Discrimination Prohibited: Under provisions of applicable public laws enacted by Congress since 1964, no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity (or, on the basis of sex, with respect to any education program or activity) receiving Federal financial assistance. In addition, Executive Order 11141 prohibits discrimination on the basis of age by contractors and subcontractors in the performance of Federal contracts, and Executive Order 11246 states that no federally funded contractor may discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. Therefore, the Heart, Lung, and Blood Institute must be operated in compliance with these laws and Executive Orders.

The bar graph on the front cover depicts the four leading causes of death in 2006: HEART DISEASE, cancer, STROKE, and COPD AND ALLIED CONDITIONS.
Morbidity & Mortality: 2009 Chart Book on Cardiovascular, Lung, and Blood Diseases

October 2009

For Administrative Use

National Institutes of Health
National Heart, Lung, and Blood Institute
The mission of the National Heart, Lung, and Blood Institute (NHLBI) is to provide leadership and support for research in cardiovascular, lung, and blood diseases; sleep disorders; women’s health; and blood resources. The ultimate goal is to improve the health and well-being of the American people. Although program priorities are determined primarily by research opportunities, other factors have an influence: the magnitude, distribution, and trends of cardiovascular, lung, and blood diseases in the United States, as well as the ability to improve the Nation’s health; congressional mandates; the health needs of the Nation, as perceived by Institute staff and outside advisory groups; and recommendations from the National Heart, Lung, and Blood Advisory Council have a significant impact on establishing research priorities.

Evaluation of the Institute’s program balance and program impact is a continuous process that relies on assessments of morbidity and mortality in the United States from cardiovascular, lung, and blood diseases. Consideration is given to their distribution among the population; to their trends over time; and to related statistics on population risk factors, lifestyles, medical care, and economic impact.

This Chart Book, like its predecessors, provides information on the progress being made in the fight against cardiovascular, lung, and blood diseases. It serves as a resource for the Institute as it plans and prioritizes future activities.

I would like to express my appreciation to Mr. Thomas Thom of the NHLBI for his time and effort in developing the material presented in this Chart Book.

Elizabeth G. Nabel, M.D.
Director
National Heart, Lung, and Blood Institute
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1. Introduction

During the past 40 years, major advances have been made in the prevention, diagnosis, and treatment of cardiovascular, lung, and blood diseases. Death rates from cardiovascular diseases (CVD) have declined significantly, and Americans are living longer, healthier lives. Despite the tremendous progress that has been made, morbidity and mortality from cardiovascular, lung, and blood diseases continue to impose a major burden on patients, their families, and the national health care system. The economic cost to the nation is substantial.

This Chart Book provides data that show the magnitude of the problem and time trends that highlight demographic differences in disease burden by age, sex, and racial/ethnic status. Nationally collected data are presented by race and ethnicity to the extent they are available, statistically reliable, and consistently collected.

A companion chart book, Incidence and Prevalence: 2006 Chart Book on Cardiovascular and Lung Diseases, represents a compendium of data from six cohort community studies and one surveillance study supported by the NHLBI.1

The “Background Data” chapter provides population and life-expectancy estimates; trends in total mortality, mortality by selected causes or major diagnosis, and days of hospital care; leading causes of death and chronic conditions; prevalence of CVD risk factors; and economic cost data. The “Cardiovascular Diseases,” “Lung Diseases,” and “Blood Diseases” chapters contain detailed morbidity and mortality statistics by racial/ethnic group, sex, and geographic distribution. Diseases included in a chapter are listed in the first table of the chapter, together with appropriate diagnostic codes of the ninth revision of the clinical modification of the International Classification (ICD-9-CM) for hospitalizations and physician office visit data, and tenth revision of the International Classification of Diseases (ICD) of the World Health Organization (WHO) for mortality.2, 3

Sources of Data

Most of the data used in this book were obtained from the National Center for Health Statistics (NCHS). Specifically, data include the annual vital statistics of the United States; the annual National Health Interview Survey (NHIS); the National Health and Nutrition Examination Survey (NHANES), 1971–1975, 1976–1980, 1988–1994, 1999–2002, and 2003–2006; the annual National Hospital Discharge Survey (NHDS); and the annual National Ambulatory Medical Care Survey. International mortality data came from the WHO Web site.

It is beyond the scope of the Chart Book to cite all of the NCHS and Bureau of the Census publications, data tapes, and Web sites that were used to prepare this document. Specific data sources for current statistics and general references to hospital and prevalence surveys and vital statistics for earlier data years may be found in Appendix E.

Population Estimates

The NCHS and the NHLBI used annual mid-year U.S. population estimates from the Bureau of the Census to express morbidity and mortality per population. Prevalence and hospital discharge statistics are based on noninstitutionalized population estimates that were included in NCHS publications. The annual live births are reported by NCHS and used for infant mortality rates.

Population counts from the 2000 Census and estimates based on it thereafter have been bridged to single race categories, combining multiple race categories found in the Census.

Quality of Data

Quality issues discussed below include accuracy of diagnosis, data comparability, and ICD classification.
Prevalence

Diagnosis for most disease prevalence and smoking habits are based only on self-reports from health interviews. Physical measurements, on the other hand, are used to determine the prevalence of cardiovascular risk factors, such as high serum cholesterol and overweight. Prevalence of hypertension is based on blood pressure readings and health interviews about relevant medication.

Hospital Statistics

Hospitalization statistics measure rates of health care use, length of stay, and hospital case fatality. They have limitations associated with diagnostic accuracy (e.g., the diagnosis may be influenced by the billing process) and diagnostic comparability over time (e.g., ICD revisions). Time trends may not accurately reflect real changes in incidence and case-fatality because data occasionally include changes in hospital admission practices.

The term hospitalizations, which replaces the NHDS term hospital discharges, refers to all inpatients, whether discharged alive or dead. The diagnosis given at discharge is the one that is used. Because the Survey is event-based rather than patient-based, annual estimates pertain to numbers of hospitalizations, not to numbers of patients hospitalized in a given year.

Charts that show hospitalization rates are based on first-listed diagnoses on the hospital record (i.e., primary diagnosis). Charts that show the numbers of hospitalizations for a particular disease include those that are classified as the primary diagnosis and those that are classified as secondary to some other disease.

Methodological problems in data collection preclude the presentation of hospital data by race.

In 1988, the NCHS redesigned the NHDS to link it with other surveys conducted by NCHS and to improve efficiency. The new survey occasionally resulted in a sudden shift in the level of rates after 1987. For this reason, charts display a break in the trend lines for hospitalization rates between the transitional years 1987–1988.

Cause-of-Death Statistics

Limitations of cause-of-death statistics, apart from discontinuities over time caused by revisions in the ICD, are well known. Inaccuracies in death certification and inconsistencies in selecting and coding the underlying cause of death create uncertainties about the true mortality from a specific cause compared with other causes. These uncertainties must be kept in mind when comparing the same cause of death over time or the same cause of death between demographic groups or countries.

Selecting only one cause of death as the underlying cause has the advantage of diagnostic specificity but the disadvantage of an incomplete account of the various causes that contributed to a death. Almost all mortality statistics presented here are limited to the underlying cause because that provides the consistency needed for the best comparison among causes of death.

Heart failure, which is nominally classified as the underlying cause for some deaths only because the true underlying cause was not known, is an exception (see Chapter 3). Heart failure mortality is presented two ways: As the underlying cause and as “any mention” cause. “Any mention” mortality means that the condition was selected as the underlying cause or was otherwise mentioned on the death certificate.

Another limitation related to cause-of-death statistics involves international comparisons of vital statistics. Comparisons of mortality data for coronary heart disease (CHD), stroke, and chronic obstructive pulmonary disease (COPD) among countries are affected by differences in diagnostic practices and physician training, interpretation of internationally recommended rules for coding a cause of death, availability of diagnostic aids, and the use of autopsies. Information presented in this book is limited to countries that are known to produce high-quality statistics.

Inconsistent race identification between death certificates and data from the Bureau of the Census and undercounts of some population groups in the Census may cause over- or underestimation of death rates in racial groups.
Beginning in 1989, the U.S. Standard Certificate of Death was revised. One reason was to improve the medical certification of cause of death. Because the revision could affect time–trend comparability, mortality trend lines between 1988 and 1989 are not connected.

ICD Revisions

Revisions in the ICD codes (Appendix A) cause discontinuity in time trends, particularly those associated with mortality. In charts where more than one ICD revision has been used, breaks in trend lines have been added between revisions or comparability ratios have been applied. Where differences in mortality classification between ICD-9 (1979–1998) and ICD-10 (1999–) exceed 4% (stroke and COPD in Charts 2–5, 3–5, and 3–55), NCHS-derived comparability ratios (Appendix B) have been applied to the death rates coded by ICD-9.

Data Presentation

Mortality data (rates per population) are generally expressed by age, race/ethnicity, and sex. Age-adjusted mortality data (rates per population or percent change) are expressed by race/ethnicity and sex and in a few cases by States. Prevalence data are given as a percent of population and are expressed by age, race/ethnicity, and sex. Hospitalization data are shown as comparisons between age groups or by primary or secondary diagnoses.

Rates per Population

Death rates are expressed per 100,000 population, using the resident population as of July 1 of the relevant year as the denominator. Hospital discharge rates are expressed per 10,000 population, and the number of discharges is the denominator for percent discharged dead. Infant mortality rates are expressed per 100,000 live births.

Age Adjustment

Age-adjusted rates are used to compare prevalence or mortality among various population groups or for one group over time. The 2000 standard population is applied in the age-adjustment so that rates are not affected by differences in age composition among the populations. The European standard population is applied for age adjustment of international mortality statistics.

The major disadvantage of using age-adjusted rates is loss of age-specific information. This becomes evident when the population groups being compared have mortality differences that are not in the same direction over a given age range. For example, the bar chart for mortality from total lung diseases (Chart 4–3) has a higher age-adjusted rate for white females than for black females. The age-specific line chart (Chart 4–4), however, shows that for ages 35–64 years, black females have higher rates than white females, but for ages 65–84 years, white females have higher rates than black females.

Percent Change

Percent changes in death rates over time, whether between 2 specified years or on an average annual basis, are calculated from log-linear regression slopes of rates for each year of a selected period. The percent changes may be influenced by unusually high or low values, especially if the period is short, and do not provide information about the levels on which they are based, which might be small. Average annual percent changes should not be summed over a period because the sum will be more than the percent change from the first to the last year in the period. Average annual percent changes give the appearance of small differences in the comparisons being made.

An exception to the use of log-linear regression to calculate percent change is made for Chart 3–6. For this chart, it is useful to have the percent change and other calculations based on the actual death rates.

Horizontal and Vertical Scales

Comparisons between time–trend charts are complicated because the range of the vertical scale may differ between charts. Vertical scales for less common diagnoses are magnified to focus on differences by age, race, and sex.
Arithmetic and Logarithmic Scales

In this Chart Book, time trends in death rates are plotted on an arithmetic scale to show their absolute change relative to zero. Note, however, that on an arithmetic scale, the absolute increase or decrease for a smaller death rate may appear to be modest compared with the change for a larger death rate, when in fact, the percent change over time is greater for the smaller rate. In addition, on an arithmetic scale, a decline can appear to be slowing, but if plotted on a logarithmic scale, it would not.

Truncated Age Ranges

The age range for death rates in some charts excludes individuals older than 84 years because of the difficulty associated with obtaining accurate diagnoses for patients who often have other contributing comorbidities. Selected truncated age groups are frequently used for U.S. data to highlight specific premature adult morbidity and mortality. For international comparisons, the age range 35–74 years was chosen so that differing age distributions among countries would be minimized in rate calculations.

Demographic Characteristics

The Chart Book provides prevalence and mortality information for various racial and ethnic groups. Several charts show comparisons between blacks and whites.

However, for mortality prior to 1968, data for nonwhites instead of blacks are presented. Many charts provide a race/sex comparison. Others present data for total males and total females or for total whites and total blacks to highlight important points that otherwise would be lost if four-way combinations were used.

The term American Indian is used to refer to the population that consists of American Indians and Alaska Natives. The term Asian is used to include persons of Asian and Pacific Islander descent. Data on socioeconomic groups are not presented because they are extensively presented elsewhere.14

State Mortality

Death rates for total population by State are shown in maps for CVD, CHD, stroke, and COPD.15 Although State death rates that combine all age, race, and sex groups can be misleading, they do show a reasonably similar geographic pattern compared with maps that are either race and sex specific or confined to a specific age range (not shown). For instance, stroke mortality is high in Southern States, reflecting high mortality in both blacks and whites. Although rankings of certain States for CHD mortality differ considerably from rankings for total heart disease, their geographic patterns are not very different.16
2. Background Data

The charts in this chapter provide population estimates, life expectancy, morbidity and mortality, and economic cost data for cardiovascular, lung, and blood diseases. Most focus on the leading causes of death, but a few address specific CVD risk factors. Immediately below are selected prevalence and incidence estimates.

Cardiovascular Diseases

Table 2–1 contains prevalence estimates for CVD in the U.S. population.\textsuperscript{17–21} It should be noted that individuals with multiple CVD are counted for each condition that applies to them.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD</td>
<td>81,100,000</td>
</tr>
<tr>
<td>Hypertension</td>
<td>74,500,000</td>
</tr>
<tr>
<td>CHD</td>
<td>17,600,000</td>
</tr>
<tr>
<td>Acute Myocardial Infarction (AMI)</td>
<td>8,500,000</td>
</tr>
<tr>
<td>Angina Pectoris</td>
<td>10,200,000</td>
</tr>
<tr>
<td>Stroke</td>
<td>6,400,000</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>5,800,000</td>
</tr>
<tr>
<td>Congenital Heart Defects</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>2,200,000</td>
</tr>
<tr>
<td>Peripheral Arterial Disease</td>
<td>8,000,000</td>
</tr>
</tbody>
</table>

Table 2–2 contains estimates for the annual occurrence of CVD in the United States.\textsuperscript{21–23}

<table>
<thead>
<tr>
<th>Condition</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Attack</td>
<td>1,255,000</td>
</tr>
<tr>
<td>First Event</td>
<td>785,000</td>
</tr>
<tr>
<td>Recurrent Event</td>
<td>470,000</td>
</tr>
<tr>
<td>Stroke</td>
<td>795,000</td>
</tr>
<tr>
<td>First Event</td>
<td>610,000</td>
</tr>
<tr>
<td>Recurrent Event</td>
<td>185,000</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>670,000</td>
</tr>
<tr>
<td>First Event</td>
<td>670,000</td>
</tr>
</tbody>
</table>

Lung Diseases

An estimated 24 million U.S. adults have COPD: 12 million physician-diagnosed and 12 undiagnosed.\textsuperscript{24–25} An estimated 23 million individuals have asthma and 12 million of them experienced at least one asthma attack during the survey year.\textsuperscript{26–28} Approximately 30,000 people have cystic fibrosis, and 1 in 3,000 babies are born with the disease; 40,000 infants and 150,000 adults have respiratory distress syndrome; and about 12 million persons have obstructive sleep apnea.

In this chapter, charts showing leading causes of death combine asthma with COPD and list the category as \textit{COPD and allied conditions}. The ICD-10 term is \textit{chronic lower respiratory diseases}.

Blood Diseases

An estimated 70,000 blacks have sickle cell anemia, and 1 in 500 black babies is born with the disease annually. About 500 to 1,000 persons develop aplastic anemia each year. Approximately 18,000 persons have hemophilia, and 400 babies are born with the disease each year. About 1,000 persons have Cooley’s anemia.

Population

Population estimates in Chart 2–1 are based on the 2000 U.S. Census and population surveys and projections. Estimates in Chart 2–1 and 2–2 reflect the 1997 Office of Management and Budget directive on race and ethnicity that allows survey respondents in Federal data collection programs to select more than one race. For Chart 2–3, designations of race were modified by NCHS to be consistent with the directive.
In 2007, the mean age and percent population aged 65 years and older were lower for minorities than for whites. This was true for both males and females.29

By 2020, the U.S. population will be 19.4% Hispanic, 13.0% black, and 5.5% Asian, and 16.1% will be aged 65 and older.30

In 2006, average life expectancy at birth was 77.7 years—80.4 years for females compared with 75.1 for males, and 78.2 years for whites compared with 73.2 years for blacks.31
From 1950 to 2006, all-cause death rates declined for males, females, blacks, and whites. Males had higher mortality rates than females, and for both sexes, blacks had higher mortality rates than whites.\textsuperscript{15, 32}

From 1950 to the mid-1960s, the unadjusted death rate for CHD increased but remained fairly stable for stroke. After 1968, death rates for CHD and stroke began to decline. CHD mortality continued to decline but stroke mortality reached a plateau in the 1990s before declining again in the 2000s. In contrast, the death rate for COPD steadily increased from 1950 until it began to plateau in the late 1990s.\textsuperscript{15, 32}
Background Data

From 1990 to 2006 (except in 1994), cardiovascular and respiratory diseases ranked first and second, respectively, in the number of days for which patients received hospital care.33, 34

From 1990 to 2006, age-adjusted death rates for cardiovascular and respiratory diseases ranked first and third, respectively.15, 35
In 2006, heart disease, stroke, and COPD and allied conditions were the first, third, and fourth leading causes of death, respectively.\textsuperscript{32}

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Deaths</td>
<td>2,426,264</td>
</tr>
<tr>
<td>Heart disease*</td>
<td>631,636</td>
</tr>
<tr>
<td>Cancer</td>
<td>559,888</td>
</tr>
<tr>
<td>Cerebrovascular diseases (stroke)</td>
<td>137,119</td>
</tr>
<tr>
<td>COPD and allied conditions\textsuperscript{†}</td>
<td>124,583</td>
</tr>
<tr>
<td>Accidents</td>
<td>121,599</td>
</tr>
<tr>
<td>Diabetes</td>
<td>72,449</td>
</tr>
<tr>
<td>Alzheimer’s disease</td>
<td>72,432</td>
</tr>
<tr>
<td>Influenza and pneumonia</td>
<td>56,326</td>
</tr>
<tr>
<td>Nephritis</td>
<td>45,344</td>
</tr>
<tr>
<td>Septicemia</td>
<td>34,234</td>
</tr>
<tr>
<td>All other causes of death</td>
<td>570,654</td>
</tr>
</tbody>
</table>

* Includes 425,425 deaths from CHD.

\textsuperscript{†} Chronic lower respiratory diseases.

In 2006, heart disease was the third leading cause of death for those aged 25–44 years, second for those aged 45–64 years, and first for those aged 65 years and older. Stroke ranked fifth for those aged 45–64 years and third for those aged 65 years and older. COPD and allied conditions ranked sixth for those aged 45–64 years and fourth for those aged 65 years and older.\textsuperscript{31}

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>1–24</th>
<th>25–44</th>
<th>45–64</th>
<th>≥65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart disease</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cancer</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cerebrovascular diseases (stroke)</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Accidents</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>COPD and allied conditions\textsuperscript{*}</td>
<td>9</td>
<td>—</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Influenza and pneumonia</td>
<td>7</td>
<td>10</td>
<td>—</td>
<td>7</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>—</td>
<td>8</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Suicide</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>—</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>—</td>
<td>7</td>
<td>7</td>
<td>—</td>
</tr>
<tr>
<td>Nephritis and nephrosis</td>
<td>—</td>
<td>—</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Homicide</td>
<td>2</td>
<td>5</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Septicemia</td>
<td>10</td>
<td>—</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Congenital malformations</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Alzheimer’s disease</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>5</td>
</tr>
</tbody>
</table>

\textsuperscript{*} Chronic lower respiratory diseases.
In 2006, among white males, heart disease, COPD and allied conditions, and stroke were the first, fourth, and fifth leading causes of death, respectively.\textsuperscript{36}

* Chronic lower respiratory diseases.

In 2006, among white females, heart disease, stroke, and COPD and allied conditions were the first, third, and fourth leading causes of death, respectively.\textsuperscript{36}

* Chronic lower respiratory diseases.
In 2006, among black males, heart disease and stroke were the first and fifth leading causes of death, respectively.36

In 2006, among black females, heart disease and stroke were the first and third leading causes of death, respectively.36
Background Data

In 2006, among Asian males, heart disease, stroke, and COPD and allied conditions were the second, third, and fifth leading causes of death, respectively.36

![Chart 2–14](chart1.png)

* Chronic lower respiratory diseases.

In 2006, among Asian females, heart disease and stroke were the second and third leading causes of death, respectively.36

![Chart 2–15](chart2.png)
In 2006, among Hispanic males, heart disease and stroke were the first and fourth leading causes of death, respectively.\textsuperscript{36}

In 2006, among Hispanic females, heart disease, stroke, and COPD and allied conditions were the first, third, and sixth leading causes of death, respectively.\textsuperscript{36}

* Chronic lower respiratory diseases.
In 2006, among American Indian males, heart disease was the leading cause of death.\textsuperscript{36}

In 2006, among American Indian females, heart disease, stroke, and COPD and allied conditions were the second, fifth, and sixth leading causes of death, respectively.\textsuperscript{36}

* Chronic lower respiratory diseases.
Background Data

Chart 2–20

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Prevalence (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis</td>
<td>6.6</td>
</tr>
<tr>
<td>Back/neck conditions</td>
<td>6.6</td>
</tr>
<tr>
<td>Heart condition</td>
<td>4.3</td>
</tr>
<tr>
<td>Mental conditions</td>
<td>3.6</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3.5</td>
</tr>
<tr>
<td>Hypertension</td>
<td>3.3</td>
</tr>
<tr>
<td>Musculoskeletal condition</td>
<td>3.2</td>
</tr>
<tr>
<td>Nervous condition</td>
<td>2.9</td>
</tr>
<tr>
<td>Lung condition</td>
<td>2.9</td>
</tr>
<tr>
<td>Fractures</td>
<td>2.7</td>
</tr>
<tr>
<td>Vision condition</td>
<td>2.0</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.6</td>
</tr>
<tr>
<td>Cancer</td>
<td>1.5</td>
</tr>
</tbody>
</table>

In 2007, heart disease was the third leading chronic condition causing activity limitation. Hypertension, lung condition, and stroke were also very common.24

Chart 2–21

From 1965 to 1990, the percent of the population aged 18 years and older who reported that they smoke cigarettes decreased significantly. Since then, the percent of the population who reported that they currently smoke declined modestly.37
Background Data

Chart 2–22

From 1976–1980 to 1999–2002, the prevalence of high serum cholesterol declined for each sex and racial/ethnic group, continuing to 2003–2006 for black and white males and black females. This trend was reversed in white and Mexican-American females.17, 37

Chart 2–23

From 1976–1980 to 2003–2006, the prevalence of overweight males and females increased for each racial/ethnic group.17, 37

* High serum cholesterol is ≥240 mg/dL.
† Non-Hispanic.

* Overweight (including obesity) is a body mass index of ≥25 kg/m².
† Non-Hispanic.
In 2010, cardiovascular, lung, and blood diseases are projected to cost $445 billion in health care expenditures and $230 billion in lost productivity. Costs attributed to them as secondary causes of morbidity and mortality are not included.\textsuperscript{35, 38–44}

### Background Data

#### Chart 2–24
Projected Economic Cost of Cardiovascular, Lung, and Blood Diseases, U.S., 2010

<table>
<thead>
<tr>
<th>Disease</th>
<th>Total (Billions)</th>
<th>Direct</th>
<th>Morbidity</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CVD</td>
<td>485.6</td>
<td>324.1</td>
<td>39.1</td>
<td>122.4</td>
</tr>
<tr>
<td>Heart disease</td>
<td>311.1</td>
<td>189.5</td>
<td>24.0</td>
<td>97.6</td>
</tr>
<tr>
<td>Coronary</td>
<td>168.6</td>
<td>96.0</td>
<td>10.6</td>
<td>62.0</td>
</tr>
<tr>
<td>Heart failure</td>
<td>38.6</td>
<td>35.1</td>
<td>—*</td>
<td>3.5</td>
</tr>
<tr>
<td>Stroke</td>
<td>71.2</td>
<td>48.2</td>
<td>7.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Hypertensive disease</td>
<td>73.9</td>
<td>54.7</td>
<td>8.4</td>
<td>10.8</td>
</tr>
<tr>
<td>Lung diseases</td>
<td>173.4</td>
<td>108.9</td>
<td>27.9</td>
<td>36.6</td>
</tr>
<tr>
<td>COPD</td>
<td>49.9</td>
<td>29.5</td>
<td>8.0</td>
<td>12.4</td>
</tr>
<tr>
<td>Asthma</td>
<td>20.7</td>
<td>15.6</td>
<td>3.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Blood diseases</td>
<td>15.9</td>
<td>11.8</td>
<td>0.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Anemias</td>
<td>9.6</td>
<td>8.0</td>
<td>0.6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* No estimate is available.

#### Chart 2–25
Projected Direct Cost of Cardiovascular, Lung, and Blood Diseases, U.S., 2010

<table>
<thead>
<tr>
<th>Disease</th>
<th>Hospital Care</th>
<th>Physicians Services*</th>
<th>Prescription Drugs</th>
<th>Home Health Care</th>
<th>Nursing Home Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CVD</td>
<td>324.1</td>
<td>150.1</td>
<td>46.4</td>
<td>52.3</td>
<td>16.8</td>
</tr>
<tr>
<td>Heart disease</td>
<td>189.5</td>
<td>106.3</td>
<td>23.8</td>
<td>22.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Coronary</td>
<td>96.0</td>
<td>54.6</td>
<td>13.4</td>
<td>10.3</td>
<td>2.2</td>
</tr>
<tr>
<td>Heart failure</td>
<td>35.1</td>
<td>20.1</td>
<td>2.4</td>
<td>3.3</td>
<td>3.4</td>
</tr>
<tr>
<td>Stroke</td>
<td>48.2</td>
<td>21.0</td>
<td>3.8</td>
<td>1.3</td>
<td>5.0</td>
</tr>
<tr>
<td>Hypertensive disease</td>
<td>54.7</td>
<td>8.5</td>
<td>13.9</td>
<td>24.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Lung diseases</td>
<td>108.9</td>
<td>68.2</td>
<td>15.9</td>
<td>16.1</td>
<td>3.6</td>
</tr>
<tr>
<td>COPD</td>
<td>29.5</td>
<td>13.2</td>
<td>5.5</td>
<td>5.8</td>
<td>1.3</td>
</tr>
<tr>
<td>Asthma</td>
<td>15.6</td>
<td>5.5</td>
<td>4.2</td>
<td>5.9</td>
<td>—†</td>
</tr>
<tr>
<td>Blood diseases</td>
<td>11.8</td>
<td>6.1</td>
<td>2.5</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Anemias</td>
<td>8.0</td>
<td>3.9</td>
<td>1.7</td>
<td>0.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

* Physicians, clinics, and other professional services.
† No estimate is available.
3. Cardiovascular Diseases

The diagnostic group cardiovascular diseases is used here to mean diseases and congenital malformations of the circulatory system as coded in the ICD.

Charts 3–1 through 3–3 show the distribution of deaths in 2006 due to specific CVD, heart disease, and stroke deaths, respectively. For CVD, Chart 3–4 shows, according to ICD-9-CM codes, the number of physician office visits, the number of hospitalizations, and length of hospital stay in 2006 and according to ICD-10 codes, the number of deaths in 2006. Subsequent charts display morbidity and mortality for total CVD and selected subgroups.

Coronary Heart Disease

CHD includes acute myocardial infarction (AMI) and angina pectoris. In the Chart Book, charts provide information on the prevalence and hospitalization rates of AMI and angina pectoris. Mortality data are not shown for them individually because good diagnostic information is often not available at the time in which death certificates are completed.

Over the years multiple revisions of the ICD resulted in changes in diagnostic terms and codes included in the CHD category that compromised direct comparability of CHD deaths over time. For example, ICD-10 expanded CHD (over ICD-9) to include “Atherosclerotic CVD.” To maintain comparability over time, CHD death rates in ICD-9 (1979–1998) were retabulated to include deaths coded to the additional term. As a result, CHD death rates from 1979 to 1998 included in this Chart Book are higher than those found in issues of the Chart Book prior to 2004.

Heart Failure

Heart failure is a sequela of various heart diseases. It is a heart “condition,” not a heart “disease,” and is more common as a contributing rather than an underlying cause of death. Thus, it is imprecise to classify heart failure as an underlying cause of death. The condition, however, is increasingly prevalent and common in the reporting of hospitalizations and mortality. In fact, hospitalizations and mortality for heart failure have increased (until very recently), while mortality for total heart diseases has declined substantially. Charts are presented for any mention of heart failure on death certificates and for heart failure nominally classified as the underlying cause.

Cardiomyopathy

In 2006, 24,703 deaths were attributed to cardiomyopathy, although no consensus exists on classification and diagnostic criteria for the disease. This limitation presumably has little effect on any mortality differences influenced by age, race, or sex.

Atrial Fibrillation and Other Heart Diseases

The number of hospitalizations for atrial fibrillation has been steadily increasing over the past several years. Charts 3–47 and 3–48 show the number and rates of hospitalizations for atrial fibrillation. Mortality due to atrial fibrillation is not shown because atrial fibrillation is not intrinsically a fatal condition, although it does predispose individuals to potentially fatal conditions such as stroke. Moreover, the inconsistency in which atrial fibrillation is mentioned on death certificates and the difficulty of determining whether it is truly the cause of death make it impossible to gather reliable data.

Diseases of pulmonary circulation, acute and subacute endocarditis, and cardiac dysrhythmias are additional heart diseases of interest. Because measures of their morbidity, and especially their mortality, are of uncertain quality, charts pertaining to them have not been included.

Cerebrovascular Diseases (Stroke)

Cerebrovascular disease (i.e., stroke) is the third leading cause of death. Only a small proportion of deaths from stroke can be classified as cerebral hemorrhage, occlusion, thrombosis, or embolism. Most are
coded to ill-defined forms of cerebrovascular diseases (Chart 3–3). Therefore, mortality for the entire category is presented in charts related to stroke.

**Hypertensive Disease**

Prevalence and trend data on awareness, treatment, and control of hypertension are important statistics associated with hypertension morbidity and have therefore been included in this chapter. Mortality statistics are not presented for hypertensive disease because it is not a distinct underlying cause of death. In fact, its presence on death certificates is often arbitrary, and its selection as the underlying cause of death is often characterized by a lack of good diagnostic information at the time of death.

**Diseases of Arteries**

The ICD term *diseases of arteries* is used to refer to peripheral vascular disease and includes a variety of atherosclerotic disorders; none of them specifically involve the heart or brain. Examples are aortic aneurysm, atherosclerosis of the extremities, arterial embolism and thrombosis, and generalized atherosclerosis. Mortality data are presented, but valid prevalence estimates are not available.

**Congenital Malformations of the Circulatory System**

The ICD term *congenital malformations of the circulatory system* includes the specific subgroup congenital heart disease. Because most deaths in the overall category occur in infants younger than 1 year of age, the preferred mortality tabulation is the infant mortality rate.
Cardiovascular Diseases

Chart 3–1
Cardiovascular Disease Deaths, Percent by Subgroup, U.S., 2006

* Heart failure as an underlying cause or otherwise mentioned on the death certificate accounted for 23% (192,002) of total CVD deaths. Total deaths = 831,272 (100%), including 3,531 due to congenital CVD defects.

Chart 3–2
Heart Disease Deaths, Percent by Subgroup, U.S., 2006

* Heart failure as an underlying cause or otherwise mentioned on the death certificate accounted for almost 29% (182,337) of total heart disease deaths. Total deaths = 634,490 (100%), including 2,854 from congenital heart defects.

Chart 3–3
Stroke Deaths, Percent by Subgroup, U.S., 2006

Total deaths = 137,119 (100%).
# Cardiovascular Diseases

## Chart 3–4
**Number of Hospitalizations, Physician Office Visits,* and Deaths for Cardiovascular Diseases, U.S., 2006**

<table>
<thead>
<tr>
<th>Diagnostic Category</th>
<th>ICD-9-CM Codes</th>
<th>First-Listed Discharges (1,000)</th>
<th>Length of Stay (Days)</th>
<th>Physician Office Visits (1,000)</th>
<th>ICD-10 Codes</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic heart disease</td>
<td>390–398</td>
<td>54</td>
<td>7.7</td>
<td>270</td>
<td>I00–I09</td>
<td>3,257</td>
</tr>
<tr>
<td>Hypertensive heart disease</td>
<td>402, 404</td>
<td>87</td>
<td>6.0</td>
<td>453</td>
<td>I11, I13</td>
<td>32,706</td>
</tr>
<tr>
<td>Coronary heart disease:</td>
<td>410–414, 429.2</td>
<td>1,760</td>
<td>4.0</td>
<td>10,956</td>
<td>I20–I25</td>
<td>425,425</td>
</tr>
<tr>
<td>AMI</td>
<td>410</td>
<td>647</td>
<td>5.4</td>
<td>206</td>
<td>I21, I22</td>
<td>141,462</td>
</tr>
<tr>
<td>Angina pectoris, stable</td>
<td>413</td>
<td>41</td>
<td>2.1</td>
<td>757</td>
<td>I20.1–I20.9</td>
<td>179</td>
</tr>
<tr>
<td>Angina pectoris, unstable</td>
<td>411</td>
<td>86</td>
<td>2.5</td>
<td>201</td>
<td>I20.0</td>
<td>30</td>
</tr>
<tr>
<td>Atherosclerotic CVD</td>
<td>429.2</td>
<td>—</td>
<td>—</td>
<td>98</td>
<td>I25.0</td>
<td>61,030</td>
</tr>
<tr>
<td>Other CHD</td>
<td>412, 414</td>
<td>986</td>
<td>3.2</td>
<td>9,695</td>
<td>Other I23–I25</td>
<td>222,724</td>
</tr>
<tr>
<td>Diseases of pulmonary circulation:</td>
<td>415–417</td>
<td>160</td>
<td>5.7</td>
<td>264</td>
<td>I26–I28</td>
<td>12,387</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>415.1</td>
<td>145</td>
<td>5.6</td>
<td>128</td>
<td>I26</td>
<td>6,924</td>
</tr>
<tr>
<td>Other</td>
<td>415.0, 415.2–417</td>
<td>15</td>
<td>5.7</td>
<td>136</td>
<td>I27–I28</td>
<td>5,463</td>
</tr>
<tr>
<td>Subacute bacterial endocarditis</td>
<td>421</td>
<td>13</td>
<td>11.7</td>
<td>—</td>
<td>I33.0</td>
<td>1,175</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>425</td>
<td>43</td>
<td>3.8</td>
<td>691</td>
<td>I42</td>
<td>24,703</td>
</tr>
<tr>
<td>Atrial fibrillation and flutter</td>
<td>427.3</td>
<td>461</td>
<td>3.5</td>
<td>4,065</td>
<td>I48</td>
<td>11,438</td>
</tr>
<tr>
<td>Other arrhythmic disorders</td>
<td>Other 427</td>
<td>311</td>
<td>3.2</td>
<td>1,966</td>
<td>Other I43–I49</td>
<td>26,301</td>
</tr>
<tr>
<td>Heart failure:</td>
<td>428</td>
<td>1,106</td>
<td>5.1</td>
<td>2,681</td>
<td>I50</td>
<td>60,337</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>428.0</td>
<td>1,002</td>
<td>5.1</td>
<td>2,605</td>
<td>I50.0</td>
<td>55,923</td>
</tr>
<tr>
<td>Left heart failure and unspecified</td>
<td>428.1–428.9</td>
<td>104</td>
<td>5.5</td>
<td>76</td>
<td>150–150.9</td>
<td>4,414</td>
</tr>
<tr>
<td>Other heart disease</td>
<td>Other 420–429</td>
<td>200</td>
<td>5.6</td>
<td>2,866</td>
<td>Other I30–I51</td>
<td>33,907</td>
</tr>
<tr>
<td>Other hypertensive disease</td>
<td>401, 403</td>
<td>426</td>
<td>3.1</td>
<td>37,885</td>
<td>I10, I12</td>
<td>23,855</td>
</tr>
<tr>
<td>Cerebrovascular diseases (stroke)</td>
<td>430–438</td>
<td>885</td>
<td>4.9</td>
<td>2,005</td>
<td>I60–I69</td>
<td>137,119</td>
</tr>
<tr>
<td>Diseases of arteries:</td>
<td>440–448</td>
<td>282</td>
<td>5.6</td>
<td>1,477</td>
<td>I70–I78</td>
<td>31,136</td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td>440</td>
<td>129</td>
<td>5.7</td>
<td>251</td>
<td>I70</td>
<td>8,652</td>
</tr>
<tr>
<td>Aortic aneurysm</td>
<td>441</td>
<td>57</td>
<td>6.5</td>
<td>253</td>
<td>I71</td>
<td>13,238</td>
</tr>
<tr>
<td>Other diseases of arteries</td>
<td>442–448</td>
<td>96</td>
<td>5.0</td>
<td>973</td>
<td>I72–I78</td>
<td>9,246</td>
</tr>
<tr>
<td>Deep vein thrombosis</td>
<td>451.1</td>
<td>10</td>
<td>4.5</td>
<td>—</td>
<td>I80.2</td>
<td>2,328</td>
</tr>
<tr>
<td>Other and unspecified CVD</td>
<td>Other 451–459</td>
<td>343</td>
<td>4.4</td>
<td>6,591</td>
<td>Other I80–I99</td>
<td>1,667</td>
</tr>
<tr>
<td>Congenital malformations of CV system:</td>
<td>745–747</td>
<td>70</td>
<td>9.6</td>
<td>419</td>
<td>Q20–Q28</td>
<td>3,531</td>
</tr>
<tr>
<td>Congenital heart disease</td>
<td>745, 746</td>
<td>41</td>
<td>8.4</td>
<td>356</td>
<td>Q20–Q24</td>
<td>2,854</td>
</tr>
<tr>
<td>Other congenital cardiovascular disease</td>
<td>747</td>
<td>29</td>
<td>11.5</td>
<td>63</td>
<td>Q25–Q28</td>
<td>677</td>
</tr>
</tbody>
</table>

* Estimates of hospitalizations and physician office visits are subject to sampling variability. Estimates of hospitalizations below 50,000 have a relative standard error of >11%. Estimates of physician office visits below 588,000 have a relative standard error of >30%.
Cardiovascular Diseases

Chart 3–5
Change in Age-Adjusted Death Rates,

The death rates for CHD increased almost 10% from 1950 to its peak in 1968; by 2006, it was 69% lower than it was in 1950. Stroke mortality, on the other hand, declined for most of those years and by 2006 was 76% lower than it was in 1950. By comparison, the death rate for non-CVD causes decreased only 15% since 1950.31, 32

Chart 3–6
Age-Adjusted Death Rates and Percent Change for All Causes and Cardiovascular Diseases, U.S., 1968 and 2006

From 1968 to 2006, the death rate for CVD declined 65%, compared with a 5.7% decline in the rate for all non-CVD causes. Mortality for CHD and stroke declined 72% and 73%, respectively.31, 32

* Excludes congenital malformations of the circulatory system.
Cardiovascular Diseases

From 1968 to 2006, the death rate for total CVD had declined. The 1999–2006 average annual percent declines in the age-adjusted death rates were 4.0% for CVD, 5.1% for CHD, and 4.9% for stroke.31, 32

From 1999 to 2006, average annual percent declines in mortality for CVD, CHD, and stroke within sex groups were greater in whites than in blacks. Within racial groups, the decline in CHD mortality was greater in females than in males. The decline in stroke mortality in whites was greater in males than in females.36

<table>
<thead>
<tr>
<th>Years</th>
<th>All Causes</th>
<th>Total CVD*</th>
<th>CHD</th>
<th>Stroke</th>
<th>Other CVD</th>
<th>All Other Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968–1978</td>
<td>-2.2</td>
<td>-3.6</td>
<td>-2.9</td>
<td>-4.2</td>
<td>-6.7</td>
<td>-0.7</td>
</tr>
<tr>
<td>1979–1989</td>
<td>-0.6</td>
<td>-2.2</td>
<td>-2.9</td>
<td>-3.7</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>1989–1998</td>
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<td>-1.8</td>
<td>-2.8</td>
<td>-0.9</td>
<td>-0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>1999–2006</td>
<td>-1.7</td>
<td>-4.0</td>
<td>-5.1</td>
<td>-4.9</td>
<td>-1.6</td>
<td>-0.4</td>
</tr>
</tbody>
</table>

* Excludes congenital malformations of the circulatory system.

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>All Causes</th>
<th>Black Male</th>
<th>White Male</th>
<th>Black Female</th>
<th>White Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
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<td>-2.3</td>
<td>-2.0</td>
<td>-1.9</td>
<td>-1.5</td>
</tr>
<tr>
<td>CVD*</td>
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<td>-3.4</td>
<td>-4.2</td>
<td>-3.8</td>
<td>-4.1</td>
</tr>
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<td>-3.4</td>
<td>-4.0</td>
<td>-4.0</td>
<td>-4.1</td>
</tr>
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<td>-5.0</td>
<td>-5.2</td>
<td>-5.4</td>
</tr>
<tr>
<td>Stroke</td>
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<td>-4.2</td>
<td>-5.4</td>
<td>-4.2</td>
<td>-4.9</td>
</tr>
<tr>
<td>Non-CVD</td>
<td>-0.4</td>
<td>-1.7</td>
<td>-0.6</td>
<td>-0.7</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* Excludes congenital malformations of the circulatory system.
Although age-adjusted death rates for CVD declined considerably between 1979 and 2006, the total number of CVD deaths declined only modestly because of a growing and aging population.\textsuperscript{31, 32}

In 2006, the percent of deaths due to CVD increased with age among adults: 19\% for those aged 35-44 years and 45\% for those aged 85 years and older.\textsuperscript{31}

\* Includes congenital malformations of the circulatory system.
Cardiovascular Diseases

In 2003–2005, CVD mortality was generally highest in the Southeastern United States.\textsuperscript{15}

From 1993–1995 to 2003–2005, the smallest percent declines in death rates for CVD tended to be in the Southeastern United States.\textsuperscript{15}

* Excludes congenital malformations of the circulatory system.

* Excludes congenital malformations of the circulatory system.
In 2006, heart disease mortality was 53% higher in males than in females. Within sex groups, it was highest in non-Hispanic blacks and lowest in Asians.\textsuperscript{36}

In 2006, heart disease mortality in males was highest in non-Hispanic blacks across all age groups. This disparity was proportionately greater in younger age groups than in older age groups.\textsuperscript{36}

* Non-Hispanic.
Total Heart Disease/Coronary Heart Disease

In 2006, the disparity in heart disease mortality between blacks and other racial and ethnic groups was as great or greater for females than for males (also see Chart 3–14).36


* Non-Hispanic.
Coronary Heart Disease

Chart 3–17

In 1999–2006, the prevalence of AMI was higher in males than in females and increased substantially with age.17

Chart 3–18

In 1999–2006, the prevalence of AMI was higher in blacks than in whites aged 35 to 64 years, but was higher in whites than in blacks among those aged 65 years and older.17
In 1999–2006, the prevalence of angina pectoris, which increased substantially with age, was slightly higher in females than in males aged 35 to 64 years, but was higher in males than in females among those aged 65 years and older.¹⁷

In 1999–2006, the prevalence of angina pectoris increased with age for blacks and whites. The increase, however, did not continue in blacks past age 74 years. Prevalence was higher in blacks than in whites prior to age 65 years but was higher in whites than in blacks for those aged 65 years and older.¹⁷
Coronary Heart Disease

Chart 3–21

For those aged 45–64 years, hospitalization rates for AMI increased from 1965 to the mid-1970s and then remained stable before declining in the mid-1990s. For those aged 65 years and older, hospitalization rates for AMI increased from 1965 to 1986; the rates began to decline in the early 2000s through 2006.33, 34

Chart 3–22
Hospital Case-Fatality Rates for Acute Myocardial Infarction, Ages Younger Than 65 and 65 and Older, U.S., 1970–2006

From 1970 to 2006, hospital case-fatality rates for AMI declined substantially for those younger than 65 years and for those aged 65 years and older.33, 34
Coronary Heart Disease

CHD accounted for 425,000 deaths in 2006. It would have accounted for 1,511,000 deaths if CHD mortality had remained at its 1968 peak.\textsuperscript{31, 32}

From 1999 to 2006, CHD mortality declined in non-Hispanic whites, non-Hispanic blacks, Hispanics, Asians, and American Indians, both male and female.\textsuperscript{36}
Coronary Heart Disease

Chart 3–25
Age-Adjusted Death Rates for Coronary Heart Disease

In the 1950s and 1960s, death rates for CHD increased in white males and in blacks, both male and female, but were relatively stable in white females. Since then, all rates have declined appreciably.31, 32

* Nonwhite from 1950 to 1967.

Chart 3–26
Deaths and Age-Adjusted Death Rates for Coronary Heart Disease, U.S., 1980–2006

Since 1980, the number of deaths and the age-adjusted death rates for CHD decreased almost every year.31, 32
The average annual decline in CHD mortality began during the 1968–1978 period for all groups (slightly earlier for white females) and was greatest—5% overall—during the 1999–2006 period. Since 1979, within sex groups, CHD mortality declined more for whites than blacks.31, 32

From 1999 to 2006, the average annual percent decline in CHD mortality was greater for those aged 55 years and older than for those aged 54 years and younger. White females aged 35–44 years experienced an increase in CHD mortality during this period.36
Coronary Heart Disease

Chart 3–29
Age-Adjusted Death Rates for Coronary Heart Disease by Race/Ethnicity and Sex, U.S., 2006

In 2006, CHD mortality was 70% higher in males than in females. Within sex groups, it was highest in non-Hispanic blacks and lowest in Asians.36

Chart 3–30
Death Rates for Coronary Heart Disease in Males by Age and Race/Ethnicity, U.S., 2006

In 2006, CHD mortality in males increased with age from 45–54 to 75–84 years for non-Hispanic blacks, non-Hispanic whites, Hispanics, American Indians, and Asians. The relatively high rates in non-Hispanic blacks and low rates in Asians occurs in all age groups.36
Coronary Heart Disease

In 2006, CHD mortality in females increased with age from 45–54 to 75–84 years for non-Hispanic blacks, non-Hispanic whites, Hispanics, American Indians, and Asians. The relatively high rates in non-Hispanic blacks and low rates in Asians occurs in all age groups.36

Chart 3–31
Death Rates for Coronary Heart Disease in Females by Age and Race/Ethnicity, U.S., 2006

In 2003–2005, a narrow band of states from New York through Appalachia to Oklahoma had high CHD death rates. Many Western Mountain states had low CHD death rates.15

Chart 3–32
Age-Adjusted Death Rates for Coronary Heart Disease by State, U.S., 2003–2005
In 2006–2007, among 16 industrialized countries, the United States ranked sixth highest for CHD mortality in males and fourth highest in females.\textsuperscript{45}

From 1999 to 2007, when compared with the United States, 8 of the 13 countries shown had a steeper average annual decline in CHD mortality in males.\textsuperscript{45}
Coronary Heart Disease/Heart Failure

From 1999 to 2007, when compared with the United States, 9 of the 13 countries shown had a steeper average annual decline in CHD mortality in females.45

From 1976–1980 to 1988–1994, the prevalence of HF increased markedly in males, females, whites, and blacks and remained relatively high thereafter. The extent to which the increase is attributed to the change in terminology, from HF to congestive HF, beginning with the 1988–1994 survey is unknown.17
Hospitalization rates for congestive HF in those younger than 65 years increased from 1971 to 1993 and remained stable through 2006. Rates for those 65 years and older increased from 1970 to 1998 and remained somewhat stable until 2006.\textsuperscript{33, 34}

Hospital case-fatality rates for congestive HF declined appreciably from 1982 to 2006 for those younger than 65 years and 65 years and older.\textsuperscript{33, 34}
From 1981 to 1988, death rates with HF as the underlying cause increased in blacks and whites, both male and female. Rates stabilized in the early 1990s and remained so through 2006. Mortality was highest in black males and lowest in white females.36

From 1989 to 2006, death rates for any mention of HF on the death certificate declined for blacks and whites, both male and female. From 1981 to 2000, mortality in males was higher in whites than in blacks and then was similar through 2006. This is in contrast to HF solely as the underlying cause (also see Chart 3–39).36
Heart Failure

In 2006, death rates for HF as the underlying cause were slightly higher in males than in females. Within sex groups, death rates were highest in non-Hispanic blacks and non-Hispanic whites and lowest in Asians.36

Chart 3–41
Age-Adjusted Death Rates for Heart Failure as the Underlying Cause of Death by Race/Ethnicity and Sex, U.S., 2006

In 2006, death rates for HF as the underlying cause were slightly higher in males than in females. Within sex groups, death rates were highest in non-Hispanic blacks and non-Hispanic whites and lowest in Asians.36

Chart 3–42
Age-Adjusted Death Rates for Any Mention of Heart Failure by Race/Ethnicity and Sex, U.S., 2006

In 2006, death rates for any mention of HF on the death certificate were higher in males than in females. Within sex groups, death rates were highest in non-Hispanic blacks and non-Hispanic whites and lowest in Asians.36
Heart Failure

In 2006, HF mortality as the underlying cause increased with age. Within sex groups, rates were higher in blacks than in whites; and within racial groups, rates were higher in males than in females.\(^{36}\)

In 2006, mortality for any mention of HF on the death certificate was higher in blacks than in whites within sex groups and at all ages, with one exception: For those aged 75–84 years, the death rate in white males surpassed the rate in black males. Within racial groups, death rates for HF were higher in males than in females.\(^{36}\)
In 2006, the death rate for cardiomyopathy was about twice as high in males than in females and nearly twice as high in blacks than in whites.35

In 2006, within sex groups, cardiomyopathy mortality was much higher in blacks than in whites at all ages from 35–44 to 75–84 years. Within racial groups, cardiomyopathy mortality was higher in males than in females.35
Atrial Fibrillation

The number of hospitalizations for atrial fibrillation as a primary diagnosis was more than 2.5 times higher in 2006 than in 1988. As a secondary diagnosis, the number of hospitalizations was 3 times higher in 2006 than in 1988.33, 34

From 1988 to 2006, hospitalization rates for atrial fibrillation nearly doubled for those aged 45–64 years and slightly more than doubled for those aged 65 years and older.33, 34
Cerebrovascular Diseases (Stroke)


In 1999–2006, the prevalence of stroke, which increased with age, was higher in females than in males through age 55–64 years; it was higher in males than in females aged 65 years and older.17
Cerebrovascular Diseases (Stroke)

In 1999–2006, the prevalence of stroke increased with age and was higher in blacks than in whites at all ages.17

Hospitalization rates for stroke in those aged 45–64 years increased from 1971 to the mid-1980s, then remained relatively stable through 2006. For those aged 65 years and older, the rates generally rose from 1971 to 1997, and subsequently declined through 2006.33,34
Cerebrovascular Diseases (Stroke)

Chart 3–53
Hospital Case-Fatality Rate for Stroke, Ages Younger Than 65 and 65 and Over, U.S., 1971–2006*

Hospital case-fatality rates for stroke in patients younger than 65 years declined appreciably from 1971 to 1983 and then fluctuated through 2006. For those aged 65 years and older, the rates continued to decline until 1997 and then stabilized.33, 34

* Estimates are not available for 1976 and 1977.

Chart 3–54

The steep decline in stroke mortality that occurred for black and for white males and females in the 1970s and mid-1980s slowed through the 1990s before resuming in 2001.31, 32

* Nonwhite from 1950 to 1967.
Cerebrovascular Diseases (Stroke)

From 1980 to the early 1990s, the number of deaths and the age-adjusted death rates for stroke declined. The number of deaths remained relatively stable after the mid-1990s but began to decline again after 2000. The age-adjusted death rates were stable for most of the 1990s but began to decline in 1998 through 2006.\textsuperscript{31,32}

From 1999 to 2006, stroke mortality declined for non-Hispanic blacks, non-Hispanic whites, Asians, Hispanics, and American Indians, both male and female.\textsuperscript{36}

* The comparability ratio 1.0502 was applied to the deaths and rates reported in vital statistics for 1979–1998.

* Non-Hispanic.
Cerebrovascular Diseases (Stroke)

Chart 3–57

<table>
<thead>
<tr>
<th>Years</th>
<th>Total Population</th>
<th>Black* Male</th>
<th>White Male</th>
<th>Black* Female</th>
<th>White Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960–1967</td>
<td>-1.4</td>
<td>-1.0</td>
<td>-1.1</td>
<td>-2.1</td>
<td>-1.6</td>
</tr>
<tr>
<td>1968–1978</td>
<td>-4.2</td>
<td>-4.4</td>
<td>-4.2</td>
<td>-5.0</td>
<td>-4.1</td>
</tr>
<tr>
<td>1989–1998</td>
<td>-0.9</td>
<td>-1.6</td>
<td>-1.1</td>
<td>-1.7</td>
<td>-0.7</td>
</tr>
<tr>
<td>1999–2006</td>
<td>-4.9</td>
<td>-4.2</td>
<td>-5.4</td>
<td>-4.1</td>
<td>-4.9</td>
</tr>
</tbody>
</table>

* Nonwhite from 1960 to 1967.

The steep average annual declines in stroke mortality that occurred in males and females, and in blacks and whites, from 1968 to 1989 were followed by modest reductions for several years. Appreciable annual declines—almost 5% overall—resumed in 1999 through 2006.31,32

In 2006, stroke mortality was about the same in males and females. By race/ethnicity, death rates were highest in non-Hispanic blacks and lowest in American Indians.36

Chart 3–58
Age-Adjusted Death Rates for Stroke by Race/Ethnicity and Sex, U.S., 2006

Deaths/100,000 Population

* Non-Hispanic.
Cerebrovascular Diseases (Stroke)

In 2006, stroke mortality in males increased with age from 45–54 to 75–84 years for non-Hispanic blacks, non-Hispanic whites, Hispanics, American Indians, and Asians.36

Chart 3–59
Death Rates for Stroke in Males
by Age and Race/Ethnicity, U.S., 2006

In 2006, stroke mortality in females increased with age from 45–54 to 75–84 years for non-Hispanic blacks, non-Hispanic whites, Hispanics, American Indians, and Asians.36

Chart 3–60
Death Rates for Stroke in Females
by Age and Race/Ethnicity, U.S., 2006

* Non-Hispanic.
† Data unreliable for American Indian females aged 45–54 years.
In 2003–2005, stroke mortality was highest in many of the Southeastern states, most of which comprise “the stroke belt.”\textsuperscript{15}

In 2006–2007, among 16 industrialized countries, the United States ranked 11th highest in stroke mortality in males and 10th in females. Eastern European countries had markedly higher death rates for stroke compared with other countries.\textsuperscript{45}

* Age adjusted to European standard.

\textsuperscript{1} Data for 2006.
Cerebrovascular Diseases (Stroke)

From 1999 to 2005–2007, among 13 industrialized countries, 11 had a steeper average annual decline in stroke mortality in males than the United States.45

From 1999 to 2007, when compared with the United States, 9 of the 13 countries shown had steeper average annual declines in stroke mortality in females.45

* Age adjusted to European standard.
† Data for years indicated in parentheses.
‡ Based on a log linear regression of the actual rates.

Chart 3–63
Change in Age-Adjusted Death Rates* for Stroke in Males by Country, Ages 35–74, 1999–2007†

Chart 3–64
Change in Age-Adjusted Death Rates* for Stroke in Females by Country, Ages 35–74, 1999–2007†
In 1999–2006, the prevalence of hypertension was appreciably higher in non-Hispanic blacks than in non-Hispanic whites or Mexican-Americans aged 20–74 years. Within racial groups, the prevalence of hypertension was similar in males and females.17

Chart 3–65

In 1999–2006, the prevalence of hypertension was 40% among those aged 50–59 years and 73% among those aged 80 years and older. These percentages are considerably higher when prehypertension is included.17

Chart 3–66

In 1999–2006, the prevalence of hypertension was appreciably higher in non-Hispanic blacks than in non-Hispanic whites or Mexican-Americans aged 20–74 years. Within racial groups, the prevalence of hypertension was similar in males and females.17

* Hypertension is defined as systolic BP ≥140 mmHg, or diastolic BP ≥90, or on medication.
† Prehypertension is defined as systolic BP 120–139 mmHg or diastolic BP 80–89.
Hypertension


In 2003–2006, 93% of persons with a high level of hypertension (160/95+ mmHg) were aware of their condition, compared with 51% in 1971–1972. The percent of hypertensive persons treated and controlled increased from 16% in 1971–1972 to 79% in 2003–2006.17
Hypertension/Diseases of the Arteries

Chart 3–69

In 2003–2006, for hypertension of 140/90+ mmHg, 78% of hypertensive persons were aware of their condition; 67% were on treatment for it; and 45% had it controlled. These percentages are appreciably greater than the comparable figures (51%, 31%, and 10%, respectively) for 1976–1980.17

* Hypertension is defined as systolic BP ≥140 mmHg, or diastolic BP ≥90 mmHg, or on medication.

Chart 3–70
Age-Adjusted Death Rates for Diseases of the Arteries by Race and Sex, U.S., 2006

In 2006, death rates for diseases of the arteries within sex groups were higher in blacks than in whites. Overall, death rates were higher in males than in females.31
Diseases of the Arteries/Congenital Malformations of the Circulatory System

In 2006, death rates for diseases of the arteries within racial groups were higher in males than in females at all ages. Rates were higher in black males and females than in white males and females, respectively, except for those aged 75–84 years, where white males had a higher rate than black males.35

The percentage of deaths from congenital malformations of the circulatory system for infants aged less than 1 year declined from 82% in 1940 to 46% in 2006.31, 32
Infant congenital heart disease mortality declined from 1970 to 2006 in blacks and in whites. Mortality from other congenital malformations of the circulatory system did not decline until the mid-1980s in blacks and whites and continued through 2003 in blacks. In whites, the rates were stable during the 2000s.\textsuperscript{31,32}
4. Lung Diseases

The term lung diseases is used here to mean:

- Acute lower respiratory infections
- Chronic lower respiratory diseases
- Lung diseases due to external agents
- Adult respiratory distress syndrome
- Pulmonary edema
- Interstitial lung diseases
- Cardiopulmonary diseases
- Selected HIV-related and other pulmonary infections
- Neonatal pulmonary diseases

Chart 4–1 shows the distribution of deaths in 2006 by major lung subgroups. For lung diseases (excluding lung cancer), Chart 4–2 shows, according to ICD-9-CM codes, the estimated number of physician office visits, the estimated number of hospitalizations, and the average length of hospital stay in 2006 and according to ICD-10 codes, the estimated number of deaths in 2006. Subsequent charts display morbidity and mortality for total lung diseases and specific subgroups: COPD, asthma, neonatal respiratory distress syndrome (RDS), and sudden infant death syndrome (SIDS).

Chronic Obstructive Pulmonary Disease

The term COPD is used here to include chronic bronchitis and emphysema. It has been defined recently as “the physiologic finding of nonreversible pulmonary function impairment.”

COPD prevalence charts in this Chart Book are based on physician-diagnosed COPD. Prevalence is determined from annual COPD data, which are obtained from NHIS, of self-reports of lifetime prevalence. In 2007, an estimated 12 million individuals were identified with COPD. Additionally, based on spirometry readings of lung function in the 1988–1994 NHANES, COPD was estimated to go undiagnosed in 12 million people.

Asthma

Three different prevalence estimates derived from NHIS data are found in this chapter. Before 1997, prevalence was based on NHIS estimates of individuals who had or knew someone in the family who had asthma during the past 12 months. Beginning in 1997, “attack prevalence” was introduced to limit the count to individuals who responded yes to the following questions:

- Have you ever been told by a doctor or other health professional that you have asthma?
- During the past 12 months, have you had an episode of asthma or asthma attack?

As a result, the estimates from 1997 to 2007 are not comparable to those based on NHIS data prior to 1997. Charts 4–18 and 4–19 indicate this change by breaking the asthma prevalence trend line between 1996 and 1997.

In 2001, a question was added to the survey to determine “current prevalence” or simply, prevalence. “Do you still have it?” is the question asked of those who have been told by a doctor or other health professional that they have asthma. Current prevalence is based on individuals who respond yes to that question. (See Charts 4–18 to 4–21.)

Chart 4–1
Deaths From Lung Diseases, Percent by Subgroup, U.S., 2006

Total Deaths = 225,028 (100%)
# Lung Diseases

## Chart 4–2

**Number of Hospitalizations, Physician Office Visits,* and Deaths for Lung Diseases,† U.S., 2006**

<table>
<thead>
<tr>
<th>Diagnostic Category</th>
<th>ICD-9-CM Codes</th>
<th>Hospitalizations</th>
<th>Physician Office Visits</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First-Listed Discharges (1,000)</td>
<td>Length of Stay (Days)</td>
<td>(1,000)</td>
<td>ICD-10 Codes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,376</td>
<td>5.3</td>
<td>35,323</td>
<td>225,028</td>
</tr>
<tr>
<td>Acute lower respiratory infections:</td>
<td>1,487</td>
<td>4.8</td>
<td>6,988</td>
<td>J00–J18, J20, J21</td>
</tr>
<tr>
<td>Influenza and pneumonia</td>
<td>1,270</td>
<td>5.0</td>
<td>4,030</td>
<td>J00–J18</td>
</tr>
<tr>
<td>Acute bronchitis</td>
<td>217</td>
<td>3.2</td>
<td>2,959</td>
<td>J00</td>
</tr>
<tr>
<td>Acute bronchiolitis</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Chronic lower respiratory disease:</td>
<td>1,125</td>
<td>4.0</td>
<td>26,939</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>COPD:</td>
<td>670</td>
<td>4.4</td>
<td>16,343</td>
<td>J00–J26, J30–J39</td>
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<tr>
<td>Chronic bronchitis</td>
<td>537</td>
<td>4.6</td>
<td>9,856</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Emphysema</td>
<td>19</td>
<td>4.4</td>
<td>324</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Other COPD</td>
<td>105</td>
<td>3.1</td>
<td>6,081</td>
<td>J00–J26, J30–J39</td>
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<td>Bronchiectasis</td>
<td>9</td>
<td>6.2</td>
<td>82</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Asthma</td>
<td>444</td>
<td>3.2</td>
<td>10,590</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Status asthmaticus</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>11</td>
<td>9.5</td>
<td>6</td>
<td>E84</td>
</tr>
<tr>
<td>Lung disease due to external agents</td>
<td>180</td>
<td>7.5</td>
<td>47</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Adult respiratory distress syndrome</td>
<td>7</td>
<td>10.3</td>
<td>—</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Interstitial lung diseases:</td>
<td>356</td>
<td>8.8</td>
<td>1,309</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>8</td>
<td>6.4</td>
<td>435</td>
<td>D06</td>
</tr>
<tr>
<td>Respiratory tuberculosis</td>
<td>8</td>
<td>7.0</td>
<td>49</td>
<td>A15, A16, A19, A31.0</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>340</td>
<td>8.9</td>
<td>663</td>
<td>J00–J26, J30–J39</td>
</tr>
<tr>
<td>Pulmonary manifestations of connective tissue disorders</td>
<td>163</td>
<td>—</td>
<td>163</td>
<td>J09, M31.0, M31.3</td>
</tr>
<tr>
<td>Cardiopulmonary diseases:</td>
<td>160</td>
<td>5.7</td>
<td>264</td>
<td>I26, I27</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>145</td>
<td>5.6</td>
<td>128</td>
<td>I26</td>
</tr>
<tr>
<td>Other pulmonary heart disease</td>
<td>15</td>
<td>6.5</td>
<td>136</td>
<td>I27</td>
</tr>
<tr>
<td>Selected HIV-related and other pulmonary infections</td>
<td>114–116, 117.3, 117.5, 117.7, 136.3</td>
<td>—</td>
<td>76</td>
<td>B38–40, B44–46, B59</td>
</tr>
<tr>
<td>Neonatal pulmonary disorders:</td>
<td>61</td>
<td>15.5</td>
<td>—</td>
<td>P22, P25–P28, Q33, R03</td>
</tr>
<tr>
<td>Respiratory distress syndrome</td>
<td>19</td>
<td>29.1</td>
<td>—</td>
<td>P22</td>
</tr>
<tr>
<td>Sudden infant death syndrome</td>
<td>1</td>
<td>4.1</td>
<td>—</td>
<td>Q33</td>
</tr>
<tr>
<td>Congenital malformation of the lung</td>
<td>1</td>
<td>4.1</td>
<td>—</td>
<td>Q33</td>
</tr>
<tr>
<td>Bronchopulmonary dysplasia</td>
<td>1</td>
<td>4.1</td>
<td>—</td>
<td>Q33</td>
</tr>
<tr>
<td>Atelecstasis of newborn</td>
<td>1</td>
<td>4.1</td>
<td>—</td>
<td>P28.0, P28.1</td>
</tr>
<tr>
<td>Other perinatal respiratory diseases</td>
<td>27</td>
<td>7.6</td>
<td>—</td>
<td>P25, P26, P27.0, P27.8, P27.9, P28.2–P28.9</td>
</tr>
</tbody>
</table>

* Estimates of hospitalizations and physician office visits are subject to sampling variability. Estimates of hospitalizations at 10,000 or below have a relative standard error of more than 18%. Estimates of physician office visits below 1 million have a relative standard error of more than 30%.

† Does not include lung cancer.
Lung Diseases

In 2006, total lung disease mortality was one-third higher in males than in females. Within sex groups, it was slightly higher in black males than in white males but was lower in black females than in white females.35

In 2006, the male–female gap in mortality from total lung diseases mostly increased with increasing age for both blacks and whites.35
Chronic Obstructive Pulmonary Disease

From 1997 through 2007, the prevalence of physician-diagnosed COPD decreased slightly for all age groups.24

In 2007, within racial groups, the prevalence of COPD was higher in females than in males, with one exception: In those aged 65 years and older, the prevalence was similar in males and females. Differences were observed between races: In males aged 45–64 years and in both males and females aged 65 years and older, the prevalence of COPD was higher in whites than in blacks.24
Chronic Obstructive Pulmonary Disease

Chart 4–7

Hospitalization rates for COPD were stable for those aged 45–64 years from 1995 to 2006 and for those aged 65 years and older from 2000 through 2006. \(^{33, 34}\)

Chart 4–8

From 1960 to 1990, COPD mortality increased in white and black males, followed by a gradual turnaround and then a steep decline beginning in 1999. COPD mortality increased in white and black females until 1999 and then stabilized through 2006. The gaps between whites and blacks within sex groups continued throughout the period. \(^{15, 32, 36, 46}\)

* Nonwhite from 1960 to 1967.
From 1999 to 2006, COPD mortality in males declined slightly in all racial/ethnic groups. In females, it declined slightly in Asians and Hispanics but was stable in non-Hispanic whites and non-Hispanic blacks. Within sex groups, COPD mortality was highest in whites.36

In white males, the 1960–2006 death rates for COPD changed from an increasing to a declining trend. In successive age groups, the change occurred later but was increasingly prominent.15, 32, 36, 46
Chronic Obstructive Pulmonary Disease

Chart 4–11

Deaths/100,000 Population

In black males, the 1960–2006 death rates for COPD changed from an increasing to a declining trend. In successive age groups, the change occurred later but was increasingly prominent.\textsuperscript{15, 32, 36, 46}

* Nonwhite from 1960 to 1967.

Chart 4–12

Deaths/100,000 Population

From 1960 to 1990, death rates for COPD increased in all age groups of white females. Rates stabilized among those aged 55–64 years in the 1990s and among those aged 65 years and older in the 2000s.\textsuperscript{15, 32, 36, 46}
Chronic Obstructive Pulmonary Disease

From 1960 to 1990, death rates for COPD increased in black females of all age groups; however, rates before 1980 for those aged 85 years and older were too erratic to discern a trend. Rates stabilized among those aged 55–64 years in the 1990s and among those aged 65 years and older in the 2000s.\textsuperscript{15, 32, 36, 46}

In 2003–2005, death rates for COPD tended to be highest in the Mountain States.\textsuperscript{15}
Chronic Obstructive Pulmonary Disease

Chart 4–15
Age-Adjusted Death Rates* for Chronic Obstructive Pulmonary Disease by Country and Sex, Ages 35–74, 2007

In 2006–2007, among 16 industrialized countries, the United States ranked second highest in COPD mortality for both males and females.45

Chart 4–16
Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by Race/Ethnicity and Sex, U.S., 2006

In 2006, COPD mortality was 35% higher in males than in females. Within sex groups, it was highest among non-Hispanic whites and lowest among Asians. COPD mortality in Hispanic males was similar to that of Asian males.35

* Age-adjusted to European standard.
† Data for 2006.

* Non-Hispanic.
Chronic Obstructive Pulmonary Disease/Asthma

In 2006, COPD mortality increased with age for all racial and sex groups. Within age groups was highest in white males aged 65 years and older and lowest in black females aged 45 years and older.35

The prevalence of asthma during a given 12-month period (for 1980–1996) and the lifetime prevalence of asthma (for 1997–2007) rose in both age groups, while trends in asthma attack prevalence (for 1997–2006) and current prevalence (for 2001–2007) were relatively stable. All prevalence measures were higher in the younger group than in the older group.26–28
Asthma

The prevalence of asthma during a given 12-month period (for 1980–1996) and lifetime prevalence of asthma (for 1997–2007) rose in black and whites, but asthma attack prevalence (for 1997–2006) and current prevalence (for 2001–2007) were more stable. Measures of prevalence were generally higher in blacks than in whites.26–28

In 2006, among children younger than 18 years of age, the prevalence of current asthma was higher in males than in females. Within sex groups, the prevalence of current asthma was higher in non-Hispanic blacks than in non-Hispanic whites and Hispanics.26–28
Asthma

In 2006, among adults aged 18 years and older, the prevalence of current asthma was higher in females than in males. Within sex groups, the prevalence of current asthma was higher in non-Hispanic blacks and non-Hispanic whites than in Hispanics.26–28

From 1990 to 2006, the number of physician office visits for asthma was erratic with no obvious trend.44
Asthma

From 1980 to 2006, the number of hospitalizations with asthma as the primary diagnosis remained relatively stable. However, the number of hospitalizations with asthma as a secondary diagnosis increased significantly.\textsuperscript{33, 34}

From 1980 to 2006, hospitalization rates for asthma were lowest among those aged 15–44 years. From 1991 to 2004, hospitalization rates for asthma were highest among those aged younger than 15 years.\textsuperscript{33, 34}
Asthma

In 2006, asthma mortality in males was 2–3.5 times higher in non-Hispanic blacks than in all other racial/ethnic groups. In females, asthma mortality was more than 2 times higher in non-Hispanic blacks than in all other racial/ethnic groups. Overall, asthma mortality was 44% higher in females than in males.31

From 1980 through 1998, death rates for asthma, although erratic, tended to rise in black and white males and females aged 1–24 years. From 2001 to 2006, asthma mortality continued to fluctuate in black males and females but was stable in white males and females.15, 35
Asthma

Chart 4–27

From 1980 to the mid-1990s, death rates for asthma rose in blacks and whites, both male and female, but then declined through 2006. Within sex groups, blacks had higher asthma mortality rates than whites.\textsuperscript{15, 35}

Chart 4–28
Death Rates for Asthma by Age, Race, and Sex, U.S., 1999–2006

In 1999–2006, among blacks, asthma mortality was higher in males than in females aged 1–34 years, but was higher in females than in males aged 35–84 years. Among whites, asthma mortality was slightly higher in males than in females aged 1–24 years, but was higher in females than in males aged 25–84 years.\textsuperscript{15}
Asthma/ Neonatal Respiratory Distress Syndrome

In 2006–2007, among 15 countries, the United States ranked ninth for males and fourth for females for asthma mortality.45

Infant mortality for RDS declined steeply from 1974 to 1981, followed by a slow but appreciable decline through 2006.31, 32

* Age-adjusted to European standard.
† Data for 2006.
Neonatal Respiratory Distress Syndrome

From 1980 to 2006, infant mortality for RDS decreased appreciably in blacks and whites, with rates remaining higher in blacks.31, 32

Chart 4–31

In 2005, infant mortality for neonatal RDS was much higher in blacks than in any other racial/ethnic group. Mortality for neonatal RDS in Mexican Americans was the lowest among all racial/ethnic groups.47

* No data for American Indians and Puerto Ricans.
† Non-Hispanic.
In 2005, mortality for SIDS was highest in American Indians and lowest in Asian Pacific Islanders.\(^{48}\)
5. Blood Diseases

The term blood diseases is used here to mean diseases within the diagnostic categories listed in Diseases of the Blood and Blood-Forming Organs and Certain Disorders Involving the Immune Mechanism of the ICD-10; hemochromatosis is also included in this chapter. Blood-clotting diseases, most of which are subsumed under CVD, have been excluded, as have other blood diseases such as bleeding and red blood disorders of the newborn and serum hepatitis.

Chart 5–1 shows the distribution of deaths in 2006 by blood disease subgroups.35 For blood diseases, Chart 5–2 shows according to ICD-9-CM codes, the number of physician office visits, the number of hospitalizations, and length of hospital stay in 2006, and according to ICD-10 codes, the number of deaths in 2006.34, 35, 44

Subsequent charts display morbidity and mortality for aplastic anemia and sickle cell anemia. The annual death rates for these diseases are small and may vary considerably from year to year. By using combined mortality over 4 to 5 years to obtain average annual death rates rather than statistics for a single year, it is possible to improve data reliability for race and sex comparisons.

Chart 5–1
Blood Disease Deaths,
Percent by Subgroup, U.S., 2006

Aplastic Anemia
10.0%
Sickle Cell Anemia
5.2%
Other Diseases of Blood and Blood-Forming Organs
20.4%
Hemochromatosis
2.4%
Diseases of White Blood Cells
4.9%
Purpura and Other Hemorrhagic Conditions
9.1%
Coagulation Defects
19.1%
Other Anemias
29.0%
Total Deaths = 9,050 (100%)
## Blood Diseases

**Chart 5–2**

Number of Hospitalizations, Physician Office Visits,* and Deaths for Blood Diseases, U.S., 2006

<table>
<thead>
<tr>
<th>Diagnostic Category</th>
<th>ICD-9-CM Codes</th>
<th>First-Listed Discharges (1,000)</th>
<th>Length of Stay (Days)</th>
<th>Physician Office Visits (1,000)</th>
<th>ICD-10 Codes</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>280–289, 275</td>
<td>465</td>
<td>4.3</td>
<td>5,503</td>
<td>D50–D89, E83.1</td>
<td>9,050</td>
</tr>
<tr>
<td>Anemias</td>
<td>280–285</td>
<td>312</td>
<td>4.0</td>
<td>3,855</td>
<td>D50–D64</td>
<td>3,396</td>
</tr>
<tr>
<td>Iron deficiency anemia</td>
<td>280</td>
<td>94</td>
<td>3.5</td>
<td>451</td>
<td>D50</td>
<td>161</td>
</tr>
<tr>
<td>Other deficiency anemia</td>
<td>281</td>
<td>—</td>
<td>—</td>
<td>382</td>
<td>D51, D52</td>
<td>53</td>
</tr>
<tr>
<td>Cooley's anemia</td>
<td>282.4</td>
<td>9</td>
<td>3.9</td>
<td>7</td>
<td>D56</td>
<td>21</td>
</tr>
<tr>
<td>Sickle cell anemia</td>
<td>282.6</td>
<td>57</td>
<td>4.9</td>
<td>104</td>
<td>D57.0, D57.1</td>
<td>473</td>
</tr>
<tr>
<td>Aplastic anemia</td>
<td>284</td>
<td>28</td>
<td>5.9</td>
<td>247</td>
<td>D60, D61</td>
<td>901</td>
</tr>
<tr>
<td>Other and unspecified anemias</td>
<td>Residual</td>
<td>124</td>
<td>3.6</td>
<td>2,663</td>
<td>Residual</td>
<td>2,387</td>
</tr>
<tr>
<td>Coagulation defects</td>
<td>286</td>
<td>13</td>
<td>5.2</td>
<td>113</td>
<td>D65–D68</td>
<td>1,725</td>
</tr>
<tr>
<td>Hemophilia: Factor VIII</td>
<td>286.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>D66</td>
<td>59</td>
</tr>
<tr>
<td>Hemophilia: Factor IX</td>
<td>286.1</td>
<td>—</td>
<td>—</td>
<td>13</td>
<td>D67</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>Residual</td>
<td>13</td>
<td>5.2</td>
<td>100</td>
<td>Residual</td>
<td>1,706</td>
</tr>
<tr>
<td>Purpura and other hemorrhagic conditions</td>
<td>287</td>
<td>35</td>
<td>5.0</td>
<td>490</td>
<td>D69</td>
<td>822</td>
</tr>
<tr>
<td>Primary thrombocytopenia</td>
<td>287.3</td>
<td>15</td>
<td>4.7</td>
<td>133</td>
<td>D69.3, D69.4</td>
<td>326</td>
</tr>
<tr>
<td>Unspecified thrombocytopenia</td>
<td>287.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>D69.5, D69.6</td>
<td>457</td>
</tr>
<tr>
<td>Other</td>
<td>Residual</td>
<td>20</td>
<td>5.3</td>
<td>357</td>
<td>Residual</td>
<td>39</td>
</tr>
<tr>
<td>Diseases of white blood cells</td>
<td>288</td>
<td>66</td>
<td>5.0</td>
<td>253</td>
<td>D70–D72</td>
<td>447</td>
</tr>
<tr>
<td>Other diseases of blood and blood-forming organs</td>
<td>289</td>
<td>22</td>
<td>4.0</td>
<td>378</td>
<td>D73–D89</td>
<td>1,844</td>
</tr>
<tr>
<td>Hemochromatosis</td>
<td>275</td>
<td>17</td>
<td>4.6</td>
<td>414</td>
<td>E83.1</td>
<td>216</td>
</tr>
</tbody>
</table>

* Estimates of hospitalizations and physician office visits are subject to sampling variability. Estimates of hospitalizations below 15,000 have a relative standard error of more than 16%. Estimates of physician office visits below 1 million have a relative standard error of more than 30%.
Aplastic Anemia

Chart 5–3
Hospitalizations for Aplastic Anemia by Primary and Secondary Diagnosis, U.S., 1982–2006

In 2006, the number of hospitalizations for aplastic anemia as a primary diagnosis was 56% higher than it was in 1990; as a secondary diagnosis it was 100% higher in 2006 than in 1990.33,34

Chart 5–4

In 2003–2006, mortality from aplastic anemia within sex groups was slightly higher in blacks than in whites. Overall, it was approximately 20% higher in males than in females.15

* Average annual rates.
In 2003–2006, mortality from aplastic anemia within sex groups was slightly higher in blacks than in whites, except those in the 75–84 age group. Within racial groups, it was higher in males than in females for blacks at all ages and for white males aged 65 years and older.15

Hospitalization rates for sickle cell anemia in blacks varied considerably between 1982 and 2006. Overall, however, hospitalization rates increased for both age groups, with rates in the 15–44 age group remaining higher than those in the younger than 15 age group.33, 34
Sickle Cell Anemia

From 1980–1984 to 1990–1994, sickle cell anemia mortality rose for black males and females. Since then, death rates have stabilized for black women, but declined for black males through 1999–2002 before stabilizing through 2003–2006.\textsuperscript{15}

In 2003–2006, sickle cell anemia mortality was somewhat similar in males and females at all ages. Death rates were relatively high for individuals aged 25–64 years.\textsuperscript{15}
Appendixes

A. International Classification of Diseases
B. Estimated Comparability Ratios
C. Definition of Terms
D. Abbreviations
E. References
Appendix A

International Classification of Diseases: Codes for Selected Diagnostic Categories (6th, 7th, 8th, 9th, and 10th Revisions)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary heart diseasel(^b)</td>
<td>420, 422</td>
<td>420, 422</td>
<td>410–413</td>
<td>410–414, 429.2</td>
<td>I20–I25</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>*</td>
<td>*</td>
<td>410</td>
<td>411</td>
<td>I21, I22</td>
</tr>
<tr>
<td>Heart failurec(^c)</td>
<td>†</td>
<td>†</td>
<td>427.0, 427.1</td>
<td>428</td>
<td>I50</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>†</td>
<td>†</td>
<td>427.0</td>
<td>428</td>
<td>I50.1</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>†</td>
<td>†</td>
<td>†</td>
<td>425</td>
<td>I42</td>
</tr>
<tr>
<td>Congenital anomalies of the circulatory system(^e)</td>
<td>†</td>
<td>†</td>
<td>746–747</td>
<td>745–747</td>
<td>Q20–Q28</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease(^f)</td>
<td>500–502, 527.1</td>
<td>500–502, 527.1</td>
<td>490–492, 519.3</td>
<td>490–492, 494–496</td>
<td>J40–J44, J47</td>
</tr>
<tr>
<td>Asthma(^g)</td>
<td>241</td>
<td>241</td>
<td>493</td>
<td>493</td>
<td>J45, J46</td>
</tr>
<tr>
<td>Neonatal respiratory distress syndrome(^h)</td>
<td>†</td>
<td>†</td>
<td>776.1, 776.2</td>
<td>769</td>
<td>P22</td>
</tr>
<tr>
<td>Sudden infant death syndrome</td>
<td>†</td>
<td>†</td>
<td>†</td>
<td>†</td>
<td>R95</td>
</tr>
</tbody>
</table>

\(^a\) The ICD term is diseases of the circulatory system.
\(^b\) The ICD-6 and ICD-7 term is arteriosclerotic heart disease; the ICDA-8, ICD-9, and ICD-10 term is ischemic heart disease.
\(^c\) The ICDA-8 terms are congestive heart failure and left ventricular failure. The ICD-9 and ICD-10 term is heart failure.
\(^d\) The ICD-6 and ICD-7 term is vascular diseases affecting the central nervous system; the ICDA-8, ICD-9, and ICD-10 term is cerebrovascular disease.
\(^e\) The ICDA-8 terms are congenital anomalies of heart and other congenital anomalies of circulatory system. The ICD-9 terms are bulbus cordis anomalies and anomalies of cardiac septal closure, other congenital anomalies of heart, and other congenital anomalies of circulatory system. The ICD-10 term is congenital malformations of the cardiovascular system.
\(^f\) The ICD-6 and ICD-7 terms are chronic bronchitis, unqualified bronchitis, and emphysema without mention of bronchitis; the ICDA-8 terms are chronic bronchitis, unqualified bronchitis, emphysema, and chronic obstructive lung disease; the ICD-9 and ICD-10 terms are chronic bronchitis, bronchitis not specified as acute or chronic, emphysema, bronchiectasis, extrinsic allergic alveolitis, and chronic airways obstruction not elsewhere classified.
\(^g\) The ICD-6 through ICD-9 term is asthma; the ICD-10 terms are asthma and status asthmaticus.
\(^h\) The ICDA-8 terms are hyaline membrane disease and respiratory distress syndrome. The ICD-9 term is respiratory distress syndrome. The ICD-10 is respiratory distress of newborns.

* No code for this category exists in this ICD revision.
† No data for this category are presented in the Chart Book in this period.
# Appendix B

## Estimated Comparability Ratios for Selected Causes of Death, U.S.

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Codes of the Classification of International Diseases</th>
<th>Number of Deaths*</th>
<th>Comparability Ratio†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major cardiovascular diseases</td>
<td>I00–I78, 390–434, 436–448</td>
<td>942,439</td>
<td>945,945</td>
</tr>
<tr>
<td>Diseases of the heart</td>
<td>I00–I09, I11, I13, 120–I51, 390–398, 402, 404, 410–429</td>
<td>719,631</td>
<td>730,444</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>I20–I25, 410–414, 429.2</td>
<td>543,063</td>
<td>542,728</td>
</tr>
<tr>
<td>Heart failure</td>
<td>I50, 428</td>
<td>48,876</td>
<td>47,052</td>
</tr>
<tr>
<td>Cerebrovascular Disease (stroke)</td>
<td>I60–I69, 430–434, 436–438</td>
<td>166,837</td>
<td>158,855</td>
</tr>
<tr>
<td>COPD</td>
<td>J40–J44, 490–492, 494, 496</td>
<td>104,775</td>
<td>99,797</td>
</tr>
<tr>
<td>Asthma</td>
<td>J45–J46, 493</td>
<td>4,971</td>
<td>5,614</td>
</tr>
<tr>
<td>Neonatal RDS‡</td>
<td>P22, 769</td>
<td>2,904</td>
<td>3,144</td>
</tr>
</tbody>
</table>

* From a sample of deaths in 1996.

† Deaths coded to ICD-10 divided by deaths coded to ICD-9.

‡ Infant deaths.
Appendix C

Definition of Terms

Age-adjusted death rate: An age-adjusted rate is a summary rate for a given age range and is computed by multiplying the age-specific rates for a given diagnosis (or cause of death) by the standard population for the age range and summing those products. The standard population is the U.S. population in 2000 as it is distributed proportionately in 10-year age groups.10

Any mention mortality: A count of death certificates for a given cause of death that was selected as either the underlying cause or otherwise mentioned on the death certificate.36

Chronic condition: A condition is considered chronic if (1) the respondent (in a health interview) indicates the condition was first noticed more than 3 months before the initial date of the interview or (2) the type of condition ordinarily has a duration of more than 3 months.37

Comparability ratio: A comparability ratio is the number of deaths from a cause as coded by an ICD revision divided by the number of deaths from the closest similar cause as coded by the proceeding ICD revision. A sample of death certificates from a chosen year is used for the calculation. The ratios measure discontinuities in mortality trends that result from the introduction of a new ICD revision.8

Hospitalization: Hospitalization refers to hospital discharge—that is, the formal release of a hospital inpatient. Hospital discharge may be the result of death or transfer to a place of residence, nursing home, or another hospital. First-listed diagnosis is the coded diagnosis identified as the primary diagnosis or the diagnosis first listed on the face sheet of the hospital medical record. Hospital refers to non-Federal, short-stay (average length of patient’s stay is less than 30 days), general (e.g., medical or surgical), or children’s general hospitals, with six or more beds for inpatient use.37

Incidence: Incidence is the number of cases with onset during a specified period of time, usually a year.37

Infant mortality rate: Infant mortality is the number of deaths occurring in infants younger than 1 year of age from a cause (or all causes) divided by the number of live births occurring the same year, and then expressed as the rate per 100,000 live births for that year.37

Limited in activity: Also called chronic activity limitation, it refers to the limitation of a person’s usual activity due to a chronic condition.37

Morbidity: Morbidity refers to incidence, prevalence, hospitalizations, and physician office visits.
## Appendix C

### Definition of Terms (continued)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>The prevalence of a condition is the number of persons who have the condition at a given time.</td>
</tr>
<tr>
<td>Relative standard error</td>
<td>The standard error is primarily a measure of sampling error—not measurement error—that is, the variation that might occur by chance because only a sample of the population is surveyed. The relative standard error of an estimate is obtained by dividing the standard error of the estimate by the actual estimate.</td>
</tr>
<tr>
<td>Underlying cause of death</td>
<td>The underlying cause of death is the disease or injury that initiated the events leading directly to death. Underlying cause of death is selected from the cause(s) or condition(s) entered in the cause-of-death section of the death certificate. When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and rules of associated classifications.</td>
</tr>
</tbody>
</table>
Appendix D

Abbreviations*

AMI         acute myocardial infarction
BP          blood pressure
CHD         coronary heart disease
CM          clinical modification
CMS         Centers for Medicare & Medicaid Services
COPD        chronic obstructive pulmonary disease
CVD         cardiovascular diseases
HF          heart failure
ICD         International Classification of Diseases
NCHS        National Center for Health Services
NHANES      National Health and Nutrition Examination Survey
NHDS        National Hospital Discharge Survey
NHIS        National Health Interview Survey
NHLBI       National Heart, Lung, and Blood Institute
RDS         respiratory distress syndrome
SIDS        sudden infant death syndrome
WHO         World Health Organization

* Country abbreviations are listed on the next page.
# Appendix D

## Abbreviations (continued)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZR</td>
<td>Czech Republic</td>
</tr>
<tr>
<td>DEN</td>
<td>Denmark</td>
</tr>
<tr>
<td>EW</td>
<td>England/Wales</td>
</tr>
<tr>
<td>FIN</td>
<td>Finland</td>
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Appendix E

References


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Appendix E

References (continued)


22. National Heart, Lung, and Blood Institute. Extrapolation to the U.S. population from unpublished data received in 2007 from the Atherosclerosis Risk in Communities Study (Surveillance) and the Cardiovascular Health Survey.
Appendix E

References (continued)


Appendix E

References (continued)


Appendix E

References (continued)


Discrimination Prohibited:

Under provisions of applicable public laws enacted by Congress since 1964, no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity (or, on the basis of sex, with respect to any education program or activity) receiving Federal financial assistance. In addition, Executive Order 11141 prohibits discrimination on the basis of age by contractors and subcontractors in the performance of Federal contracts, and Executive Order 11246 states that no federally funded contractor may discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. Therefore, the Heart, Lung, and Blood Institute must be operated in compliance with these laws and Executive Orders.

The bar graph on the front cover depicts the four leading causes of death in 2006: HEART DISEASE, cancer, STROKE, and COPD AND ALLIED CONDITIONS.