alaska Native infants living in the Alaska and Southwest regions were hospitalized for RSV at 159 percent and 76 percent higher rates, respectively, than the average U.S. infant.[17] One study found that the age-adjusted RSV-specific hospitalization rates among Navajo and White Mountain Apache infants less than one year old were three times higher than the rates reported for infants in the general U.S. population.[18]

Want to learn more about RSV? Please view the fact sheet at **http://www.lungusa.org/rsvfactsheet**

How is RSV diagnosed and managed?

Standard tests such as antigen detection assays are used to diagnose RSV disease.

For children with mild disease, no specific treatment is necessary other than the treatment of symptoms (e.g., acetaminophen to reduce fever). Children with severe disease may require oxygen therapy and occasionally mechanical ventilation. Ribavirin aerosol may be used in the treatment of some patients with severe disease.

The U.S. Food and Drug Administration has licensed two products (RespiGam and Synagis) to prevent serious RSV disease in children under age two who are at increased risk for complications of RSV infection. These are not true vaccines but pre-formed antibodies.

Development of an RSV vaccine is a high research priority to public health officials, but none is yet available. Current prevention options include good infection-control practices for all viral illnesses, such as frequent hand washing.

What is new in RSV research?

While it is known that RSV bronchiolitis is a common cause of hospitalization in children, and data also show that it is a risk factor in the development of childhood asthma, little is known about what influences the development of RSV bronchiolitis. Therefore, a study was conducted to uncover the environmental and other risk factors associated with RSV onset. Specifically, age, postnatal cigarette smoke exposure, race and high household allergen levels were studied. The study found that younger infants were at greater risk for more severe forms of the disease[1]. In addition, cigarette use by the mother and exposure to secondhand smoke were associated with RSV onset in children. Of importance for future research, genetics also impact the onset of RSV.[19]

What is the American Lung Association doing about RSV?

The Lung Association is funding research at the University of Washington that is comparing two different tests that may help predict which children with RSV are at risk for asthma. Determining which children are likely to improve on their own and which may go on to develop asthma would allow health care providers to begin asthma therapy at a very early age and avoid asthma complications that often plague young children with the disease.

New research shows that tobacco use or exposure to secondhand smoke, especially among pregnant mothers and their infants, may increase the risk of RSV. The American Lung Association says that this is yet another reason for them to avoid tobacco use and secondhand smoke. Visit http://www.lungusa.org to get help quitting, including information on how to sign up for an American Lung Association Freedom From Smoking® Clinic in your area or for the online clinic, which is free of charge at http://www.ffsonline.org.

Thousands of advocates for lung health have joined with the American Lung Association to tell Congress that more needs to be done to fight RSV. Join us to win the battle against lung disease by visiting http://lungaction.org.

[1] All participants were 12 months or younger at the time of their RSV diagnosis. Younger age, in months, was related to greater disease severity.

Sarcoidosis

What is sarcoidosis?

Sarcoidosis is a disease that causes small areas of inflammation of the body's tissues. This swelling produces small lumps called granulomas that can be either inside the body or on the outside as sores on the face or shins. Scar tissue forms while the lumps are expanding into groups.[1] Sarcoidosis can attack any organ and always affects more than one of the body's systems. However, more than 90 percent of patients with sarcoidosis will have lung involvement.[2] When scarring occurs in the lungs, the lungs' tiny air sacs (alveoli) are replaced by fibrotic tissue that is stiff, thicker than the normal lung tissue, and cannot absorb oxygen.[3] Between 20 percent and 30 percent of people with pulmonary sarcoidosis end up with permanent lung damage.[4] Pulmonary sarcoidosis can cause loss of lung volume, which is the amount of air the lungs can hold, and it can cause abnormal lung stiffness.

People with sarcoidosis often do not have any symptoms and therefore do not report the disease. Despite the difficulties this poses for tracking the disease, sarcoidosis is known to be the most common fibrotic lung disorder in the United States.

Symptoms of pulmonary sarcoidosis may include a dry cough, shortness of breath or mild chest pain.

The cause of sarcoidosis is not yet known, but researchers have several theories. Most researchers agree that sarcoidosis involves an altered immune system, but do not know the source of the problem and what causes such a response. Some researchers believe that sarcoidosis may result from a respiratory infection caused by a virus, bacteria or an unidentified environmental toxin.

Want to learn more about sarcoidosis? Please view the disease listing at **http://www.lungusa.org/sarcoidosis**

One study suggested that behaviors associated with rural living play some role in the development of sarcoidosis. Researchers found that pulmonary sarcoidosis was linked to exposures involving the burning of wood, such as using wood stoves or fireplaces for home heating, especially in African Americans.[5]

More than 50 percent of sarcoidosis patients in one sample had an abnormal immune system response to proteins resulting from the tuberculosis bacteria when compared to people without sarcoidosis. This supports the idea that bacteria may be responsible for sarcoidosis in some individuals with the disease.[6]

Several studies have explored occupational and environmental risk factors for sarcoidosis. It was found that in the 1940s, cases of "sarcoidosis" were high among women in the fluorescent light industry, which led to the recognition of beryllium exposure as the cause of "Salem sarcoid."[7] Although beryllium phosphors are no longer used in fluorescent light bulbs, in 2003 it was found that 6 percent of patients initially diagnosed with sarcoidosis actually had chronic beryllium disease.[8] This finding emphasizes the importance of taking an occupational history when sarcoidosis is suspected.[9]

Want to learn more about sarcoidosis? Please view the fact sheet at **http://www.lungusa.org/sarcoidosisfactsheet**

Sarcoidosis occasionally runs in families, which suggests that genetics may play a role. One study found that the risk for sarcoidosis was increased 4.6-fold in parents and siblings of patients with the disease.[10]

Who has sarcoidosis?

Prevalence estimates in the United States range from less than 1 to 40 cases per 100,000 population. However, both gender and ethnicity may impact disease risk; the age-adjusted annual incidence rate is higher for Blacks (35.5 per 100,000) than Whites (10.9 per 100,000). Women also have higher observed rates compared to men.[11]

Sarcoidosis occurs primarily in adults 20 years to 40 years of age, although all ages can be affected.[12] However, newer research suggests that a second peak occurs in those over 50 years old, especially in women.[13]

People of Scandinavian, German, Irish, Asian and Puerto Rican origin also are more prone to sarcoidosis than the general population.[14]

Three percent to 14 percent of patients worldwide have an affected family member. The ACCESS study (a study of the causes of sarcoidosis) found that patients were five times more likely to report an affected member of their immediate family.[15]

Want to learn more about sarcoidosis and diverse communities?
Please view the *State of Lung Disease in Diverse Communities: 2007* report at
http://www.lungusa.org/solddc-sarcoidosis

What is the health impact of sarcoidosis?

Sarcoidosis usually is not disabling and most people with the disease can live normal lives. In the majority of cases, the condition appears temporarily and disappears on its own without treatment. In cases where the lumps do not heal and disappear, the tissues tend to remain inflamed and become scarred. About 20 percent to 30 percent of people with sarcoidosis are left with some permanent lung damage.[16]

Although not common, death from sarcoidosis can occur if the disease causes serious damage to a vital organ other than the lung. Mortality is most commonly due to lung failure. In the United States, the mortality rate among African Americans (1.6 per 100,000) is about 16 times that of Whites (0.1 per 100,000).[17]

According to the National Heart Lung and Blood Institute (NHLBI), there were 10,000 hospitalizations in 2004 and 146,000 doctor visits during 2003 in the United States due to sarcoidosis.[18]

Studies have shown that certain populations have a greater risk of specific expression of sarcoidosis. African Americans are more likely to have involvement of the skin other than skin inflammation, and eye, liver, bone marrow and lymph involvement outside the chest region. Women are more likely to have neurologic and eye involvement and skin inflammation; men are more likely to have elevated calcium levels.[19]

How is sarcoidosis diagnosed and managed?

Diagnostic tests for sarcoidosis include chest x-rays, pulmonary function tests and special blood tests. In most cases, a biopsy is necessary to fully establish the diagnosis.

Although no treatment has been shown to be clearly effective on a prolonged basis, when the disease progresses, or there are significant symptoms, including critical organ involvement (such as the eyes, brain and heart), health care providers will ordinarily prescribe corticosteroids. Some patients with sarcoidosis are unable to tolerate corticosteroids and other treatment options due to side effects, or have diseases unresponsive to these agents.

As a second line therapy, immunosuppressive agents may be of some benefit. Lung transplantation can be considered as the treatment of last resort for intractable sarcoidosis unresponsive to immunotherapy.

What is new in sarcoidosis research?

Since sarcoidosis tends to occur more frequently in certain ethnic groups and may occur in families, much research is taking place to find the genetic basis for these predispositions.[20]

Research into genetic risk for sarcoidosis has been promising, focusing primarily on human leukocyte antigens genes but also other candidate genes. Unfortunately, many of these studies have not been replicated. Genomewide scans on both German and African-American families have produced candidate genes on chromosomes 6 and 5, respectively. The former gene may impact sarcoidosis through impairment of the immune system.[21]

T cells, white blood cells that are part of the immune system, have drawn attention to the study of sarcoidosis. CD4+ T cell levels are often extremely elevated in certain sarcoidosis patients. These cells are associated with sarcoid inflammation and offer a potential treatment approach. Regulatory T cells have been found to be abnormal in some sarcoidosis patients and may be contributing to the disease.[22]

Infliximab was found to be a safe and effective treatment for certain types of sarcoidosis that were previously unresponsive to standard treatment. Nine out of 10 patients receiving Infliximab were reviewed and reported symptomatic improvement with therapy; all 10 demonstrated evidence of improvement. It also was recommended that patients receiving the drug should be screened for latent tuberculosis[I] and lymphoproliferative[II] disorders.[23]

What is the American Lung Association doing about sarcoidosis?

The American Lung Association has supported prominent researchers who have greatly contributed to the understanding of sarcoidosis. One researcher has been instrumental in helping scientists better understand the mechanisms underlying sarcoidosis and how it affects different populations, especially African Americans. His research group is searching for the specific genes that cause sarcoidosis by using genetic linkage and association analysis. Currently, two possible sarcoidosis genes have been identified. Other genetic factors that predispose people to the progressive disease are being investigated.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight sarcoidosis. Join us to win the battle against lung disease by visiting http://lungaction.org.

[I] Occurs when the person's immune system is able to successfully fight the tuberculosis infection; also called inactive infection.

[II] Disorders in which lymphocyte cells are produced in excessive quantities, usually in patients with compromised immune systems.

Sudden Infant Death Syndrome (SIDS)

What is sudden infant death syndrome?

Sudden infant death syndrome (SIDS), often called crib death, is a mysterious disease that mainly occurs between the ages of one and six months.[1] It is defined as the sudden death of an infant less than one year of age that remains unexplained after a thorough case investigation, including an autopsy, a death scene investigation, review of the infant's health status before dying and a family medical history.

There are many theories as to what actually causes SIDS. Some health experts believe that SIDS babies are born with differences in their brains that make them unable to awaken from sleep when exposed to high carbon dioxide or low oxygen levels, leading to abnormal breathing or heart function. In a recent study, researchers found that infants who eventually died from SIDS tended to have more trouble waking up by the end of the night than a control group. The infants studied who later died from SIDS also tended to partially wake more frequently and for a longer period of time in the first part of the night (between 9:00 pm and 12:00 am) and completely wake[1] fewer times during the latter part of the night (between 3:00 am and 6:00 am).[2]

Risk factors for SIDS include prone and side sleeping positions, maternal smoking during pregnancy, exposure to secondhand smoke, overheating, young maternal age, inadequate prenatal care, soft bedding, premature or low weight at birth, African-American or American Indian/Alaska Native heritage, bed sharing and being male.[3]

In 1992, the American Academy of Pediatrics recommended that infants be placed to sleep on their backs to reduce the risk of SIDS. In 1994, the Centers for Disease Control and Prevention initiated a national Back to Sleep education campaign to encourage parents, healthcare providers and the public to make sure all infants sleep on their backs or sides. As of 2000, approximately 20 percent of United States infants continued to sleep face down.

[1] Infants were monitored and arousals during the night were defined as either incomplete waking or complete waking.

The Back to Sleep campaign has been so successful that the frequency of infants placed on their backs to sleep increased from 13 percent in 1992 to 72.8 percent in 2003. The SIDS mortality rate decreased by more than 50 percent in the United States during this time period.[4]

Maternal smoking during pregnancy is estimated to double the risk of SIDS; one study found that the risk of SIDS is 2.6 times higher among smoking pregnant women compared to mothers who do not smoke during pregnancy. Among smokers, 61 percent of SIDS cases were due to maternal smoking; out of all SIDS cases, 21 percent were due to maternal smoking and thus could be prevented.[5] The California Environmental Protection Agency attributes 430 SIDS deaths a year to secondhand smoke exposure.[6] Also, SIDS is more likely among preterm or low birth weight babies and those born to mothers who had their first pregnancy under age 20.[7]

Want to learn more about secondhand smoke and children? Please view the fact sheet at **http://www.lungusa.org/secondhandsmokekidsfactsheet**

A study also found a link between use of a used infant mattress and an increased risk of SIDS, particularly if the mattress was from another home.

New evidence is emerging that variations in genes and a difference in DNA sequence may contribute to vulnerability to SIDS.[8]

However, the most important risk factors to be aware of are:

- Maternal smoking during pregnancy;
- Prone sleep position (lying face down),which can cause the baby to breathe in too much carbon dioxide and not enough oxygen; and
- Secondhand smoke exposure.

Want to learn more about SIDS? Please view the fact sheet at **http://www.lungusa.org/sidsfactsheet**

Who dies of SIDS?

SIDS is more likely to occur in male infants (3:2 ratio) than in female infants. There is no evidence that suspended breathing precedes or predicts SIDS.[9] Premature and low weight babies are more likely to die of SIDS than full-term babies and those born with normal weights. Also, African American or American Indian/Alaska Native babies die of SIDS more frequently than those of other races or ethnicities.[10]

What is the health impact of SIDS?

Sudden infant death syndrome is the third-ranking cause of death for infants under one year of age. Of the 27,860 infant deaths that occurred in 2004, about 1 in 12 (8.0 percent) were due to SIDS. These 2,247 deaths result in a death rate of 54.6 per 100,000 live births.[11] According to preliminary data, there were

2,107 cases of SIDS in 2005, a rate of 50.9 per 100,000 live births.[12]

While overall SIDS rates have declined in all populations throughout the United States, differences in SIDS rates and prevalence of risk factors remain in certain groups. Table 1 displays SIDS mortality by race and ethnicity. African American and American Indian infants are 2.1 and 1.9 times more likely, respectively, to die from SIDS than White infants.[13]

Table 1: SIDS Mortality by Race and Ethnicity[I]*

	2002[1]		2003[2]		2004[3]	
Race/Ethnicity	Number	Rate	Number	Rate	Number	Rate
Total	2,295	57.1	2,162	52.9	2,247	54.6
Non-Hispanic White	1,269	55.2	1,173	50.5	1,240	54.0
Non-Hispanic Black	642	110.9	627	108.8	642	110.9
Hispanic	260	29.7	234	25.6	261	27.6
Puerto Rican	31	54.3	31	53.1	36	58.8
Mexican	181	28.8	162	24.8	181	26.7
Central and South American	26	20.8	27	19.9	23	16.0
American Indian[II]	52	123.3	53	124.0	44	100.2
Asian American/ Pacific Islander	51	24.3	61	27.7	55	24.0

Sources:
1. Mathews TJ, MacDorman MF. National Vital Statistics Reports. Infant Mortality Statistics from the 2002 Period Linked Birth/Infant Death Data Set. November 24, 2004; 53(10).
2. Mathews TJ, MacDorman MF. National Vital Statistics Reports: Infant Mortality Statistics from the 2003 Period Linked Birth/Infant Death Data Set. May 3, 2006; 54(16).
3. Mathews TJ, MacDorman MF. National Vital Statistics Reports. Infant Mortality Statistics from the 2004 Period Linked Birth/Infant Death Data Set. May 2, 2007; 55(14).

Notes:
I. Mortality rates are per 100,000 live births in a specified population.
II. Includes Aleuts and Eskimos.
*** Comparisons should only be made between groups and diseases using rates, not number of deaths, as these do not take into account differences which may exist in population size or demographics.**

The indirect costs of SIDS are estimated at $951 million.[14]

Want to learn more about SIDS in diverse communities? Please view the *State of Lung Disease in Diverse Communities: 2007* report at **http://www.lungusa.org/solddc-sids**

How is SIDS diagnosed?

The diagnosis of SIDS can only be made after thorough investigation of an unexplained infant death.

What is new in SIDS research?

SIDS may be a result of incorrect brain signals due to irregular brain chemistry. This also might explain why male infants have double the risk compared to female infants for SIDS death since their brain chemistry already limits incoming brain signals. In SIDS cases, there are differences in serotonin neurotransmission compared to healthy babies. Male infants already have far fewer serotonin binding neurons, multiplying the effect of abnormal neurotransmitter signaling.[15]

Scientists have noticed that stillbirth and SIDS babies share some similarities. A study conducted in Cambridge found that pregnant women with abnormally high production of alpha-fetoproteins were more likely to give birth to a SIDS baby. Infants exposed to the highest levels of alpha-fetoproteins were 2.8 times more likely to die from SIDS than their counterparts exposed to the lowest levels. Factors associated with a mother's alpha-fetoprotein production included premature birth and intrauterine growth restriction.[16]

What is the American Lung Association doing about SIDS?

The American Lung Association strongly recommends against smoking, especially during pregnancy, as it is a risk factor for SIDS. Also, secondhand smoke exposure increases the risk. Visit http://www.lungusa.org to get help quitting, including information on how to sign up for an American Lung Association Freedom From Smoking® Clinic in your area or for our online clinic, which is free of charge at http://www.ffsonline.org.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight SIDS. Join us to win the battle against lung disease by visiting http://lungaction.org.

Tobacco Use

What is the connection between tobacco use and lung disease?

The evidence that smoking kills is overwhelming. Over 438,000 Americans die from diseases directly related to cigarette smoking each year. Smoking is responsible for more than one in five U.S. deaths.[1] About half of all regular cigarette smokers will eventually be killed by their addiction.[2] The earlier someone quits smoking, the longer their life expectancy will become.[3]

In addition to the staggering death toll, tobacco use also causes serious, chronic diseases that impact upon quality of life. About 8.6 million people in the United States have at least one serious illness caused by smoking.[4]

Cigarette smoke contains about 4,000 chemicals, over 60 of which are known to cause cancer.[5] Smoking is directly responsible for 90 percent of deaths from chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis. Additionally, smoking is responsible for approximately 80 percent and 90 percent of lung cancer deaths in women and men, respectively. Smoking is also a major risk factor for coronary heart disease, stroke and lower respiratory tract infections. It causes cancer in other parts of the body, including the esophagus, oral cavity and bladder, and has been linked to a variety of other conditions and disorders.[6]

Smoking also can increase the effects of other hazards, especially those related to occupational exposure (see chapter on occupational lung diseases for more information). Smoking both increases the risk of developing such diseases (depending on the exposure level) and can worsen conditions that are already present. Exposure to cigarette smoke, for example, greatly raises the risk of lung disease for workers exposed to coal, silica and grain or cotton dusts. Smoking enhances the effects of hazardous materials that may be found in the workplace and plays a major role in occupation-associated lung cancer. For example, nonsmoking asbestos workers are five times more likely to develop lung cancer than nonsmokers not exposed to asbestos. However, if an asbestos worker is also a smoker, the risk factor jumps to 50 times or higher.[7]

One study found smoking even one to four cigarettes a day nearly triples the

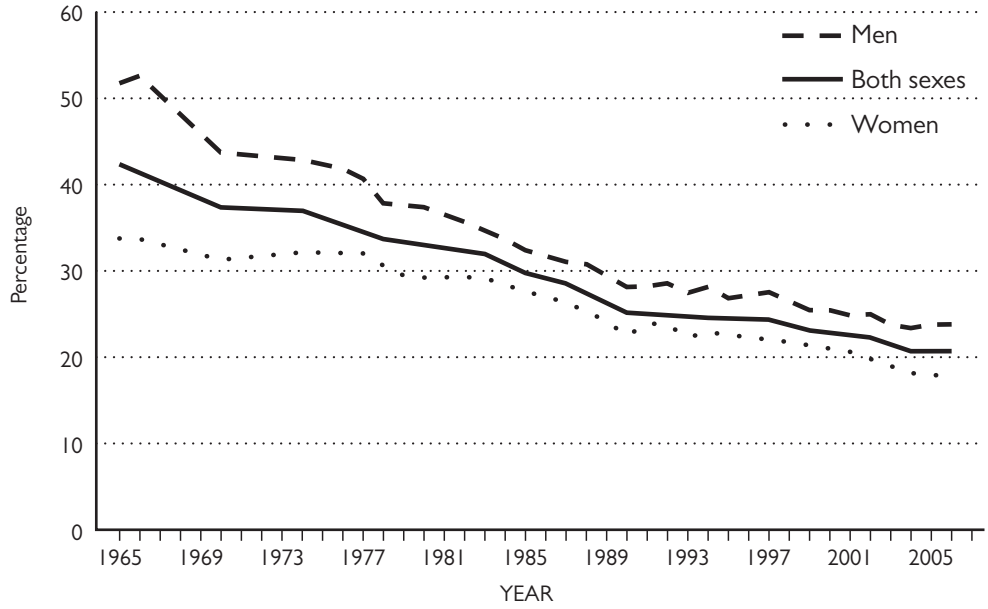
risk of death from heart disease and quintuples the risk of women dying from lung cancer, compared to those who have never smoked.[8]

Want to learn more about smoking trends and data? Please view the *Trends in Tobacco Use* report, which includes statistics and information on consumption and quitting, as well as related morbidity and mortality, at **http://www.lungusa.org/tobaccotrends**

Who are the smokers and who has smoking attributable diseases?

According to the Centers for Disease Control and Prevention, an estimated 45.3 million American adults 18 or older (20.8%) were current smokers[1] in 2006—23.9 percent of all men and 18.0 percent of all women.[9] The annual prevalence of smoking declined 40 percent between 1965 and 1990, but the decrease has slowed since then.[10] Figure 1 shows the downward trend from 1965 to 2006.

Figure 1: Estimated Percentage of Adults Who Were Current Smokers by Year and Sex, U.S., 1965–2006*



Source: Centers for Disease Control and Prevention. Cigarette Smoking Among Adults—United States, 2006. *Morbidity and Mortality Weekly Report.* November 9, 2007; 56(44):1157-61.
Note:
* Due to the redesign of the NHIS survey in 1997, comparisons with data from prior years must be conducted with caution.

In 2006, adults with less than a high school diploma had the highest prevalence of smoking (26.8%), while college graduates had the lowest prevalence (8.8%). Smoking prevalence rates are highest among people ages 18 to 24 years (23.7%) and lowest for those older than 65 years of age (10.0%).[11]

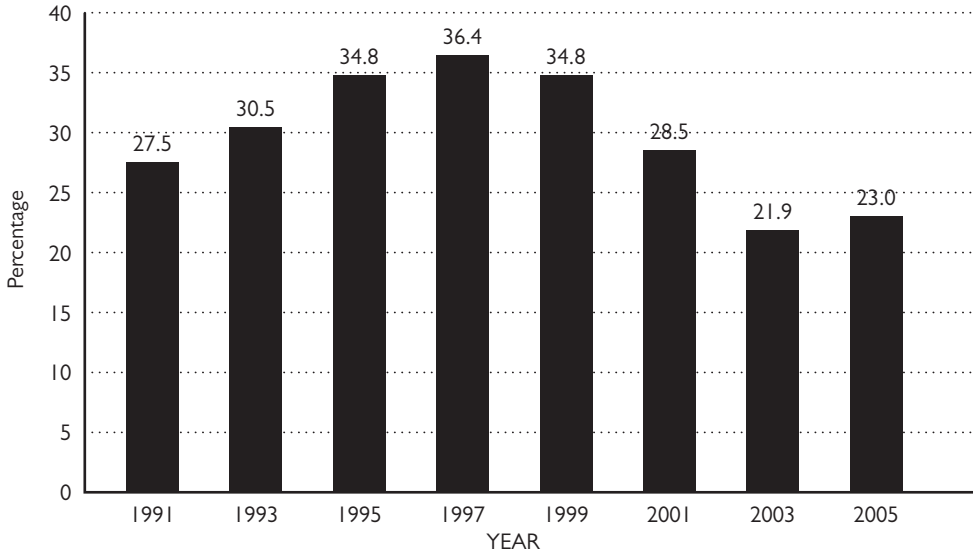
[1] Current smokers were defined as persons having ever smoked 100 cigarettes and who currently smoke every day or some days.

Teenagers and children…

Ninety percent of adults who smoke started by the age of 21, and half of them became regular smokers by their 18th birthday.[12] Among new daily smokers 12 to 49 years of age, the average age of daily smoking initiation is 18.9 years, although many teenagers experiment with cigarettes at a much younger age. Every day, approximately 4,000 children between 12 and 17 years of age smoke their first cigarette; an estimated 1,300 of them will become regular smokers.[13] Half of them will ultimately die from their habit.[14]

Current cigarette smoking among high school students appears to be holding steady after declining significantly between 1997 and 2003. Figure 2 shows the percent of high school students (9th through 12th grade) who reported having smoked one or more cigarettes in the previous 30 days. It shows the increasing trend that peaked in 1997 at 36.4 percent, the subsequent decline to 21.9 percent in 2003 and a slight uptick in 2005. Another survey which provides data on individual grade levels reported that in 2006, 21.6 percent of 12th grade students reported current smoking, down from 36.5 percent in 1997.[15]

Figure 2: Estimated Percentage of High School Students Who Were Current Smokers by Year, U.S., 1991–2005*



Source: Centers for Disease Control and Prevention. Cigarette Use Among High School Students—United States, 1991–2005. *Morbidity and Mortality Weekly Report.* July 7, 2006; 55(26):724-6.
Note:
* Reported smoking cigarettes on one or more of the 30 days preceding the survey.

Among high school students in 2005, the most prevalent forms of tobacco used were cigarettes (23.0%), cigars (14.0%) and smokeless tobacco (8.0%).[16,17] In 2005, White teenage girls had the highest percentage of smoking at 27 percent, compared to White boys (24.9%); Black teenage girls had the lowest at 11.9 percent.[18] Middle school White girls also had the highest percentage of smoking (8.6% in 2004) compared to other students in middle school.[19]

Data from 1976 through 1992 show a dramatic decrease in cigarette smoking among Black 12th grade girls (from 37.5% to 7.0%) compared with that among White girls (from 39.9% to 31.2%). Between 1992 and 1998, smoking prevalence

increased among White girls (from 31.2% to 41.0%).[20] Between 2000 and 2005, cigarette smoking prevalence among high school girls decreased by 16 percent.[21] However, between 2006 and 2007, there was only a 0.5 percent decrease in prevalence of cigarette use among 12th grade girls.[22] Since 2000, the overall trend in cigarette smoking among teenage girls has been decreasing, but not enough considering all of the publicity on the health risks associated with smoking.

Bidi use (skinny, flavored cigarettes) by 12th graders decreased to less than 2 percent in 2007, while kretek use (clove cigarettes) by 12th graders did not change from 2006.[23]

In 2006, the most recent year of data available for middle school students (6th through 8th grade), the most prevalent forms of tobacco used among middle school students were cigarettes (6.3%) and cigars (4.0%), followed by smokeless tobacco (2.6%), pipe tobacco (2.2%), bidis (1.7%) and kreteks (1.4%).[24]

In 2002, 49.6 percent of middle school students and 62.1 percent of high school students who were current smokers reported wanting to completely stop. [25] In 2005, 54.6 percent of current smokers in high school reported trying to quit smoking in the last twelve months.[26]

Individuals who begin smoking at an early age are at increased risk for smoking-related diseases. One study concluded that a higher number of harmful changes within DNA were associated with tobacco smoke exposure at a young age compared to unexposed individuals, which was consistent with findings that the risk of lung cancer is 7 to 15 times greater in smokers compared to nonsmokers.[27] Another study supports these results by suggesting that adolescence is the critical period in which these DNA changes occur.[28]

Advertising and promotion…

Data released by the Federal Trade Commission in April 2007 showed that tobacco companies are continuing to spend billions of dollars annually marketing their deadly products. In 2005, cigarette companies spent $13.1 billion on marketing efforts—approximately $36 million a day. The majority of these dollars are spent on price promotions, such as "buy one, get one free" or coupons for $1.50 off two packs.[29] These promotions target kids, the most price-sensitive consumers, and attempt to undermine states' efforts to increase the cost of cigarettes by raising cigarette excise taxes.

Research has found that the Master Settlement Agreement (MSA) with the tobacco industry, which prohibits tobacco advertising that targets people younger than 18 years of age, seems to have had little effect on shielding young people from exposure to cigarette ads. Since the signing of the MSA in 1998 through 2005, the average youth in the United States was exposed to 559 tobacco ads, every adult woman was exposed to 617 advertisements and every African American adult was exposed to 892 ads.[30] The impact of the MSA was weakened because the tobacco industry changed its tactics. These numbers are troubling considering that exposure to pro-tobacco marketing and media more than doubles the chances (2.2 times) of children and adolescents starting to use tobacco.[31]

Want to learn more about tobacco advertising and promotion? Please view the fact sheet at **http://www.lungusa.org/tobaccoadsfactsheet**

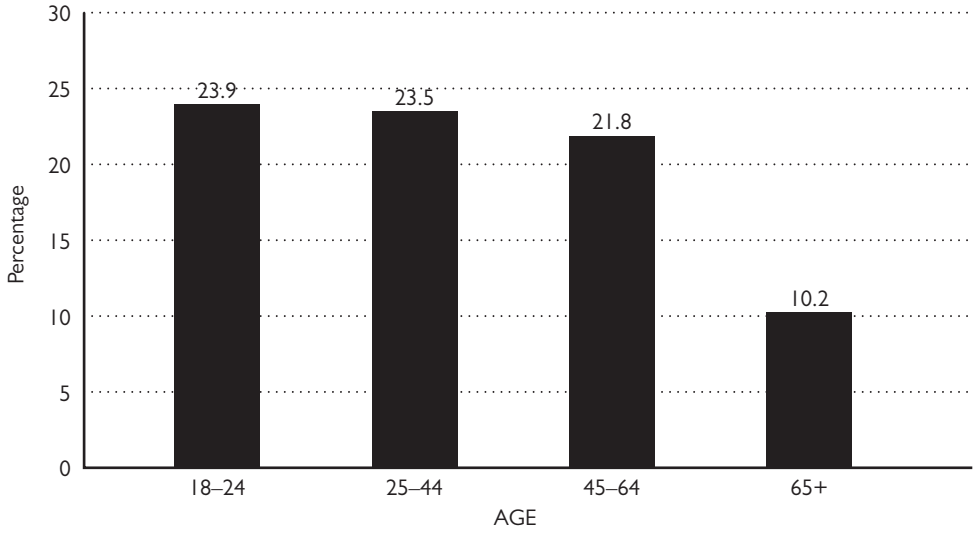
According to numerous studies, films play a role in influencing teens in their decision to start smoking. Researchers found that teens who were exposed to the greatest amount of smoking in movies were 2.6 times more likely to start smoking themselves compared with those teens who watched the least amount of smoking in movies.[32] While smoking prevalence has been declining among major adolescent and adult movie characters, 39 percent of top box office films still depict more smoking than actually occurred among U.S. adults at the respective time of release for each film.[33] It is estimated that each U.S. adolescent (10-14 years of age) is exposed to 665 examples of smoking from major movies. The same study found that 1.5 percent of actors were the source of 25 percent of all smoking impressions among adolescents.[34]

Television also has an effect on smoking. One study found that daily television viewing was related to earlier smoking initiation. A higher level of TV viewing was related to earlier onset of smoking in teenagers. For each hour of additional television viewed per day, the average teen began smoking 60 days earlier. This relationship of TV viewing and age of smoking initiation was found to be stronger than that of peer pressure to smoke, parental smoking or gender.[35]

Older adults…

In 2006, almost 20 million Americans over the age of 45 smoked, accounting for over 43 percent of all adult smokers. As of 2006, 10 percent of Americans over 65 years of age smoked.[36] Figure 3 shows the percent of adults who are current smokers, by age group, in 2006.

Figure 3: Estimated Percentage of Adults Who Were Current Smokers by Age, U.S., 2006*



Source: Centers for Disease Control and Prevention. Cigarette Smoking Among Adults—United States, 2006. *Morbidity and Mortality Weekly Report.* November 9, 2007; 56(44):1157-61.
Note:
* Reported smoking cigarettes on one or more of the 30 days preceding the survey.

Men 65 years of age or older who smoke are twice as likely to die from a stroke, and women smokers are about one and a half times as likely to die from a stroke as their nonsmoking counterparts. The risk of dying from a heart attack is 60 percent higher for smokers than nonsmokers 65 years of age or older.[37] Among the elderly, smokers experience mental decline five times faster than nonsmokers. They have a much higher risk of both Alzheimer's disease and dementia.[38] Older smokers also have two to three times the risk of developing cataracts (the leading cause of blindness) compared to nonsmokers.[39] Quitting smoking at any age is beneficial and reduces the negative health risks immediately.[40]

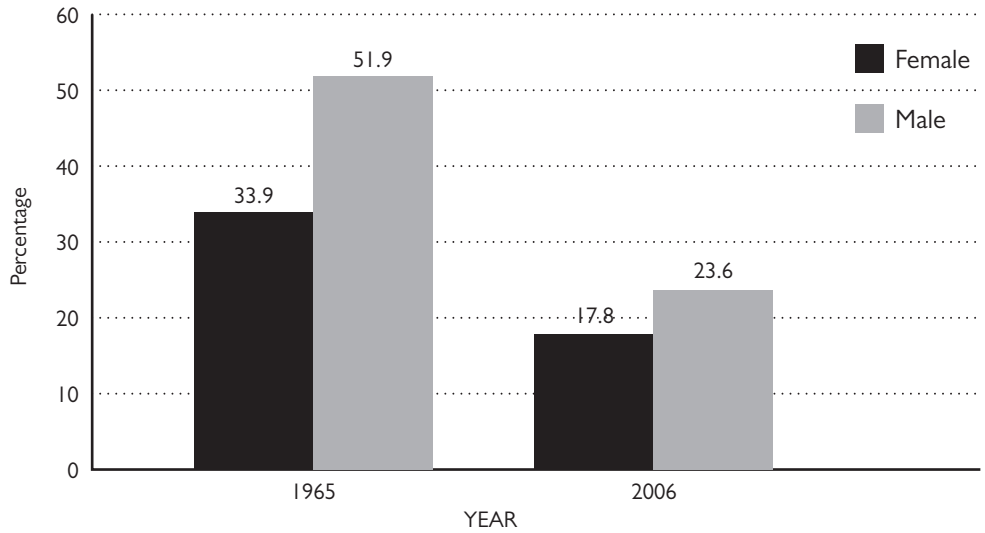
Smoking is the main risk factor for COPD, a disease which has a prevalence rate that is highest among those 65 years of age and older. It consistently ranks among the top 10 most common chronic health conditions and causes of daily activity limitation. As stated previously, smoking is directly responsible for 90 percent of COPD deaths.[41] COPD is currently the fourth-leading cause of death in the United States and is predicted to become the third by 2020.[42]

Want to learn more about smoking and older adults? Please view the fact sheet at **http://www.lungusa.org/olderadultssmokingfactsheet**

Women…

A report of the U.S. Surgeon General published in 2001, "Women and Smoking," declared that smoking-related disease is a full-blown epidemic among women. Over the past 25 years, the gap between men and women smoking rates has narrowed. In 1965, 51.9 percent of men and 33.9 percent of women smoked. Currently, 23.6 percent of males currently smoke compared to 17.8 percent of females.[43] This difference is shown in Figure 4.

Figure 4: Estimated Percentage of Adults Who Were Current Smokers by Year and Sex, U.S., 1965 and 2006*



Source: Centers for Disease Control and Prevention. National Center for Health Statistics. National Health Interview Survey, 1965–2006. Analysis by the American Lung Association, Research and Program Services Division using SPSS and SUDAAN software.
Note:
* Reported smoking cigarettes on one or more of the 30 days preceding the survey.

With a much smaller gap between men's and women's smoking rates, women now share much more of the smoking-related disease burden. In 2007, an estimated 70,880 women died of lung cancer.[44] Lung cancer is the leading cause of cancer death among both women and men. Current female smokers aged 35 or older are 12 times more likely than nonsmoking females to die prematurely from lung cancer and COPD.[45]

Women who smoke are also at increased risk for a number of negative reproductive outcomes. Smoking by expectant mothers leads to low birth-weight babies, a risk factor for infant death. Nicotine from smoking may restrict blood flow in the umbilical cord and uterus, decreasing oxygen to the developing fetus. Nicotine also is found in breast milk. Abnormal lung function in babies is a result of maternal smoking during pregnancy. These mothers also have about twice the risk of experiencing complications during pregnancy.[46] A review of 188 publications spanning 25 years (1980-2004) found that prenatal and postnatal exposure to secondhand tobacco smoke could lead to lung cancer in children through genetic damage to lung tissue. DNA changes were 1.3 times higher in children exposed to postnatal maternal secondhand smoke and 7 times higher if that exposure was *in utero*.[47]

Exposure to secondhand smoke is related to the onset of asthma and is especially dangerous for children. Toxic substances can be transferred across the placenta to the fetus either by the mother's smoking or her exposure to secondhand smoke during pregnancy. Recent studies have suggested that children of smokers are twice as likely to develop asthma as the children of nonsmokers, and that even apparently healthy babies born to women who smoked during pregnancy have abnormally narrowed airways, which may predispose them to asthma and other respiratory disorders. This research was further substantiated by a recent study reporting that a child's risk of being diagnosed with asthma by the age of seven increased 23 percent if its mother smoked even less than 10 cigarettes a day during their pregnancy. The chance of developing asthma increased to 35 percent if the mother smoked more than 10 cigarettes a day while pregnant.[48]

Fortunately, smoking during pregnancy has been declining. In 2005, 10.7 percent of all women smoked during pregnancy, down almost 45 percent from 1990. American Indian/Alaska Native women had the highest rate of smoking during pregnancy (17.8%). Almost 14 percent of non-Hispanic White mothers smoke compared with 8.5 percent of non-Hispanic Black mothers. The smoking rate for Hispanic and Asian/Pacific Islander mothers was substantially lower (2.9% and 2.2%, respectively).[II] Since 1990, teenagers and young adults have had the highest rates of maternal smoking during pregnancy. In 2005, 16.6 percent of young girls aged 15 to 19 and 18.6 percent of young women aged 20 to 24 smoked during pregnancy.[49]

[II] Information on smoking during pregnancy was reported according to two different and noncomparable questions in 2005: the 1989 U.S. Standard Certificate of Live Birth (unrevised; 36 states, New York City and District of Columbia), a simple "yes/no" question, and the 2003 revision (11 states), which asks about smoking during each trimester of pregnancy. Data in this section are based on the 1989 version of the U.S. Standard Certificate of Live Birth, unless otherwise noted.

In addition, smoking during pregnancy carries an economic burden. Neonatal health-care costs attributable to maternal smoking in the United States have been estimated at $366 million per year, or $740 per maternal smoker.[50]

Women have been strongly targeted in tobacco marketing where themes of social desirability, independence and weight control are mixed with smoking messages and feature slim, attractive, athletic models.[51] The tobacco companies have a long and disgraceful history of preying on young girls and teens, dating back to a 1930s campaign called "Reach for a Lucky Instead of a Sweet." The campaign played on women's concern about their weight. This marketing strategy continued through the late 1960s and 1970s with "You've Come a Long Way Baby"—the first of many Virginia Slims advertising campaigns focusing on women's liberation, independence, weight issues, style and physical attractiveness. In January 2007, R.J. Reynolds launched its "Light and Luscious" Camel No. 9 cigarette, the latest campaign to target young girls and teens with its bright pink-and-green packaging.[52]

Want to learn more about women and smoking? Please view the fact sheet at **http://www.lungusa.org/womensmokingfactsheet**

Diverse communities…

Similar to women, diverse populations have been singled out as a target for the tobacco industry's marketing. A study in 2007 comparing mostly African American and mostly White communities found 2.6 times more tobacco advertisements in the African American areas. Additionally, studies have found that the numbers of tobacco advertisements are higher in magazines targeted toward African Americans than in magazines targeted at the general population.[53] Expenditures for magazine advertising of mentholated cigarettes, popular among African Americans, increased from 13 percent of total advertisement expenditures in 1998 to 49 percent in 2005.[54]

Want to learn more about tobacco use in diverse communities?
Please view the *State of Lung Disease in Diverse Communities 2007* report at
http://www.lungusa.org/solddc-tobacco

Various diverse populations are at an increased risk for lung cancer, premature childbirth (associated with both newborn respiratory distress syndrome and sudden infant death syndrome), acute infections, asthma, and lung disease related to occupational and environmental hazards. Smoking can be a cause of some of these diseases and can make all of them worse. For the many diverse groups with high percentages of heavy smokers, these risks are even greater.

As of 2006, the prevalence of current smoking is highest among American Indians/Alaska Natives (26.9%), intermediate among non-Hispanic Whites (21.8%) and non-Hispanic Blacks (22.6%), and lowest among Hispanics (15.1%) and Asians (11.2%). The smoking rate among Asians is substantially lower than that of other races due to the low rate of smoking among women in this group. Within the last few years, smoking rates have been comparable between Blacks

and Whites, although Black men have consistently had higher smoking rates than White men. This trend traditionally has been reversed in women, with White women having higher smoking rates than Black women, though in 2006 the two rates were similar (19.7% and 19.2%, respectively).[55]

LGBT (lesbian, gay, bisexual and transgender) groups also appear to have significantly above-average smoking rates, although more research is needed in this area. A 2004 study found that adolescents who reported same-sex attraction or activity were 2.5 times as likely to smoke at least weekly compared to heterosexuals; bisexual/lesbian girls were 9.7 times more likely.[56] Similar results were published in a 2007 study comparing gay, lesbian and bisexual populations to the general population in California.[57]

What is secondhand smoke and is it as dangerous as active smoking?

Secondhand smoke is smoke from other people's cigarettes that is involuntarily inhaled by the people around them. The U.S. Surgeon General's 2006 report entitled *The Health Consequences of Involuntary Exposure to Tobacco Smoke* concluded that secondhand smoke causes premature death and disease in children and in adults who do not smoke. Scientific evidence indicates that there is no risk-free level of exposure to secondhand smoke. Secondhand smoke causes approximately 3,400 lung cancer deaths and between 22,700 to 69,600 heart disease deaths in nonsmoking adults in the United States each year, along with magnifying hundreds of thousands of asthma cases and lower respiratory tract infections.[58]

Those living with a smoking spouse or working in a location where smoking occurs are at an increased risk for heart attacks. One study found that both the average number of cigarettes smoked per day by a spouse and the number of years of secondhand smoke exposure were associated with an increased risk of a heart attack.[59] The 2006 Surgeon General's report concluded that the risk of heart disease increased by 25 to 30 percent and the risk of lung cancer by 20 to 30 percent for persons exposed to secondhand smoke. In addition, the report suggested that breast and cervical cancer risk also may be influenced by exposure to secondhand smoke.[60]

Parental smoking also has been associated with a wide range of negative health effects in children, including impaired lung growth, a greater number of colds and ear infections, worsening of asthma and sudden infant death syndrome.[61] While maternal smoking appears to have a larger impact on risk for asthma development, paternal smoking is also a major independent risk factor.[62]

Approximately three million American children (11%) aged six and younger are exposed to secondhand smoke on a regular basis (four or more days per week).[63] Inside the home, toxicity levels due to secondhand smoke can be up to eight times higher than in homes where parents smoke outside. In homes where parents smoke outside, the levels are still seven times higher than in households of nonsmoking parents.[64]

In children 18 months and younger, exposure to secondhand smoke causes 150,000 to 300,000 lower respiratory tract infections (pneumonia and bronchitis), which result in 7,500 to 15,000 hospitalizations each year.[65] Exposure to secondhand smoke also causes 430 sudden infant death syndrome cases and causes buildup of fluid in the middle ear (otitis media, or middle ear infection) resulting in 790,000 physician office visits per year. Middle ear infections are the most common cause of childhood operations and childhood hearing loss.[66]

Another study found that secondhand smoke exposure is associated with more missed school days due to respiratory health problems among children 8 to 12 years of age, especially those with asthma.[67] Secondhand smoke exposure has been estimated to cost the United States an additional $10 billion each year, $5 billion in direct medical costs and over $5 billion in indirect costs.[68]

Want to learn more about secondhand smoke? Please view the fact sheet at **http://www.lungusa.org/secondhandsmokefactsheet**

Can other tobacco products harm the lungs?

No other form of tobacco use offers a safe alternative to cigarette smoking.

Cigar smoking has been strongly associated with an increased risk of lung, oral cavity, larynx and esophageal cancers, as cigars contain many of the same cancer-causing and toxic ingredients as cigarettes.[69] Research also suggests that smoking bidis, kreteks and hookahs may increase the risk of developing lung cancer, oral cancer, or heart disease.[70,71] Bidis and kreteks both have been shown to deliver more nicotine, carbon monoxide and tar than normal cigarettes.[72] Hookahs, or waterpipes, deliver the same harmful gases, cancer-causing toxins and addictive nicotine as cigarettes.[73] Additionally, spit or smokeless tobacco is not a safe alternative to smoking tobacco and poses a significant health risk as it contains 28 carcinogens and is a known cause of cancer.[74]

Want to learn more about cigar smoking and lung disease? Please view the fact sheet at **http://www.lungusa.org/cigarfactsheet**

What are the health benefits of quitting?

In 1990, the U.S. Surgeon General's report *Reducing Tobacco Use* concluded that quitting smoking is the single most important step that smokers can take to enhance the length and quality of their lives.[75]

Quitting smoking at any age lessens the health risks immediately. Within a day's time, risk of a heart attack decreases; after 15 smoke-free years, the risk of dying returns to nearly the same level as never-smokers.[76]

There are currently 45.7 million ex-smokers in the United States. The year 2006 was the fifth straight year in which adults who quit smoking outnumbered adults who were still smoking. Since 1965, the proportion of former smokers has increased dramatically; in 2006, there were 88 percent more former smok-

ers than in 1965. By 2006, 50.2 percent of people 18 years of age and older who had ever smoked had quit.[77] The majority of current smokers, 18 to 35 years of age, reported they had tried to quit smoking during the past year (58.6% within the United States and its territories[III]), though only about one-third were able to quit smoking successfully (34%). People who quit smoking before 35 years of age have a life expectancy similar to that of never-smokers.[78]

One study found that life expectancy among smokers who quit at 35 years of age exceeded that of continuing smokers by 6.9 to 8.5 years for men and 6.1 to 7.7 years for women. Smokers who quit at younger ages gained the most years of life, but even those who quit much later in life gained some benefits. Among smokers who quit at age 65, men gained 1.4 to 2.0 years of life, and women gained 2.7 to 3.7 years.[79] Just cutting down on cigarettes, but not quitting entirely, does not reduce the risk of death from tobacco-related diseases.[80]

Results from one study showed that female smokers who quit recovered their ability to breathe more quickly than men who quit. The study followed 5,300 people over five years and found that, by the end of the study, the lung capacity of women who quit had improved an average of nearly 2 percent, while men's capacity had improved by 0.4 percent.[81]

A study found both middle-aged smokers and former smokers with mild or moderate COPD breathed easier after quitting. After one year, the women who quit smoking had twice the improvement in lung function compared to men who quit.[82]

Even at advanced ages, quitting smoking has proven health benefits. When an older person quits smoking, circulation improves immediately and the lungs begin to repair damage. In one year, the added risk of heart disease is cut almost in half, and risk of a stroke, lung disease and cancer decrease.[83] However, many older adults say they have not quit smoking because they believe doing so offers no benefit at an advanced age. In addition, most obstacles brought up by older adults for not quitting are based on incorrect information, such as the potential health risks from cessation aids like nicotine replacement therapy.[84]

Using smoking cessation treatments doubles the quitting success rate compared to quitting cold turkey. Treatments for quitting smoking are effective and can decrease health care costs.[85] The chances of a quit attempt being successful increase when medication is combined with a brief clinical intervention, counseling or behavioral cessation therapy. Individual, group or telephone counseling all have been shown to be effective.[86] Researchers have found that when nicotine replacement therapy (NRT) and counseling or behavioral techniques are used simultaneously, the chances of quitting successfully are greatly increased, compared to using NRT alone. The U.S. Department of Health encourages all patients trying to quit to use an effective medication in addition to non-medical treatment options. In addition, combining a self-administered form of nicotine replacement (gum) with the patch is more effective than using just one type alone.[87] These high-dose NRT approaches require professional supervision.

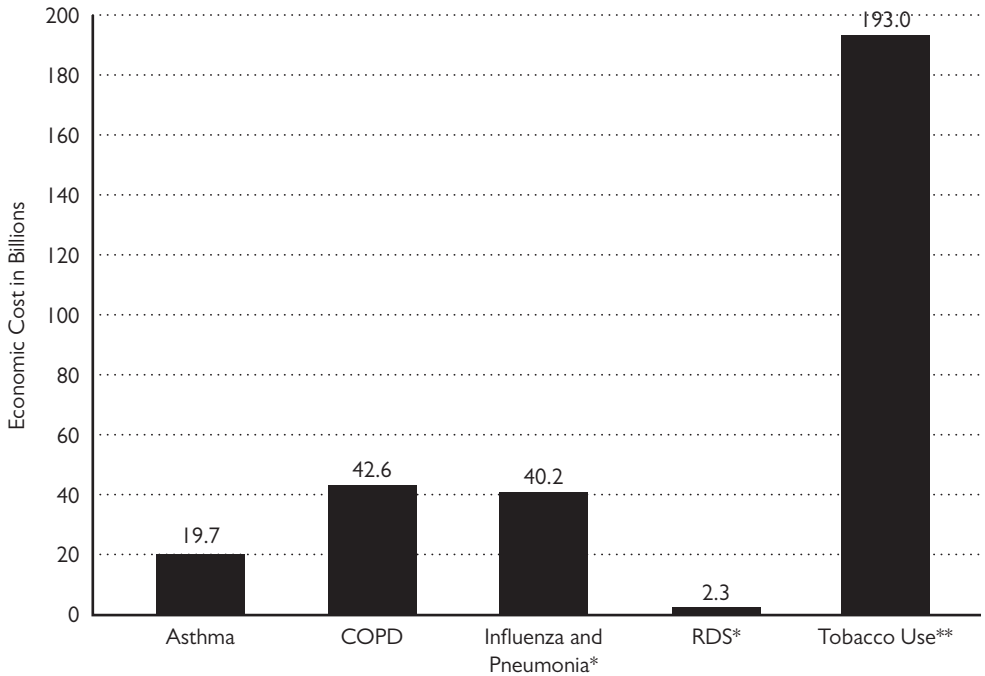
[III] The estimated percent of daily smokers who had quit for one or more days in the U.S. was determined by taking the median value from the reported percentages of each state or territory.

Nicotine replacement products and some prescription medications can help relieve the withdrawal symptoms people experience when they quit smoking. The Food and Drug Administration has approved three over-the-counter medications—nicotine gum, patches and lozenges; as well as two prescription NRTs—a nasal spray and an inhaler. In addition, two non-nicotine pills have been approved for tobacco use cessation—bupropion SR (Zyban) and varenicline tartrate (Chantix).[88] In a recent analysis of four studies examining the effectiveness of varenicline, results suggest that varenicline may be more effective than bupropion.[89] However, different products work best for different people. A health care provider can help patients decide which products are best suited for them.

Although most former smokers preferred quitting cold turkey, this method has the lowest success rate.[90]

Only 24 percent of employers offer smoking cessation coverage as part of their health insurance plan even though it only costs an additional 10 to 40 cents per member per month. It is in the economic interest of employers to provide this additional coverage as male and female employees who smoke incur, on average, $15,800 and $17,500 more in lifetime medical expenses and are absent from work an average of four and two days more each year, respectively, than nonsmokers.[91]

Figure 5: Economic Cost of Select Lung Diseases, U.S., 2007



Sources: U.S. Department of Health and Human Services. National Institutes of Health. National Heart, Lung, and Blood Institute. Morbidity and Mortality: 2007 Chartbook on Cardiovascular, Lung, and Blood Diseases. Unpublished data provided upon special request to NHLBI.
Notes:
* Unpublished data, 2005.
** Centers for Disease Control and Prevention. Best Practices for Comprehensive Tobacco Control Programs—2007. Executive Summary.

What is the economic burden of tobacco use?

The economic costs of smoking are astronomical. In 2004, tobacco use was estimated to cost the United States $193 billion, including $97 billion in lost productivity and $96 billion in direct health care expenditures.[92] These costs include all diseases related to tobacco use, including those of the lung and heart. Figure 5 displays the economic costs of selected lung diseases compared to tobacco-related diseases in 2007. Some of these costs may overlap as the health effects of tobacco use may manifest as lung diseases.

What is new in tobacco use research?

Recent studies have shown that school-based smoking cessation programs may be an effective way to help teenagers quit smoking. Since adolescents who smoke are likely to become habitual smokers, targeting high schools with cessation programs and raising awareness about the negative health effects of smoking may help counter this trend.[93]

Research continues on secondhand smoke and how it negatively impacts health. One study of 495 never-smokers over 65 years of age reported that those with high lifetime exposure (more than 30 years) to secondhand smoke were about 30 percent more likely to develop dementia over a six-year period than those reporting no lifetime secondhand smoke exposure.[94] Another study determined that exposure to household secondhand smoke increased the risk of dying from any cause in never-smokers, with the risk of cardiovascular and respiratory diseases increasing the most. Men who never smoked but were exposed to household secondhand smoke were 1.2 times more likely to die than those with no household secondhand smoke exposure, while women were at 1.3 times greater risk. Differences were not seen in lung cancer mortality risk, most likely because lung cancer develops over a period of time far longer than the three-year follow-up used in the study.[95]

Another area of research is investigating differences in the risk of lung cancer among those with different smoking levels. One study found that never-smokers with non-small cell lung cancer (although never-smokers represent only a small percentage of those with the disease), had a better prognosis than smokers with the disease, including five-year survival rate (64% versus 56%). As the amount and duration of smoking increased, five-year survival rates decreased. Those with the lowest smoking levels (5 to 19 pack-years[IV,96]) had the best five-year survival rate at 63 percent, compared to 48 percent for those at a higher level (20 or more pack-years). Those who had smoked the most (40 pack-years) had a five-year survival rate of only 35 percent.[97]

[IV] Pack-years is the number of packs of cigarettes smoked per day multiplied by the number of years a person smoked at that level. This provides a way to measure how much a person has smoked over a long period of time.

What is the American Lung Association doing about tobacco use?

The American Lung Association is committed to the elimination of tobacco use in future generations. To that end, the American Lung Association offers programs to help smokers quit and advocates for policy change at the federal, state and local level.

The Lung Association offers two smoking cessation programs: *Freedom From Smoking*®, a comprehensive program for adults, and *Not On Tobacco* (N-O-T), a non-punitive program for high school-aged smokers.

The *Freedom From Smoking*® program consists of eight group sessions, during which participants develop a personalized plan to quit smoking.

Not On Tobacco (N-O-T) was developed by the American Lung Association in collaboration with researchers at West Virginia University to help teenagers quit smoking. This 10-session program offers support and instruction on topics such as understanding reasons for smoking, nicotine addiction and withdrawal, accessing and maintaining social support, coping with stress and preventing relapses.

Want to learn more about smoking cessation for teens through the American Lung Association's Not On Tobacco program? Please view the online programs at **http://www.lungusa.org/not**

The American Lung Association also sponsors the nationwide Teens Against Tobacco Use (TATU) peer-teaching tobacco control program. TATU uses a 'kids helping kids' approach to empower adolescents to become tobacco-control advocates, role models for younger children and to live smokefree lives.

In addition to these programs, the American Lung Association offers cessation services nationwide through Freedom From Smoking Online, which is available free of charge at www.ffsonline.org. Help also is available through the Lung Help Line (1-800-LUNG-USA), which is staffed by registered nurses, respiratory therapists and quit-smoking specialists who offer free counseling and support to callers, including those seeking information about smoking cessation.

The American Lung Association leads efforts to pass state laws and local ordinances to provide smokefree workplaces. In addition, the Lung Association strongly advocates for increasing cigarette taxes to discourage consumption, especially among youth. The Lung Association believes that revenue from tobacco excise taxes and the Master Settlement Agreement (MSA) should be used to fund comprehensive tobacco control programs at levels recommended by the Centers for Disease Control and Prevention.

Want to learn more about smoking policies in the workplace? Please view the fact sheet at **http://www.lungusa.org/smokingpolicies**

The American Lung Association strongly believes that Congress should enact strong and effective legislation to provide the U.S. Food and Drug Administration (FDA) with full authority to regulate the manufacture, distribution and marketing of tobacco products in order to reduce the death and disease they cause. No federal agency currently has the authority to regulate manufactured tobacco products.

With meaningful FDA oversight absent, the tobacco industry has been marketing new and existing cigarettes and smokeless tobacco products as posing a "reduced risk" to consumers. The American Lung Association is concerned that this marketing tool will hook new, young tobacco users and reduce the number of current users who would otherwise quit. The Lung Association is urging Congress to pass legislation to grant the FDA full and effective authority over tobacco products. As this information is being written, FDA legislation is moving through the Congress.

In 2005, the Lung Association intervened in the Racketeer Influenced and Corrupt Organizations (RICO) civil case filed by the U.S. Department of Justice against the nation's tobacco companies. The Lung Association suggested strict remedies to prevent and restrain tobacco industry conduct, including preventing illegal marketing and claims as well as providing funds for cessation. A federal district court judge found the tobacco companies liable of these charges in August 2006; the verdict and resulting remedies are currently being appealed.

On May 21, 2003, the World Health Assembly approved the first-ever global public health treaty, the Framework Convention on Tobacco Control (FCTC). The treaty is a significant first step in the global battle against tobacco use and addiction. The FCTC was negotiated by representatives from 171 nations, known as the Intergovernmental Negotiating Body (INB), under the auspices of the World Health Organization. Subsequent meetings have been held to continue negotiating terms of the treaty. The American Lung Association has been actively involved in the FCTC process since its beginning.

Key provisions of the treaty include banning tobacco advertising and promotion unless constitutional barriers exist, limiting public exposure to secondhand smoke and requiring health warning labels on cigarette packages to cover at least 30 percent of the display area. The treaty also prohibits false, misleading and deceptive language—which may include "low tar," "light," or "mild"—that imply that a tobacco product is less harmful.

Throughout the process, the American Lung Association has supported a strong and enforceable global tobacco control treaty, calling on the U.S. government to reject weakening provisions backed by the tobacco industry.

For more information or to find out how you can help

Each year, the American Lung Association releases its *State of Tobacco Control* report, which grades tobacco control policies in all 50 states, the District of Columbia and Puerto Rico in four key areas: tobacco prevention and control spending, smokefree air, cigarette taxes and youth access laws. The report also grades the federal government in four areas: FDA regulation of tobacco prod-

ucts, federal cessation policies, the federal cigarette tax and the Framework Convention on Tobacco Control.

To view the latest *State of Tobacco Control* report and see if your state is making the grade, please visit **http://www.stateoftobaccocontrol.org/**

In addition, the American Lung Association publishes *State Legislated Actions on Tobacco Issues (SLATI)*, the only report that provides up-to-date information on tobacco control laws in all 50 states and the District of Columbia.

Want to learn more about *SLATI*? Please visit the webpage at **http://slati.lungusa.org**

Thousands of advocates have joined with the Lung Association to tell Congress that more needs to be done to fight Big Tobacco. Join the battle against lung disease by visiting http://www.lungaction.org.

Tuberculosis
(TB)

What is tuberculosis?

Tuberculosis (TB) has been with us since ancient times. In the first half of the 20th century, it was generally called "consumption"—an often fatal illness. At that time, when infectious diseases were responsible for the majority of deaths, tuberculosis was a leading cause of death. As special hospitals, called sanatoriums, were used to control the spread of TB along with better nutrition, housing, sanitation and the introduction of antibiotics in the middle of the 20th century, TB and other infectious diseases became curable and less rampant.[1]

Tuberculosis is an airborne infectious disease caused by the bacterium *Mycobacterium tuberculosis* that usually affects the lungs, although other organs and tissues such as the kidney, spine and brain can be affected as well.[2] Fortunately, TB in these parts of the body is usually not infectious.

Want to learn more about tuberculosis? Please view the disease listing at **http://www.lungusa.org/tuberculosis**

Active TB disease of the lungs or throat can be infectious and spread to other people if the infected person coughs, sneezes or spits, releasing the bacteria into the air. People nearby can breathe in these bacteria and become infected if the germs settle in their lungs and begin to multiply.[3] From the lungs, the bacteria can move through the blood to other parts of the body.

Symptoms of active TB disease include prolonged coughing (sometimes including coughing up of blood), repeated night sweats, unexplained weight loss, loss of appetite, fever, chills and general tiredness.[4] Because these signs also may indicate other diseases, a person must consult a healthcare provider to determine their cause.

Not everyone infected with the TB bacteria becomes sick with tuberculosis. If a person's immune system can successfully fight the infection, they have what is called latent or inactive TB infection. People who have latent TB infection do not feel sick, do not have any symptoms and cannot spread TB to others. The TB

infection may remain inactive for a lifetime, although latent TB infection can become active if the person's immune system becomes weakened (such as with HIV).[5]

People with active TB disease are most likely to spread it to people they spend time with every day. A person with active TB will infect an average of 10 to 15 people each year if they are not properly treated.[6] Repeated exposure to someone with TB disease is generally necessary for infection to take place. Active TB disease can be treated and cured if medical help is sought. TB patients become noninfectious soon after beginning treatment; however, to get rid of TB, therapy must continue for a period of time. People with latent TB infection also can take medicine so they will be less likely to develop active TB disease.

If people with active TB disease do not complete their drug therapy program, they can develop and spread strains of TB that are resistant to available drugs. Multidrug-resistant tuberculosis (MDR-TB) is resistant to two or more of the primary anti-TB drugs, making it very difficult to treat. One MDR-TB case can cost up to $1 million to treat. Forty-five states and the District of Columbia have reported diagnosing and caring for persons with MDR-TB.[7]

Pockets of drug resistance to TB medications began to appear in the mid-1970s. Drug resistance is troublesome when dealing with any contagious infection, since it indicates the emergence of a strain of "survivor bugs" — bacteria that have developed the ability to withstand antibiotic attack and are passing that ability on to their descendants. In other words, resistance spreads with the infection itself; it therefore tends to concentrate in geographically identifiable areas. The major cause of TB drug resistance is inadequate treatment in terms of drugs used or a patient's failure to complete prescribed treatment.

Extensively drug-resistant tuberculosis (XDR-TB) is an emerging public health threat. This strain is thought to have developed from MDR-TB as they are both resistant to the same primary or first-line anti-TB drugs (isoniazid and rifampin). However, XDR-TB also shows resistance to any fluoroquinolone and at least one of three second-line anti-TB drugs (amikacin, kanamycin or capreomycin).[8] Between 2000 and 2004, there were 17,690 drug-resistant tuberculosis isolates identified worldwide; 20 percent were MDR-TB and 2 percent were XDR-TB.[9]

Want to learn more about XDR-TB? Please view the disease listing at **http://www.lungusa.org/xdrtb**

Who has tuberculosis?

It is estimated that worldwide nearly one billion people will be newly infected with TB, over 150 million will become sick and 36 million will die from the disease between now and 2020—if TB control is not strengthened.[10] In 2006 there were an estimated 9.2 million new TB cases in the world.[11]

One-third of the increase in global TB cases over the last five years can be attributed to the HIV epidemic.[12] About 10 percent of individuals infected with

latent TB will develop TB disease at some point in their lives. A much higher proportion will develop TB disease if they also are infected with HIV, the virus that causes AIDS. HIV suppresses the immune system, opening the door to new active infection and permitting activation of latent disease. Someone with both latent TB infection and HIV infection has a 7 to 10 percent chance per year of developing active TB disease compared to a 10 percent *lifetime chance* in people without HIV. Between 2005 and 2006, among those TB cases where HIV status was reported, the percentage of TB cases with HIV infection decreased 4.4 percent (from 13.0% to 12.4%). However, the percentage of TB cases with unknown HIV status increased 10.3 percent (from 28.7% to 31.7%). This change in TB cases with HIV infection may be the result of incomplete reporting of HIV test results due to a lack of testing or reporting.[13]

Want to learn more about TB and HIV? Please view the fact sheet at **http://www.lungusa.org/hivtbfactsheet**

The incidence of TB had been decreasing in the U.S. until 1985 when the number of active TB cases began to rise. It is estimated that approximately 64,000 excess cases of TB occurred in the U.S. between 1985 and 1993.[14] This resurgence was due to a variety of interrelated factors including the HIV epidemic, increased numbers of immigrants, increased poverty, injection drug use and homelessness, poor compliance to drug therapy and an aging population.[15]

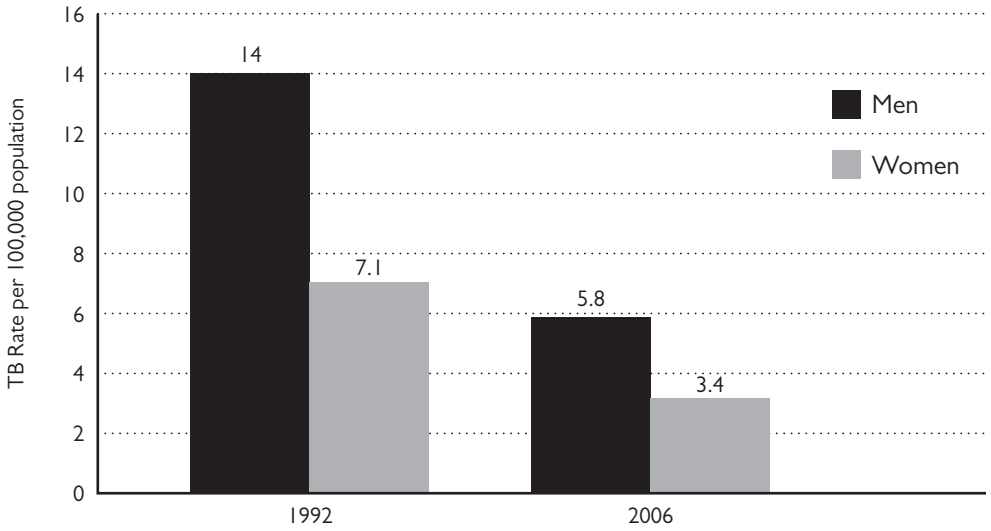
During 2007, preliminary data show a total of 13,293 new TB cases in the United States were reported to the Centers for Disease Control and Prevention (CDC)—a 4.2 percent decline from 2006, a 58 percent decline from the 1992 peak of the TB resurgence, and the lowest recorded TB rate (4.4 per 100,000 persons) in the United States since reporting began in 1953.[16] However, the decline is slowing down as noted from an annual average of 7.3 percent decrease between 1993 and 2000 to an average of 3.8 percent decrease between 2000 and 2007.[17]

In part, this decline reflects the impact of federal resources to assist state and local TB-control efforts, wider screening and preventive therapy for those at high risk, and growing support for TB prevention programs among HIV-infected persons.[18]

Want to learn more about tuberculosis trends and data? Please view the *Trend Report on Tuberculosis* at **http://www.lungusa.org/tbtrends**

Figure 1 shows that men have a higher TB rate than women; in 2006 it was almost 71 percent higher. The rates of new TB cases in men and women in 2006 were 5.8 and 3.4 per 100,000, respectively. The decrease in the number of cases and the case rate between 1992 and 2006 was notably greater among men than women.[19]

Figure 1: Tuberculosis Case Rates by Year and Gender, U.S., 1992 and 2006

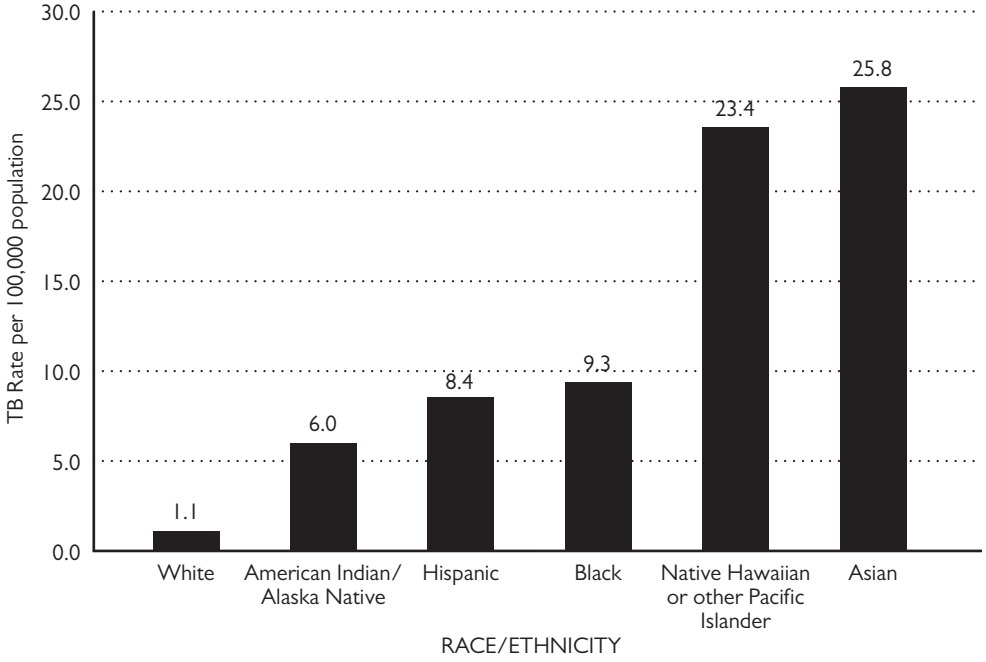


Source: Centers for Disease Control and Prevention. Reported Tuberculosis in the United States, 2006. October 2007.

Communities of color and foreign-born persons continued to account for a disproportionate percentage of all reported TB cases in 2007. Based on provisional data, the 2007 TB incidence rate in the United States was almost 23 times greater in non-Hispanic Asians (25.8 per 100,000), over 21 times greater in non-Hispanic Native Hawaiians or other Pacific Islanders (23.4 per 100,000), 8.3 times greater in non-Hispanic Blacks (9.3 per 100,000), over 7 times greater in Hispanics (8.4 per 100,000), and 5.5 times greater in non-Hispanic American Indians/Alaska Natives (6.0 per 100,000) than in non-Hispanic Whites (1.1 per 100,000). Figure 2 shows the tuberculosis rates in 2007 by race/ethnicity in the United States. In 2007, over 71% of TB cases among Blacks were in U.S.-born persons. The TB rate among U.S.-born Blacks was 7.8 times that of Whites born in the United States.[20] Several factors likely contribute to the uneven burden of TB in these communities. Barriers to health care exist among poor and socially excluded communities where TB incidence is 20 times higher compared with higher socioeconomic groups.[21,22] Understanding the role of social determinants of health are key to addressing this disparity.

Want to learn more about TB in diverse communities? Please view the *State of Lung Disease in Diverse Communities 2007* report at **http://www.lungusa.org/solddc-tb**

Figure 2: Tuberculosis Case Rates by Race/Ethnicity, U.S., 2007*



Source: Centers for Disease Control and Prevention. Trends in Tuberculosis—United States, 2007. *Morbidity and Mortality Weekly Report.* March 21, 2008; 57(11):281-285.
Note:
*All categories are non-Hispanic, other than Hispanic.

Preliminary data show that tuberculosis cases among persons born internationally (foreign-born persons) but now living in the United States accounted for 58.5 percent of all reported cases in 2007, compared with 29 percent of reported cases in 1993. The TB case rate among foreign-born persons (20.6 per 100,000) was approximately 9.7 times greater than that for U.S.-born persons (2.1 per 100,000) in 2007.[23] Most cases of active TB disease among foreign-born persons residing in the United States result from initial infection with the tuberculosis germ in the person's country of birth. Four countries of origin (Mexico, the Philippines, India and Vietnam) accounted for over half (51.8%) of all foreign-born cases reported in the United States in 2007.[24]

While the proportion of patients with MDR-TB in the United States has decreased from 2.4 percent in 1993 to approximately 1 percent in 2006, the profile of who has MDR-TB is changing.[25] In 1993, 25.5 percent (103 of 407) of all MDR-TB cases in the United States occurred in foreign-born people. This proportion increased to 80 percent (73 of 91) in 2006. The percentage of U.S.-born patients with MDR-TB has remained less than 0.7 percent since 1998.[26] XDR-TB is still very rare; in 2006 only four cases were reported in the United States and only two had been reported in 2007 as of February 13, 2008. Monitoring of XDR-TB continues in case it shows signs of becoming widespread.[27]

What is the health impact of tuberculosis?

Tuberculosis is the world's foremost cause of death from a single infectious agent, causing more than 26 percent of avoidable adult deaths in the developing world.[28] The World Health Organization (WHO) estimated that 1.7 million people worldwide died from TB in 2006.[29] In 2005, 646 people died of tuberculosis in the United States, a 1.7 percent decline from 657 deaths in 2004.[30]

While rare, XDR-TB is a serious public health risk. Between 1993 and 2002, XDR-TB patients were 64 percent more likely to die during treatment than MDR-TB patients.[31]

TB takes a heavy toll on the U.S. economy with $703.1 million in direct health care costs per year. Direct health care costs include $423.8 million for inpatient care, $182.3 million for outpatient care, $72.1 million for screening, $3.4 million for contact investigations, $17.9 million for preventive therapy, and $3.6 million for surveillance and outbreak investigations.[32] The total funding available for TB control worldwide (91% of countries) is estimated at $2.7 billion in 2008.[33]

Want to learn more about tuberculosis? Please view the fact sheet at **http://www.lungusa.org/tbfactsheet**

How is tuberculosis diagnosed and managed?

The simplest way to identify a TB infection is by a TB skin test, widely available at health care clinics or providers' offices. One type of skin test, the Mantoux test, is preferred and should be used for screening and diagnosis. In this test, a small amount of testing material is injected under the very top layers of skin on the forearm. In 48 to 72 hours the test is read by a trained health care provider. A significant reaction (redness, swelling) suggests there is TB infection and the health care provider will run more tests, such as a chest x-ray, to determine whether the TB infection is active or latent. In some groups, such as infants under six months of age or those individuals with impaired immunity (such as with HIV infection), the skin test may be negative in the presence of TB infection.[34] People with HIV may need to be retested.

Want to learn more about tuberculosis skin tests? Please view the fact sheet at **http://www.lungusa.org/tbskintestfactsheet**

Tuberculin screening programs should be targeted to each community's high-risk groups. It is extremely important that these screening programs undergo regular evaluation of their usefulness.

Want to learn more about TB skin-testing in high-risk groups and who these groups are? Please visit the Centers for Disease Control and Prevention fact sheet at **http://www.cdc.gov/tb/pubs/tbfactsheets/skintestresults.htm**

Scientists are researching numerous diagnostic tests to replace the time-consuming skin test and sputum analysis (testing matter discharged from the airways) used now. In April 2003, scientists announced the development of a new diagnostic test for TB that is more accurate than the skin test in detecting latent TB infections before people go on to develop active TB.[35]

In 2005, the FDA approved a new blood test (different from above) known as QuantiFERON-TB Gold. It is approved for use in detecting both active TB disease and latent TB infection.[36]

BCG or "bacille Calmette-Guérin" (named for its French developers) is a vaccine used routinely against TB in some countries. BCG is not recommended in the United States for a number of reasons. One is its unsuitability for persons infected with HIV—who, as noted previously, constitute the highest at-risk group for TB.[37] Another is the failure of repeated trials over the years to clearly demonstrate the vaccine's effectiveness. Results have been inexplicably conflicting, with some studies seemingly showing that it works, others that it is worthless. One recent analysis of those studies suggests that the BCG vaccine may be, at best, 50 percent effective. Generally, vaccines approved for use in the United States are at least 70 percent effective.

In August 1998, the federal Advisory Council for the Elimination of Tuberculosis (ACET) issued a national call for vaccines to combat TB. ACET recommendations include developing a post-infection vaccine for people who already have been exposed to the disease and test positive when given a TB test but have not yet developed active tuberculosis disease.[38] The American Lung Association has urged government health officials to follow the ACET recommendations.

To treat TB infection, the CDC and the American Thoracic Society (ATS) recommend a six- or nine-month treatment schedule consisting of an initial two-month period with the drugs isoniazid, rifampin and pyrazinamide, followed by four or seven months of isoniazid and rifampin for patients with non-drug-resistant TB who follow the treatment plan. Ethambutol (or streptomycin in young children) also should be included in the initial regimen until the results of drug-resistance tests are available.[39]

The CDC and the ATS also have issued treatment guidelines for latent tuberculosis infection. For most individuals with latent TB, these guidelines recommend the nine-month schedule of daily or twice weekly isoniazid as the preferred treatment. The CDC recommends that health care providers use rifampin and pyrazinamide with caution, especially in those patients currently taking other medications that have been associated with liver injury and those with alcoholism, even if alcohol use is discontinued during treatment. However, with careful monitoring, rifampin and pyrazinamide are an option for patients at high risk of developing active TB disease and who are unlikely to complete nine months of isoniazid therapy.[40]

Treatment for MDR-TB is expensive and involves drug therapy over many months or years. Even with the longer course of treatment, the cure rate for MDR-TB is approximately 50 percent, compared to over 90 percent for non-resistant strains of TB. XDR-TB treatment is successful approximately 30 percent of

the time for patients without compromised immune systems; it is even lower for those with compromised immune systems (such as those with HIV/AIDS).[41]

Want to learn more about MDR-TB? Please view the fact sheet at **http://www.lungusa.org/mdr-tbfactsheet**

To counter the increasing problems of MDR-TB and patients who fail to complete the lengthy treatment, the ATS, CDC, and Infectious Diseases Society of America have jointly issued therapy and disease control guidelines for use by health care providers and public health officials. They include recommendations for rapid identification of persons with active disease, relying not only on skin testing (which may give false-negative results) but also on chest x-rays and sputum analysis; and screening of high-risk populations. Other recommendations address the need for comprehensive contact investigation and follow-up; preferred treatment regimens, including management of noncompliance with therapy; environmental control of infection in hospitals and other institutions; and prevention of recurrent infection and protection of health care personnel.[42]

The internationally recommended strategy for TB control by the WHO is directly observed therapy, short-course (DOTS). DOTS aims to decrease TB-related morbidity, deaths and transmission. It combines five elements: political commitment to TB control, access to quality testing methods, directly observed and standardized short-course treatment, adequate supply of drugs, and use of a standardized surveillance and monitoring system. Since DOTS was introduced on a global scale, millions of infectious patients have received effective treatment. DOTS produces cure rates of up to 95 percent even in the poorest of countries. Costing $11 per patient for a six-month drug supply in some countries, the World Bank has ranked the strategy as one of the most cost-effective of all health interventions.[43] The WHO's new approach to TB control entitled "Stop TB Strategy" goes further than previous efforts to make TB control more comprehensive and effective. DOTS remains at the core of this enhanced approach.[44]

The National Coalition For Elimination of Tuberculosis (NCET) published a report in 2004 warning of a repeat of the neglect that led to the TB resurgence in the United States between 1985 and 1992. It cites the link between the declining rate of decrease in TB cases and the cuts in funding for the CDC's Division of Tuberculosis Elimination. In order to continue to move toward the eradication of TB in the United States and avoid another outbreak, NCET recommended that prevention, detection and treatment efforts should be increased for Blacks in order to eliminate the racial gap in disease rates; the same steps should be taken for foreign-born persons in the United States, especially those who frequently cross the U.S.-Mexico border; DNA fingerprinting efforts should be intensified for all culture-positive TB cases; and more resources should be focused on research of TB diagnosis and treatment.[45]

What is new in tuberculosis research?

Although TB control programs, like DOTS, have been successful, the decrease

in the TB incidence rate in the United States has slowed down, as mentioned previously. One explanation is that immigrants from high-incidence countries bring TB with them into this country. As immigrants may enter illegally, screening for TB during the immigration process may not be a viable option for reducing TB incidence.

A 2005 study investigated how U.S. investment in tuberculosis control in high-incidence countries could result in a cost savings for the United States by reducing TB among immigrants. The study specifically investigated how U.S. investment in measures like DOTS, tuberculin skin testing and x-ray screening in Haiti, the Dominican Republic and Mexico would impact the tuberculosis-related disease, death, and cost issues in the United States over 20 years. The researchers investigated cost, migration patterns and co-infections (HIV) to predict the impact of U.S. foreign investment. They found that a U.S. investment of $9.4 million to increase DOTS in Haiti and the Dominican Republic would result in a net savings of $20 million and in 590 fewer Haitian and Dominican migrant TB infections. However, even more cost effective were the strategies proposed for DOTS implementation in Mexico. The study showed that a $34.9 million investment in the DOTS strategy there would result in 2,591 fewer TB cases in the United States, 349 fewer deaths and a savings of $108 million over 20 years. Therefore, it appears that U.S. investment in DOTS control programs in foreign countries has the potential to reduce TB disease and death rates in a very cost-effective manner.[46]

There are also strategies to control the global TB epidemic. While 9.2 million new cases of TB occurred worldwide in 2006, the majority of cases were concentrated in Asia and sub-Saharan Africa.[47] Globally, the number of HIV-positive and MDR-TB co-infected patients continues to increase. While global funding available for TB control has increased greatly since 2002 (reaching $2 billion), interventions proposed by the Global Plan to Stop TB still require an additional $1.1 billion in funding. In addition, the national tuberculosis programs of many countries with high incidence fail to conduct TB research, employ skilled staff or have the funding required to carry out the essential operations that would reduce TB rates. To aid in the decline of TB worldwide, the World Health Organization set targets for 2005 of a 70 percent detection rate and an 85 percent cure rate (of all cases). The targets were missed on a global scale as only 60 percent and 84 percent of cases were detected and treated, respectively.[48]

What is the American Lung Association doing about tuberculosis?

The American Lung Association was founded in 1904 to fight tuberculosis. The National Association for the Study and Prevention of Tuberculosis, as it was known then, was the first nationwide voluntary health organization aimed at conquering a specific disease.

In 1907, Dr. Joseph Wales realized that the small sanatorium on the Brandywine River in Delaware where he worked was down to its last dollar. He wrote

to his cousin, Emily Bissell, asking for help in raising the $300 needed to keep the sanatorium open. In response, Emily Bissell designed the first American Christmas Seal and borrowed $40 to have 50,000 of them printed. Before the Christmas season was over, she had raised not $300, but $3,000.

The National Association joined the Modern Health Crusade in 1915, taking tuberculosis associations into the nation's schools in a successful master plan for health education.

The National Association embarked on a research program that was to become truly significant in its scope and influence. Representative of the myriad of scientific refinements and improvements were those affecting the x-ray and tuberculin test. The research committee of the National Association began supporting investigations into improved x-ray machines and techniques. The tuberculin skin test and the x-ray became twin tools of diagnosis. The tuberculosis associations, along with health departments and the U.S. Public Health Service, bought and took these tools to locations where people were in order to conduct testing. Examples include screenings at factories in Cleveland and in Harlem as people celebrated the end of World War II.

The National Association launched a medical research and teaching fellowships award program in 1948, targeting young physicians or students in related fields. Some of the country's leading specialists in pulmonary medicine received their start through the National Association's fellowship program.

Currently, the American Lung Association continues to fund research on the basic scientific processes that initiate and control TB infection as well as the molecules and genes in the TB germ that enable it to infect humans and become resistant to drugs. A greater understanding of how the body's immune system protects against TB and why this defense system sometimes fails is being sought. Studies such as these will provide a solid foundation for developing a better TB vaccine.

As more strains of tuberculosis emerge and become resistant to first-line antibiotics, there is an increased reliance on second-line drugs to successfully treat multi-drug-resistant tuberculosis infections. Researchers, funded by the American Lung Association, aim to develop new antibiotic derivatives that regain antibacterial activity against resistant strains with fewer side effects.

Other research is exploring why only some people infected with tuberculosis actually develop the active, infectious disease. Detection and treatment of individuals with latent TB before they become infectious to others could have a huge impact on the incidence of global tuberculosis.

The American Lung Association supports increased U.S. government funding for programs aimed at eliminating TB in the United States as defined by the Institute of Medicine: an incidence rate of less than one TB case per million persons each year. The American Lung Association also supports the Healthy People 2010 goal of less than one new case per 100,000 persons in the United States by 2010.

The American Lung Association also supports increased federal funding to

support the development of the Global Plan to Stop TB and funding for international TB control efforts at the Centers for Disease Control and Prevention, the Fogarty International Center (National Institutes of Health) and the U.S. Agency for International Development.

Thousands of advocates have joined with the American Lung Association to tell Congress that more needs to be done to fight TB. Join the battle against lung disease by visiting http://lungaction.org.

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Beginning our second century, the American Lung Association works to prevent lung disease and promote lung health. Asthma is the leading serious chronic childhood illness. Lung diseases and breathing problems are the primary causes of infant deaths in the United States today. Smoking remains the nation's number one preventable cause of chronic illness. Lung disease death rates continue to increase while other major causes of death have declined.

The American Lung Association has long funded vital research to discover the causes and seek improved treatments for those suffering with lung disease. We are the foremost defender of the Clean Air Act and laws that protect citizens from secondhand smoke. The Lung Association teaches children the dangers of tobacco use and helps teenage and adult smokers overcome addiction. We help children and adults living with lung disease to improve their quality of life. With your generous support, the American Lung Association is "Improving life, one breath at a time."

For more information about the American Lung Association
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