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MORBIDITY &
MORTALITY:
2009 CHART BOOK
ON CARDIOVASCULAR,
LUNG, AND BLOOD
DISEASES



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OCTOBER 2009
FOR ADMINISTRATIVE USE
NATIONAL INSTITUTES
OF HEALTH
National Heart, Lung,
and Blood Institute

Foreword

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 Institutes 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*.

[Signed]
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.

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.⁴

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 1987.⁵ For this reason, charts display a break in the trend lines for hospitalization rates between the transitional years 1987–1988.

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.

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.⁶

Beginning in 1989, the U.S. Standard Certificate of Death was revised. One reason was to improve the medical certification of cause of death.⁷ 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-9.⁸

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.^{9–11} The European standard population is applied for age adjustment of international mortality statistics.¹²

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.¹³ 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.^{17–21} It should be noted that individuals with multiple CVD are counted for each condition that applies to them.

CVD	81,100,000
Hypertension	74,500,000
CHD	17,600,000
Acute Myocardial Infarction (AMI)	8,500,000
Angina Pectoris	10,200,000
Stroke	6,400,000
Heart Failure	5,800,000
Congenital Heart Defects	1,000,000
Atrial Fibrillation	2,200,000
Peripheral Arterial Disease	8,000,000

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

Heart Attack	1,255,000
First Event	785,000
Recurrent Event	470,000
Stroke	795,000
First Event	610,000
Recurrent Event	185,000
Heart Failure	670,000
First Event	670,000

Lung Diseases

An estimated 24 million U.S. adults have COPD: 12 million physician-diagnosed and 12 undiagnosed.^{24–25} An estimated 23 million individuals have asthma and 12 million of them experienced at least one asthma attack during the survey year.^{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 *COPD and allied conditions*. The ICD-10 term is *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.

Chart 2–1

Total Population by Mean Age, Percent Age 65 and Older, Race/Ethnicity, and Sex, U.S., 2007

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

	Total Population			Male			Female		
	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65
Total	301.6	36.8	12.6	148.6	35.6	10.8	153.0	38.0	14.3
White	241.2	38.4	13.7	119.5	37.2	11.7	121.6	39.6	15.6
Hispanic	(42.1)	(28.6)	(5.6)	(21.8)	(29.1)	(4.6)	(20.3)	(30.2)	(6.7)
Non-Hispanic	(199.1)	(40.2)	(15.4)	(97.7)	(39.0)	(13.3)	(101.3)	(41.5)	(17.4)
Black	38.8	32.2	8.1	17.9	30.8	6.5	19.6	33.6	9.6
Hispanic	(1.7)	(28.3)	(5.0)	(0.8)	(27.3)	(4.1)	(0.9)	(29.2)	(5.5)
Non-Hispanic	(37.0)	(33.0)	(8.5)	(17.6)	(31.4)	(6.8)	(19.4)	(34.4)	(10.0)
American Indian*	2.9	32.9	7.2	1.5	32.2	6.4	1.5	33.5	8.1
Asian*	13.4	36.0	9.2	6.5	35.0	8.2	6.9	37.0	10.2
Hispanic†	45.5	29.5	5.5	23.5	29.0	4.6	22.0	30.1	6.5

* Estimates for Hispanic American Indians and Hispanic Asians are not available.

† Hispanic can be of any race.

Chart 2–2

Total Projected Population by Mean Age, Percent Age 65 and Older, Race/Ethnicity, and Sex, U.S., 2020

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

	Total Population			Male			Female		
	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65
Total	341.6	38.4	16.1	168.3	37.3	14.5	173.1	39.4	17.6
White	266.3	39.3	17.4	132.2	38.3	15.8	134.1	40.3	19.0
Hispanic	(61.0)	(31.1)	(7.7)	(30.9)	(30.6)	(6.7)	(30.1)	(31.6)	(8.7)
Non-Hispanic	(205.3)	(41.8)	(20.3)	(101.3)	(40.7)	(18.6)	(103.9)	(42.8)	(22.0)
Black	44.4	35.3	11.4	21.3	33.8	9.4	23.1	36.8	13.3
Hispanic	(2.5)	(29.7)	(6.9)	(1.2)	(28.6)	(5.9)	(1.3)	(30.7)	(7.8)
Non-Hispanic	(41.8)	(35.7)	(11.7)	(20.0)	(34.1)	(9.6)	(21.8)	(37.2)	(13.6)
American Indian*	3.8	33.8	10.9	1.9	33.1	9.9	1.9	34.6	12.0
Asian*	18.8	38.2	13.0	8.8	37.1	11.8	10.0	39.2	14.1
Hispanic†	66.4	30.9	7.6	33.6	30.3	6.6	32.8	31.4	8.6

* Estimates for Hispanic American Indians and Hispanic Asians are not available.

† Hispanic can be of any race.

Chart 2–3

Average Remaining Lifetime Years by Age, Race, and Sex, U.S., 2006

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

Age (Years)	Total	Male	Female	Total White	White Male	White Female	Total Black	Black Male	Black Female
Birth	77.7	75.1	80.4	78.2	75.7	80.6	73.2	69.7	76.5
15	63.4	60.9	65.9	63.8	61.3	66.1	59.5	56.0	62.7
35	44.4	42.2	46.4	44.7	42.6	46.7	40.9	37.9	43.5
65	18.5	17.0	19.7	18.6	17.1	19.8	17.1	15.1	18.6
75	11.6	10.5	12.3	11.5	10.5	12.3	11.1	9.8	12.0

Chart 2–4**Age-Adjusted Death Rates for All Causes by Race and Sex, U.S., 1950–2006**

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.^{15, 32}

Year	Deaths/100,000 Population			
	Black* Male	White Male	Black* Female	White Female
1950	1,949.5	1,642.5	1,574.1	1,184.0
1951	1,902.4	1,621.7	1,539.4	1,178.6
1952	1,889.8	1,588.5	1,496.0	1,157.0
1953	1,865.3	1,589.0	1,469.0	1,146.5
1954	1,726.6	1,516.3	1,326.3	1,081.8
1955	1,707.5	1,544.7	1,326.7	1,095.4
1956	1,724.1	1,554.3	1,331.9	1,089.9
1957	1,797.0	1,581.7	1,374.6	1,104.1
1958	1,779.2	1,573.1	1,354.6	1,090.8
1959	1,724.6	1,552.1	1,304.9	1,065.2
1960	1,777.6	1,586.0	1,334.6	1,074.4
1961	1,725.2	1,547.3	1,296.4	1,038.8
1962	1,801.7	1,579.1	1,324.5	1,052.6
1963	1,859.0	1,614.7	1,347.8	1,062.6
1964	1,768.0	1,572.0	1,282.7	1,030.8
1965	1,791.0	1,589.9	1,266.0	1,026.7
1966	1,832.4	1,595.7	1,274.9	1,024.7
1967	1,767.2	1,566.9	1,209.7	992.9
1968	1,876.9	1,581.8	1,277.5	1,029.4
1969	1,814.1	1,549.8	1,274.9	1,008.4
1970	1,872.8	1,513.7	1,229.4	944.0
1971	1,836.1	1,514.4	1,196.8	933.4
1972	1,871.8	1,520.2	1,181.2	878.9
1973	1,849.5	1,507.2	1,179.7	921.4
1974	1,769.5	1,450.8	1,109.7	884.2
1975	1,697.0	1,391.0	1,042.4	834.1
1976	1,676.0	1,379.5	1,031.2	828.9
1977	1,647.9	1,343.5	1,012.2	799.7
1978	1,625.6	1,332.5	954.4	796.6
1979	1,604.5	1,289.6	969.2	770.2
1980	1,697.8	1,317.6	1,033.3	796.1
1981	1,626.6	1,282.2	986.6	773.6
1982	1,580.4	1,255.9	960.1	758.7
1983	1,600.7	1,259.4	980.7	763.9
1984	1,600.8	1,245.9	976.9	760.7
1985	1,634.5	1,249.8	994.4	764.3
1986	1,650.1	1,230.4	994.4	758.1
1987	1,650.3	1,213.4	989.7	753.3
1988	1,677.6	1,215.9	1,006.8	759.0
1989	1,670.1	1,176.6	998.1	738.8
1990	1,644.5	1,165.9	975.1	728.7
1991	1,622.0	1,146.4	968.0	719.8
1992	1,591.4	1,125.6	954.4	709.5
1993	1,629.3	1,143.0	977.7	728.9
1994	1,589.8	1,123.4	965.0	723.5
1995	1,582.3	1,112.7	970.1	726.6
1996	1,513.9	1,086.1	956.3	723.3
1997	1,446.7	1,062.5	940.7	718.3
1998	1,410.6	1,038.5	938.2	715.1
1999	1,432.6	1,040.0	933.6	716.6
2000	1,403.5	1,029.4	927.9	715.3
2001	1,375.0	1,006.1	912.5	706.7
2002	1,341.4	992.9	901.8	701.3
2003	1,319.1	973.9	885.6	693.1
2004	1,269.4	936.9	855.3	666.9
2005	1,252.9	933.2	845.7	666.5
2006	1,215.6	908.2	813.0	648.2

* Nonwhite from 1950 to 1967

Chart 2–5 Unadjusted Death Rates for Selected Causes, U.S., 1950–2006

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.^{15, 32}

Year	Deaths/100,000 Population				
	CHD	Stroke	Lung Cancer	Other Cancer	COPD
1950	262.8	104.0	12.2	127.6	2.1
1951	265.8	106.7	12.9	127.6	2.4
1952	269.6	106.8	13.9	129.5	2.4
1953	277.2	107.3	14.9	129.8	2.9
1954	272.2	104.1	15.4	130.2	3.1
1955	282.7	106.0	16.3	130.2	3.4
1956	289.2	106.3	17.4	130.4	3.9
1957	298.7	110.2	18.1	130.5	4.8
1958	296.8	110.1	18.6	128.2	5.4
1959	297.4	108.4	19.4	127.9	5.9
1960	304.7	108.0	20.3	128.9	6.9
1961	301.6	105.4	21.3	128.1	7.2
1962	311.1	106.3	22.3	127.6	8.6
1963	317.6	106.7	23.1	128.2	10.3
1964	311.2	103.7	24.0	127.3	10.6
1965	314.0	103.9	25.0	128.4	12.1
1966	318.5	104.7	26.3	128.8	12.9
1967	315.0	102.4	27.6	129.6	13.3
1968	338.4	106.0	29.8	130.0	15.2
1969	332.6	102.9	30.7	129.7	15.6
1970	328.1	101.9	32.1	130.7	16.2
1971	326.0	101.1	33.2	129.8	16.7
1972	327.0	101.9	34.7	130.2	17.5
1973	323.7	101.4	35.5	130.4	18.5
1974	311.6	97.2	37.0	131.7	18.4
1975	298.3	90.1	38.1	131.2	19.1
1976	297.0	86.7	39.7	133.1	20.2
1977	290.5	82.8	41.2	134.2	20.3
1978	289.2	79.1	42.8	135.9	21.9
1979	275.0	75.3	43.8	135.8	22.2
1980	280.6	75.0	45.8	138.1	24.7
1981	272.0	71.1	46.4	137.5	25.6
1982	268.0	67.9	48.1	139.2	25.8
1983	267.3	66.4	49.2	140.3	28.3
1984	260.0	65.3	50.3	142.0	29.3
1985	255.7	64.2	51.5	142.5	31.4
1986	247.1	62.2	52.3	143.2	31.9
1987	241.3	61.7	53.7	143.2	32.3
1988	238.2	61.4	54.5	143.9	33.9
1989	230.5	58.8	55.6	145.5	34.2
1990	224.5	57.8	56.8	146.4	34.8
1991	219.3	56.6	56.8	146.6	35.8
1992	214.0	55.9	56.9	146.0	35.8
1993	216.5	57.6	57.3	146.6	38.9
1994	210.0	58.1	56.8	146.3	38.6
1995	207.5	59.2	56.8	145.4	38.6
1996	202.2	59.2	56.4	143.9	39.3
1997	195.5	58.5	56.2	141.7	40.0
1998	190.9	57.3	56.0	140.3	40.8
1999	189.8	60.0	55.5	145.3	42.8
2000	183.1	59.6	56.1	143.5	41.8
2001	176.3	57.4	55.3	140.7	41.7
2002	171.4	56.4	54.9	138.6	41.8
2003	165.1	54.2	54.1	136.0	42.1
2004	153.7	51.1	53.2	132.6	40.2
2005	150.4	48.4	53.7	135.0	42.9
2006	142.1	45.8	53.0	134.0	40.4

Chart 2–6**Number of Days of Inpatient Hospital Care by Major Diagnosis, U.S., 1990–2006**

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}

Year	Days of Care (Millions)							
	Cardiovascular	Respiratory	Mental	Digestive	Injury and Poisoning	Neoplasms	Musculoskeletal	Endocrine
1990	37.9	20.4	18.8	19.2	18.9	16.8	10.2	7.6
1991	39.0	20.7	19.0	19.3	19.1	16.4	10.2	8.1
1992	39.4	19.8	18.6	18.4	16.9	15.4	10.0	7.5
1993	37.5	21.1	18.8	17.5	17.3	13.6	9.0	8.0
1994	36.1	19.6	20.9	16.8	15.2	13.2	8.2	7.4
1995	33.6	19.9	17.9	15.8	14.6	11.8	7.3	6.8
1996	33.7	19.2	16.5	14.7	13.8	11.2	7.2	6.8
1997	32.5	19.6	15.6	14.6	13.2	10.9	6.8	6.6
1998	32.6	19.2	15.1	14.7	13.6	10.8	6.5	6.3
1999	30.8	20.1	15.1	15.1	13.8	10.5	6.7	6.6
2000	30.4	18.5	15.8	14.9	13.4	9.3	6.3	6.6
2001	29.3	18.2	17.3	15.5	13.9	10.0	6.6	6.7
2002	29.9	18.8	17.5	16.2	14.2	10.2	6.8	6.9
2003	30.0	19.6	16.5	16.4	14.8	10.0	7.5	7.5
2004	29.8	18.4	16.5	16.8	15.5	9.4	7.4	7.0
2005	28.2	19.5	16.6	16.2	14.8	9.6	7.6	6.8
2006	27.4	17.7	17.0	16.3	16.0	9.5	7.6	6.5

Chart 2–7**Age-Adjusted Death Rates by Major Diagnosis, U.S., 1990–2006**

From 1990 to 2006, age-adjusted death rates for cardiovascular and respiratory diseases ranked first and third, respectively.^{15, 35}

Year	Deaths/100,000 Population							
	Cardiovascular	Neoplasms	Respiratory	Injury and Poisoning	Endocrine	Digestive	Mental	Musculoskeletal
1990	412.5	219.0	85.5	60.4	27.7	33.1	11.9	3.4
1991	401.6	218.7	84.5	59.3	28.0	32.5	12.2	3.3
1992	392.3	217.3	82.3	57.4	28.2	32.1	12.7	3.2
1993	397.6	217.6	87.8	58.9	29.8	31.7	14.3	3.4
1994	387.1	216.1	86.0	58.3	30.7	31.4	15.5	3.5
1995	384.3	214.7	85.9	57.8	31.6	30.7	16.7	3.7
1996	375.5	211.6	86.2	56.9	32.2	30.3	17.5	3.7
1997	366.0	208.6	87.6	56.1	32.5	30.4	18.5	3.9
1998	355.2	205.4	89.6	55.7	33.0	29.8	20.0	3.8
1999	350.7	205.6	84.3	54.3	34.0	30.3	15.5	4.9
2000	341.3	204.5	83.7	53.9	34.1	30.4	16.7	5.0
2001	328.2	200.5	81.6	56.1	34.3	30.3	17.8	5.0
2002	319.0	196.1	81.4	56.7	34.4	30.0	19.2	5.0
2003	307.7	194.7	80.5	57.0	34.2	29.8	20.2	4.9
2004	288.0	190.4	76.1	57.3	33.1	28.8	20.3	4.8
2005	278.9	188.3	78.5	58.7	33.7	28.4	22.8	4.7
2006	262.5	185.3	72.6	59.6	31.8	27.9	28.6	4.5

Chart 2–8 Leading Causes of Death, U.S., 2006

In 2006, heart disease, stroke, and COPD and allied conditions were the first, third, and fourth leading causes of death, respectively.³²

Cause of Death	Number
Total deaths	2,426,264
Heart disease*	631,636
Cancer	559,888
Cerebrovascular disease (stroke)	137,119
COPD and allied conditions†	124,583
Accidents	121,599
Diabetes	72,449
Alzheimer's disease	72,432
Influenza and pneumonia	56,326
Nephritis	45,344
Septicemia	34,234
All other causes of death	570,654

* Includes 425,425 deaths from CHD.

† Chronic lower respiratory diseases.

Chart 2–9 Leading Causes of Death by Age and Rank, U.S., 2006

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.³¹

Cause of Death	1–24	25–44	45–64	≥65
Heart disease	5	3	2	1
Cancer	4	2	1	2
Cerebrovascular disease	8	9	5	3
Accidents	1	1	3	9
COPD and allied conditions*	9	—	6	4
Influenza and pneumonia	7	10	—	7
Diabetes mellitus	—	8	4	6
Suicide	3	4	8	—
Chronic liver disease	—	7	7	—
Nephritis and nephrosis	—	—	9	8
Homicide	2	5	—	—
Septicemia	10	—	10	10
Congenital malformations	6	—	—	—
Alzheimer's disease	—	—	—	5

* Chronic lower respiratory diseases.

Chart 2–10

Leading Causes of Death, White Males, U.S., 2006

In 2006, among white males, heart disease, COPD and allied conditions, and stroke were the first, fourth, and fifth leading causes of death, respectively.³⁶

Cause of Death	Percent of All Deaths
Heart disease	26.6
Cancer	24.5
Accidents	6.5
COPD and allied conditions*	5.3
Stroke	4.4
Diabetes	2.8

* Chronic lower respiratory diseases.

Chart 2–11

Leading Causes of Death, White Females, U.S., 2006

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

Cause of Death	Percent of All Deaths
Heart disease	26.0
Cancer	22.0
Stroke	6.7
COPD and allied conditions*	5.8
Alzheimer's disease	4.5
Accidents	3.5

* Chronic lower respiratory diseases.

Chart 2–12

Leading Causes of Death, Black Males, U.S., 2006

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

Cause of Death	Percent of All Deaths
Heart disease	24.4
Cancer	21.9
Accidents	6.5
Homicide	5.2
Stroke	5.0
Diabetes	3.9

Chart 2–13
Leading Causes of Death, Black Females, U.S., 2006

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

Cause of Death	Percent of All Deaths
Heart disease	25.5
Cancer	21.6
Stroke	6.8
Diabetes	5.0
Nephritis	3.2
Accidents	3.1

Chart 2–14
Leading Causes of Death, Asian Males, U.S., 2006

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

Cause of Death	Percent of All Deaths
Cancer	25.6
Heart disease	24.9
Stroke	7.2
Accidents	5.6
COPD and allied conditions*	3.6
Diabetes	3.5

* Chronic lower respiratory diseases.

Chart 2–15
Leading Causes of Death, Asian Females, U.S., 2006

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

Cause of Death	Percent of All Deaths
Cancer	27.2
Heart disease	22.7
Stroke	9.3
Accidents	3.8
Diabetes	3.8
Influenza/pneumonia	3.0

Chart 2–16
Leading Causes of Death, Hispanic Males, U.S., 2006

In 2006, among Hispanic males, heart disease and stroke were the first and fourth leading causes of death, respectively.³⁶

Cause of Death	Percent of All Deaths
Heart disease	20.9
Cancer	18.7
Accidents	12.3
Stroke	4.4
Diabetes	4.2
Homicide	4.0

Chart 2–17
Leading Causes of Death, Hispanic Females, U.S., 2006

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

Cause of Death	Percent of All Deaths
Heart disease	22.8
Cancer	21.8
Stroke	6.4
Diabetes	5.4
Accidents	5.0
COPD and allied conditions*	2.7

* Chronic lower respiratory diseases.

Chart 2–18
Leading Causes of Death, American Indian Males, U.S., 2006

In 2006, among American Indian males, heart disease was the leading cause of death.³⁶

Cause of Death	Percent of All Deaths
Heart disease	20.1
Cancer	16.0
Accidents	15.5
Diabetes	4.7
Chronic liver disease	4.3
Suicide	4.0

Chart 2–19
Leading Causes of Death, American Indian Females, U.S., 2006

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.³⁶

Cause of Death	Percent of All Deaths
Cancer	19.2
Heart disease	18.8
Accidents	8.1
Diabetes	7.0
Stroke	5.0
COPD and allied conditions*	4.3

* Chronic lower respiratory diseases.

Chart 2–20
Prevalence of Leading Chronic Conditions Causing Limitation of Activity, U.S., 2007

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

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

Chart 2–21**Age-Adjusted Percent of Population Currently Smoking by Race and Sex, Ages 18 and Older, U.S., 1965–2007**

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

Year	Black Male	White Male	Black Female	White Female
1965	58.8	50.4	31.8	33.9
1966	—	—	—	—
1967	—	—	—	—
1968	—	—	—	—
1969	—	—	—	—
1970	—	—	—	—
1971	—	—	—	—
1972	—	—	—	—
1973	—	—	—	—
1974	53.6	41.7	35.6	32.0
1975	—	—	—	—
1976	—	—	—	—
1977	—	—	—	—
1978	—	—	—	—
1979	43.9	36.4	30.5	30.3
1980	—	—	—	—
1981	—	—	—	—
1982	—	—	—	—
1983	41.7	34.2	31.3	29.6
1984	—	—	—	—
1985	40.2	31.3	30.9	27.9
1986	—	—	—	—
1987	—	—	—	—
1988	—	—	—	—
1989	—	—	—	—
1990	32.8	27.6	20.8	23.5
1991	—	—	—	—
1992	33.3	27.7	24.5	25.3
1993	33.7	26.6	20.6	23.4
1994	34.3	27.1	21.6	24.0
1995	29.4	26.2	23.5	23.4
1996	—	—	—	—
1997	32.4	26.8	22.5	22.8
1998	29.0	26.0	21.1	23.0
1999	28.4	25.0	20.5	22.5
2000	25.7	25.4	20.7	22.0
2001	27.6	24.8	18.0	22.0
2002	26.6	24.9	18.3	21.0
2003	25.3	23.8	17.9	20.1
2004	23.5	23.0	16.9	19.5
2005	25.9	23.3	17.1	19.1
2006	26.1	23.5	18.5	18.8
2007	23.4	22.2	15.6	18.5

Chart 2–22**Age-Adjusted Percent of Population With High Serum Cholesterol* by Race and Sex, Ages 20–74, U.S., 1976–1980 to 2003–2006**

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}

Year	White† Male	White† Female	Black† Male	Black† Female	Mexican-American Male	Mexican-American Female
1976–1980	26.4	29.6	25.5	26.3	20.3	20.5
1988–1994	18.7	20.7	16.4	19.9	18.7	17.7
1999–2002	17.0	17.4	12.5	16.6	17.6	12.7
2003–2006	16.0	17.9	11.2	13.0	17.7	13.8

* High serum cholesterol is ≥ 240 mg/dL.

† Non-Hispanic.

Chart 2–23**Age-Adjusted Percent of Population That Is Overweight* by Race and Sex, Ages 20–74, U.S., 1976–1980 to 2003–2006**

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

Year	White† Male	White† Female	Black† Male	Black† Female	Mexican-American Male	Mexican-American Female
1976–1980	53.8	38.7	51.3	62.6	61.6	61.7
1988–1994	61.6	47.2	58.2	68.5	69.4	69.6
1999–2002	69.5	57.0	62.0	77.6	74.1	71.4
2003–2006	72.1	57.4	72.0	80.5	77.3	74.4

* Overweight (including obesity) is a body mass index of ≥ 25 kg/m².

† Non-Hispanic.

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

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.^{35, 38–44}

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

* No estimate is available.

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

In 2010, hospital care is projected to be the largest type of direct cost for health care expenditures related to cardiovascular, lung, and blood diseases.^{38–44}

Disease	Dollars (Billions)					
	Total	Hospital Care	Physicians Services*	Prescription Drugs	Home Health Care	Nursing Home Care
Total CVD	324.1	150.1	46.4	52.3	16.8	48.2
Heart disease	189.5	106.3	23.8	22.1	7.4	23.4
Coronary	96.0	54.6	13.4	10.3	2.2	12.3
Heart failure	35.1	20.1	2.4	3.3	3.4	4.5
Stroke	48.2	21.0	3.8	1.3	5.0	17.1
Hypertensive disease	54.7	8.5	13.9	24.7	2.7	5.1
Lung diseases	108.9	68.2	15.9	16.1	3.6	5.2
COPD	29.5	13.2	5.5	5.8	1.3	3.7
Asthma	15.6	5.5	4.2	5.9	—†	—†
Blood diseases	11.8	6.1	2.5	0.8	1.2	1.1
Anemias	8.0	3.9	1.7	0.6	0.8	1.0

* 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.³⁵ 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.^{34, 35, 44} 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.

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

Cause of Death	Percent
CHD	51.2
Stroke	16.5
Other CVD	14.5
Heart failure (underlying)*	7.3
Hypertensive diseases	6.8
Diseases of arteries	3.7

* 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

Cause of Death	Percent
Other CHD	44.8
AMI	22.3
Heart failure (underlying)*	9.5
Other	7.2
Rhythmic	6.1
Hypertensive	5.2
Cardiomyopathy	4.0
Rheumatic/congenital	1.0

* 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

Cause of Death	Percent
Stroke, unspecified	52.9
Other hemorrhage	19.8
Other cerebrovascular	17.9
Cerebral infarction	5.1
Subarachnoid hemorrhage	4.3

Total deaths = 137,119 (100%).

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

Diagnostic Category	ICD-9-CM Codes	Hospitalizations		Physician Office Visits (1,000)	ICD-10 Codes	Deaths
		First-Listed Discharges (1,000)	Length of Stay (Days)			
Total	390–404, 410–448, 451–459, 745–747	6,211	4.5	72,559	I00–I99, Q20–Q28	831,272
Heart disease:	390–398, 402, 404, 410–429	4,195	4.4	24,182	I00–I09, I11, I13, I20–I51	631,636
Rheumatic heart disease	390–398	54	7.7	270	I00–I09	3,257
Hypertensive heart disease	402, 404	87	6.0	453	I11, I13	32,706
Coronary heart disease:	410–414, 429.2	1,760	4.0	10,956	I20–I25	425,425
AMI	410	647	5.4	206	I21, I22	141,462
Angina pectoris, stable	413	41	2.1	757	I20.1–I20.9	179
Angina pectoris, unstable	411	86	2.5	201	I20.0	30
Atherosclerotic CVD	429.2	—	—	98	I25.0	61,030
Other CHD	412, 414	986	3.2	9,695	Other I23–I25	222,724
Diseases of pulmonary circulation:	415–417	160	5.7	264	I26–I28	12,387
Pulmonary embolism	415.1	145	5.6	128	I26	6,924
Other	415.0, 415.2–417	15	6.7	136	I27–I28	5,463
Subacute bacterial endocarditis	421	13	11.7	—	I33.0	1,175
Cardiomyopathy	425	43	3.8	691	I42	24,703
Atrial fibrillation and flutter	427.3	461	3.5	4,065	I48	11,438
Other arrhythmic disorders	Other 427	311	3.2	1,966	Other I43–I49	26,301
Heart failure:	428	1,106	5.1	2,681	I50	60,337
Congestive heart failure	428.0	1,002	5.1	2,605	I50.0	55,923
Left heart failure and unspecified	428.1–428.9	104	5.5	76	150–150.9	4,414
Other heart disease	Other 420–429	200	5.6	2,836	Other I30–I51	33,907
Other hypertensive disease	401, 403	426	3.1	37,885	I10, I12	23,855
Cerebrovascular diseases (stroke)	430–438	885	4.9	2,005	I60–I69	137,119
Diseases of arteries:	440–448	282	5.6	1,477	I70–I78	31,136
Atherosclerosis	440	129	5.7	251	I70	8,652
Aortic aneurysm	441	57	6.5	253	I71	13,238
Other diseases of arteries	442–448	96	5.0	973	I72–I78	9,246
Deep vein thrombosis	451.1	10	4.5	—	I80.2	2,328
Other and unspecified CVD	Other 451–459	343	4.4	6,591	Other I80–I99	1,667
Congenital malformations of CV system:	745–747	70	9.6	419	Q20–Q28	3,531
Congenital heart disease	745, 746	41	8.4	356	Q20–Q24	2,854
Other congenital cardiovascular disease	747	29	11.5	63	Q25–Q28	677

* 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%.

Chart 3–5
Change in Age-Adjusted Death Rates, U.S., 1950–2006

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}

Year	Percent Change		
	CHD	Stroke*	Non-CVD
1950	0.0	0.0	0.0
1951	-1.3	0.4	-2.0
1952	-1.9	-0.3	-4.5
1953	0.0	-0.8	-6.0
1954	-3.1	-4.0	-11.6
1955	0.1	-1.9	-11.8
1956	1.6	-1.8	-12.0
1957	4.1	1.2	-10.6
1958	4.3	1.3	-12.6
1959	3.7	-0.9	-14.1
1960	5.5	-1.6	-11.5
1961	3.7	-4.2	-14.8
1962	6.9	-3.7	-13.2
1963	8.8	-3.8	-10.5
1964	5.4	-7.6	-12.9
1965	6.1	-8.0	-12.2
1966	5.8	-7.5	-11.4
1967	3.3	-11.8	-13.0
1968	9.8	-10.1	-8.2
1969	6.9	-14.0	-7.4
1970	1.9	-18.3	-10.9
1971	2.0	-18.3	-8.4
1972	1.4	-18.5	-7.2
1973	-0.6	-19.7	-8.9
1974	-5.7	-24.3	-9.6
1975	-11.7	-31.7	-11.1
1976	-13.0	-35.0	-10.9
1977	-16.2	-38.9	-14.7
1978	-17.6	-42.6	-13.6
1979	-22.8	-43.6	-21.1
1980	-21.5	-44.1	-18.1
1981	-25.0	-48.0	-19.4
1982	-27.1	-51.1	-20.6
1983	-28.1	-52.8	-19.2
1984	-30.8	-54.3	-18.1
1985	-32.6	-55.6	-16.1
1986	-35.5	-57.5	-15.3
1987	-37.7	-58.4	-14.9
1988	-38.9	-59.0	-13.1
1989	-41.4	-61.1	-13.1
1990	-43.2	-62.0	-13.0
1991	-45.3	-63.4	-13.9
1992	-47.1	-64.3	-15.1
1993	-46.9	-63.6	-12.6
1994	-48.9	-63.6	-12.9
1995	-50.0	-63.3	-13.1
1996	-51.7	-63.7	-14.2
1997	-53.7	-64.5	-15.3
1998	-55.2	-65.5	-14.8
1999	-55.7	-65.8	-13.2
2000	-57.5	-66.4	-12.7
2001	-59.5	-68.0	-13.0
2002	-61.1	-68.8	-13.0
2003	-62.9	-70.4	-13.2
2004	-65.8	-72.3	-15.2
2005	-67.2	-74.2	-14.0
2006	-69.3	-75.9	-14.9

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

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}

Cause of Death	Deaths/100,000 Pop.		1968–2006 Difference	Percent Change
	1968	2006		
All causes	1,304.5	776.5	-528.0	-40.5
CVD*	759.5	262.5	-497.0	-65.4
CHD	482.6	134.9	-347.7	-72.0
Stroke	162.5	43.6	-118.9	-73.2
Other CVD	114.4	84.0	-30.4	-26.6
Non-CVD	545.0	514.0	-31.0	-5.7

* Excludes congenital malformations of the circulatory system.

Chart 3–7

Average Annual Percent Change in Age-Adjusted Death Rates for All Causes and Cardiovascular Diseases, U.S., 1968–2006

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}

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

* Excludes congenital malformations of the circulatory system.

Chart 3–8

Average Annual Percent Change in Age-Adjusted Death Rates for All Causes and Cardiovascular Diseases by Race and Sex, U.S., 1999–2006

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

Cause of Death	All Causes	Black Male	White Male	Black Female	White Female
All causes	-1.7	-2.3	-2.0	-1.9	-1.5
CVD*	-4.0	-3.4	-4.2	-3.8	-4.1
Heart disease	-4.0	-3.4	-4.0	-4.0	-4.1
CHD	-5.1	-4.4	-5.0	-5.2	-5.4
Stroke	-4.9	-4.2	-5.4	-4.2	-4.9
Non-CVD	-0.4	-1.7	-0.6	-0.7	0.1

* Excludes congenital malformations of the circulatory system.

Chart 3–9

Deaths and Age-Adjusted Death Rates for Cardiovascular Diseases, U.S., 1979–2006

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.^{31, 32}

Year	Deaths in Thousands	Deaths/100,000 Population
1979	963	535.8
1980	993	543.7
1981	978	519.7
1982	972	505.0
1983	986	501.5
1984	978	487.5
1985	983	480.6
1986	973	466.4
1987	968	455.3
1988	974	450.4
1989	936	425.0
1990	920	412.5
1991	920	400.0
1992	918	389.6
1993	952	395.3
1994	945	384.3
1995	956	380.5
1996	954	372.1
1997	948	362.4
1998	945	353.8
1999	954	350.8
2000	942	341.4
2001	927	328.2
2002	923	319.0
2003	907	307.7
2004	866	288.0
2005	861	278.8
2006	828	262.5

Chart 3–10

Percent of All Deaths Due to Cardiovascular Diseases* by Age, U.S., 2006

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.³¹

Age (Years)	Percent of All Deaths
<1	7.6
1–4	8.8
5–14	7.9
15–24	4.7
25–34	10.3
35–44	19.2
45–54	25.9
55–64	28.9
65–74	30.7
75–84	36.3
≥85	44.9

* Includes congenital malformations of the circulatory system.

Chart 3–11
Age-Adjusted Death Rates for Cardiovascular Diseases* by State, U.S., 2003–2005

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

Rank	State	Deaths/100,000 Population
1	Mississippi	378.7
2	Oklahoma	362.6
3	Alabama	358.4
4	Tennessee	346.0
5	West Virginia	346.0
6	Louisiana	341.9
7	Kentucky	336.0
8	Arkansas	332.6
9	Missouri	321.0
10	Michigan	319.4
11	Georgia	319.2
12	Nevada	313.3
13	Ohio	313.1
14	Indiana	311.0
15	South Carolina	309.5
16	New York	305.5
17	Pennsylvania	301.6
18	North Carolina	300.2
19	Delaware	298.9
20	Illinois	296.3
21	Texas	296.2
22	Maryland	294.6
23	Virginia	284.6
24	Rhode Island	284.1
25	New Jersey	282.3
26	California	282.2
27	Kansas	277.3
28	Iowa	271.4
29	Wisconsin	267.8
30	Idaho	260.8
31	South Dakota	260.2
32	New Hampshire	259.8
33	Maine	259.1
34	Oregon	259.0
35	Nebraska	258.5
36	Florida	258.1
37	Washington	257.6
38	North Dakota	257.6
39	Wyoming	257.0
40	Connecticut	252.7
41	Vermont	249.6
42	Massachusetts	247.9
43	Montana	246.8
44	Arizona	244.4
45	Alaska	243.7
46	New Mexico	242.2
47	Colorado	241.3
48	Utah	237.0
49	Hawaii	235.8
50	Minnesota	214.1

* Excludes congenital malformations of the circulatory system.

Chart 3–12**Percent Decline in Age-Adjusted Death Rates for Cardiovascular Diseases* by State, U.S., 1993–1995 to 2003–2005**

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

Rank	State	Percent Decline
1	Minnesota	-33.0
2	Vermont	-32.6
3	Nebraska	-29.2
4	New Hampshire	-28.6
5	Connecticut	-28.3
6	New York	-28.0
7	South Carolina	-27.9
8	Maine	-27.9
9	Illinois	-27.4
10	Virginia	-27.3
11	Alaska	-27.2
12	Massachusetts	-26.9
13	South Dakota	-26.6
14	Wisconsin	-26.5
15	North Dakota	-26.4
16	Arizona	-26.3
17	Florida	-25.6
18	North Carolina	-25.3
19	Indiana	-25.3
20	Iowa	-25.1
21	New Jersey	-24.9
22	Pennsylvania	-24.9
23	Montana	-24.7
24	Wyoming	-24.4
25	Oregon	-24.1
26	Washington	-24.0
27	Georgia	-23.9
28	Michigan	-23.7
29	Kansas	-23.6
30	Ohio	-23.3
31	Colorado	-23.3
32	California	-23.2
33	Hawaii	-23.0
34	Missouri	-22.9
35	Texas	-22.8
36	New Mexico	-22.7
37	Utah	-22.6
38	Idaho	-22.3
39	Kentucky	-21.9
40	Rhode Island	-21.7
41	Delaware	-21.6
42	Mississippi	-21.2
43	Maryland	-21.1
44	West Virginia	-21.0
45	Arkansas	-20.9
46	Nevada	-20.4
47	Louisiana	-20.3
48	Tennessee	-20.3
49	Oklahoma	-15.4
50	Alabama	-14.2

* Excludes congenital malformations of the circulatory system.

Chart 3–13

Age-Adjusted Death Rates for Heart Disease by Race/Ethnicity and Sex, U.S., 2006

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.³⁶

Race/Ethnicity	Deaths/100,000 Population	
	Male	Female
Total	248.5	162.2
Black*	326.5	216.2
White*	250.0	160.9
American Indian	170.1	113.2
Hispanic	175.2	118.9
Asian	136.2	87.3

* Non-Hispanic.

Chart 3–14

Death Rates for Heart Disease in Males by Age and Race/Ethnicity, U.S., 2006

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.³⁶

Age (Years)	Deaths/100,000 Population				
	Black*	White*	Hispanic	American Indian	Asian
45–54	235.0	124.5	75.6	119.5	55.7
55–64	537.9	284.5	202.3	256.2	145.4
65–74	1,062.7	644.3	505.6	573.6	344.3
75–84	2,164.2	1,767.4	1,308.4	1,176.6	963.3

* Non-Hispanic.

Chart 3–15

Death Rates for Heart Disease in Females by Age and Race/Ethnicity, U.S., 2006

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

Age (Years)	Deaths/100,000 Population				
	Black*	White*	American Indian	Hispanic	Asian
45–54	114.4	42.2	41.8	27.3	15.9
55–64	257.7	113.2	125.2	86.9	48.4
65–74	588.6	329.1	322.5	273.0	187.4
75–84	1,483.2	1,135.8	937.9	894.5	639.8

* Non-Hispanic.

Chart 3–16**Age-Adjusted Prevalence of Acute Myocardial Infarction by Race and Sex, Ages 25–74, U.S., 1971–1975 to 2003–2006**

From 1971–1975 to 1999–2002, the prevalence of AMI mostly declined in whites, males, and females. In 2003–2006, the downward trend continued in males, but was reversed in whites and females. The prevalence of AMI rose in blacks from 1976–1980 to 1988–1994 but then declined through 2003–2006.¹⁷

Years	Percent of Population			
	Black	White	Male	Female
1971–1975	2.64	3.81	5.06	2.51
1976–1980	2.48	3.38	4.69	1.97
1988–1994	3.49	3.17	4.81	1.84
1999–2002	3.02	2.98	4.25	1.63
2003–2006	2.81	3.26	4.08	2.28

Chart 3–17**Prevalence of Acute Myocardial Infarction by Age and Sex, U.S., 1999–2006**

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

Age (Years)	Percent of Population	
	Male	Female
35–44	1.04	0.47
45–54	3.25	1.92
55–64	9.62	3.73
65–74	14.59	6.57
≥75	19.40	10.41

Chart 3–18**Prevalence of Acute Myocardial Infarction by Age and Race, U.S., 1999–2006**

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

Age (Years)	Percent of Population	
	Black	White
35–44	1.36	0.78
45–54	2.77	2.68
55–64	6.92	6.49
65–74	7.81	10.84
≥75	14.06	14.62

Chart 3–19
Prevalence of Angina Pectoris by Age and Sex, U.S., 1999–2006

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

Age (Years)	Percent of Population	
	Male	Female
35–44	1.8	2.2
45–54	5.0	5.3
55–64	6.9	7.4
65–74	13.4	10.6
≥75	14.3	13.5

Chart 3–20
Prevalence of Angina Pectoris by Age and Race, U.S., 1999–2006

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

Age (Years)	Percent of Population	
	Black	White
35–44	3.4	1.8
45–54	6.5	5.0
55–64	9.5	6.8
65–74	10.9	11.8
≥75	9.2	14.8

Chart 3–21
Hospitalization Rates for Acute Myocardial Infarction, Ages 45–64 and 65 and Older, U.S., 1965–2006

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}

Year	Hospitalizations/10,000 Population	
	Ages 45–64 Years	Ages ≥65 Years
1965	42.9	98.5
1966	43.3	99.3
1967	45.5	93.5
1968	43.9	99.3
1969	48.4	110.6
1970	53.0	122.0
1971	52.4	119.5
1972	57.6	136.5
1973	53.9	132.0
1974	57.8	137.8
1975	63.9	131.1
1976	63.1	137.6
1977	61.9	136.5
1978	62.5	141.8
1979	56.7	122.4
1980	51.7	129.4
1981	57.9	141.6
1982	57.9	141.5
1983	56.4	139.6
1984	57.5	142.9
1985	59.5	152.7
1986	58.4	155.0
1987	61.5	145.0
1988	52.4	141.6
1989	52.3	143.3
1990	49.6	126.9
1991	48.8	133.5
1992	55.4	137.3
1993	50.5	136.0
1994	51.0	136.7
1995	49.1	140.5
1996	52.2	147.7
1997	47.1	133.5
1998	41.9	146.7
1999	46.4	148.6
2000	39.6	143.2
2001	40.0	140.0
2002	38.9	140.8
2003	33.0	138.2
2004	32.5	126.6
2005	29.5	116.9
2006	29.1	105.7

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}

Year	Percent Discharged Dead	
	Ages <65 Years	Ages ≥65 Years
1970	16.0	37.8
1971	14.0	33.0
1972	11.9	32.6
1973	12.7	31.5
1974	10.3	29.6
1975	11.9	28.4
1976	12.1	25.7
1977	10.2	25.9
1978	9.7	28.2
1979	8.5	29.3
1980	8.4	26.6
1981	7.1	23.3
1982	10.0	27.6
1983	8.2	26.4
1984	7.7	22.4
1985	6.9	21.8
1986	7.6	21.0
1987	5.9	19.8
1988	7.4	18.0
1989	4.8	17.2
1990	5.0	17.6
1991	5.9	16.4
1992	3.8	15.7
1993	4.7	13.7
1994	3.8	14.3
1995	3.9	14.0
1996	4.5	14.7
1997	3.7	12.9
1998	3.8	13.6
1999	4.4	12.7
2000	5.8	12.5
2001	4.7	13.2
2002	3.1	11.4
2003	3.0	9.9
2004	2.6	12.2
2005	2.9	10.9
2006	2.1	9.8

Chart 3–23**Age-Adjusted Death Rates for Coronary Heart Disease, Actual and Expected, U.S., 1950–2006**

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.^{31, 32} Peak minus actual rates results in 1,086,000 fewer deaths in 2006 than expected—Actual: 425,000; Expected: 1,511,000.

Year	Deaths/100,000 Population		
	Actual Rate	Rate if Rise Continued	Peak Rate
1950	439.5	—	—
1951	433.6	—	—
1952	431.2	—	—
1953	439.5	—	—
1954	426.0	—	—
1955	440.1	—	—
1956	446.7	—	—
1957	457.6	—	—
1958	458.2	—	—
1959	455.8	—	—
1960	463.8	—	—
1961	455.9	—	—
1962	469.7	—	—
1963	478.4	—	—
1964	463.2	—	—
1965	466.4	—	—
1966	465.1	—	—
1967	453.9	—	—
1968	482.6	—	482.6
1969	469.8	—	482.6
1970	448.0	480.9	482.6
1971	448.5	483.4	482.6
1972	445.5	486.0	482.6
1973	437.0	488.5	482.6
1974	414.6	491.1	482.6
1975	388.1	493.7	482.6
1976	382.2	496.3	482.6
1977	368.5	498.9	482.6
1978	362.0	501.5	482.6
1979	339.1	504.2	482.6
1980	345.2	506.9	482.6
1981	329.5	509.5	482.6
1982	320.4	512.2	482.6
1983	316.1	514.9	482.6
1984	304.1	517.6	482.6
1985	296.2	520.4	482.6
1986	283.4	523.1	482.6
1987	273.9	525.9	482.6
1988	268.5	528.7	482.6
1989	257.5	531.4	482.6
1990	249.6	534.2	482.6
1991	240.6	537.1	482.6
1992	232.6	539.9	482.6
1993	233.2	542.8	482.6
1994	224.5	545.6	482.6
1995	219.7	548.5	482.6
1996	212.1	551.4	482.6
1997	203.6	554.3	482.6
1998	197.1	557.2	482.6
1999	194.6	560.2	482.6
2000	186.8	563.1	482.6
2001	177.8	566.1	482.6
2002	170.8	569.1	482.6
2003	162.9	572.1	482.6
2004	150.5	575.1	482.6
2005	144.4	578.1	482.6
2006	134.9	581.2	482.6

Chart 3–24**Age-Adjusted Death Rates for Coronary Heart Disease by Race/Ethnicity and Sex, U.S., 1999–2006**

From 1999 to 2006, CHD mortality declined in non-Hispanic whites, non-Hispanic blacks, Hispanics, Asians, and American Indians, both male and female.³⁶

Male (Deaths/100,000 Population)					
Year	Black*	White*	American Indian	Hispanic	Asian
1999	260.3	253.0	184.3	200.1	154.1
2000	271.9	243.5	168.1	190.2	143.9
2001	264.4	230.2	147.1	185.8	130.1
2002	253.2	222.7	148.6	172.2	127.7
2003	246.1	212.4	152.3	158.0	119.3
2004	226.7	196.8	136.1	149.6	107.1
2005	216.3	190.2	121.5	148.4	105.2
2006	209.8	179.3	122.4	132.8	101.3

Female (Deaths/100,000 Population)					
Year	Black*	White*	American Indian	Hispanic	Asian
1999	189.7	150.8	112.1	133.1	89.3
2000	185.0	144.3	99.1	125.1	83.7
2001	178.4	137.7	88.0	122.6	82.1
2002	171.4	131.7	87.1	112.2	76.9
2003	162.7	125.7	84.8	107.4	72.5
2004	150.5	115.5	82.4	95.3	66.7
2005	142.8	110.7	75.2	94.2	62.6
2006	132.0	102.4	76.4	85.4	58.9

* Non-Hispanic.

Chart 3–25**Age-Adjusted Death Rates for Coronary Heart Disease by Race and Sex, U.S., 1950–2006**

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}

Year	Deaths/100,000 Population			
	Black* Male	White Male	Black* Female	White Female
1950	365.2	558.6	276.7	346.0
1951	365.7	555.9	269.0	338.0
1952	365.6	553.4	271.5	338.3
1953	386.8	558.2	278.2	342.3
1954	362.1	555.4	263.0	331.0
1955	372.9	568.7	274.0	343.4
1956	388.3	575.4	286.0	347.5
1957	410.8	589.0	297.8	355.8
1958	409.9	592.4	292.3	356.7
1959	407.1	590.7	284.1	355.0
1960	388.8	605.6	292.3	356.5
1961	420.5	598.2	305.2	348.0
1962	444.2	610.4	313.6	354.4
1963	461.9	624.5	318.5	359.8
1964	442.1	611.1	312.8	353.4
1965	419.3	613.9	303.0	358.6
1966	460.6	619.4	314.0	352.9
1967	441.8	608.4	301.3	343.7
1968	556.8	632.4	399.3	367.7
1969	539.5	619.5	381.3	357.2
1970	517.2	592.5	368.0	340.0
1971	511.2	596.7	357.3	340.0
1972	515.9	592.1	352.9	338.4
1973	510.4	584.4	355.5	329.8
1974	485.2	555.4	329.9	313.6
1975	452.7	525.5	304.5	291.2
1976	446.6	517.6	298.3	287.8
1977	441.6	500.2	296.2	275.9
1978	433.1	489.3	287.7	272.9
1979	397.3	462.1	255.8	255.4
1980	418.7	466.3	274.2	262.6
1981	395.6	447.5	258.2	250.2
1982	383.1	435.0	249.8	243.7
1983	383.3	427.3	254.5	241.1
1984	370.4	410.1	244.4	232.9
1985	367.7	399.3	241.2	226.4
1986	358.9	377.8	238.7	218.0
1987	352.6	363.4	232.3	211.5
1988	348.3	355.7	232.4	207.6
1989	345.6	339.5	228.6	198.5
1990	336.9	330.5	220.1	192.1
1991	331.7	317.6	216.9	184.7
1992	319.0	307.6	208.8	178.2
1993	324.6	306.8	215.3	178.9
1994	308.5	295.3	203.9	172.7
1995	308.7	287.3	201.8	169.3
1996	290.7	278.3	195.2	163.4
1997	283.8	266.5	187.6	156.6
1998	277.2	256.7	183.3	152.0
1999	282.0	251.2	188.0	150.5
2000	269.5	241.6	183.2	143.9
2001	262.0	228.4	176.7	137.4
2002	250.6	220.5	169.7	131.2
2003	243.3	209.6	160.9	125.0
2004	223.9	194.2	148.7	114.7
2005	213.9	187.7	140.9	110.0
2006	206.4	176.3	130.0	101.5

* 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}

Year	Deaths in Thousands	Deaths/100,000 Population
1980	636	345.2
1981	624	329.5
1982	621	320.3
1983	625	316.1
1984	613	304.1
1985	608	296.2
1986	593	283.4
1987	584	273.9
1988	582	268.5
1989	569	257.5
1990	558	249.6
1991	555	240.6
1992	549	232.6
1993	563	233.2
1994	553	224.5
1995	552	219.7
1996	545	212.1
1997	533	203.6
1998	527	197.1
1999	530	194.6
2000	514	186.8
2001	502	177.8
2002	494	170.8
2003	480	162.9
2004	451	150.2
2005	446	144.4
2006	425	134.8

Chart 3–27**Average Annual Percent Change in Age-Adjusted Death Rates for Coronary Heart Disease by Race and Sex, U.S., 1950–2006**

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}

Years	Total Population	Black* Male	White Male	Black* Female	White Female
1950–1957	0.6	1.3	0.7	0.9	0.4
1958–1967	0.1	1.3	0.4	0.8	-0.2
1968–1978	-2.9	-2.5	-2.6	-3.3	-3.1
1979–1989	-2.9	-1.8	-3.2	-1.5	-2.7
1989–1998	-2.8	-2.4	-3.0	-2.3	-2.7
1999–2006	-5.1	-4.4	-5.0	-5.2	-5.4

* Nonwhite from 1950 to 1967.

Chart 3–28**Average Annual Percent Change in Death Rates for Coronary Heart Disease by Age, Race, and Sex, U.S., 1999–2006**

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

Age (Years)	Black Male	White Male	Black Female	White Female
35–44	-3.0	-1.2	-2.1	1.0
45–54	-2.0	-2.5	-2.9	-1.3
55–64	-4.1	-4.5	-4.8	-5.3
65–74	-4.8	-5.9	-6.1	-5.7
75–84	-3.7	-4.8	-4.8	-5.1
≥85	-6.0	-5.1	-4.5	-5.4

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

Race/Ethnicity	Deaths/100,000 Population	
	Male	Female
Total	176.5	103.1
Black*	209.8	132.0
White*	179.3	102.4
American Indian	122.4	76.4
Hispanic	132.8	85.4
Asian	101.3	58.9

* Non-Hispanic.

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

Age (Years)	Deaths/100,000 Population				
	Black*	White*	American Indian	Hispanic	Asian
45–54	133.8	90.2	81.0	52.7	39.9
55–64	347.2	216.7	191.7	156.5	114.0
65–74	717.2	488.6	424.4	394.1	261.7
75–84	1,476.8	1,288.8	900.6	1,022.8	736.4

* Non-Hispanic.

Chart 3–31

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

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

Age (Years)	Deaths/100,000 Population				
	Black*	White*	American Indian	Hispanic	Asian
45–54	57.7	25.1	21.8	15.5	8.7
55–64	151.4	74.6	85.5	60.9	31.9
65–74	373.4	221.9	234.9	199.2	132.2
75–84	954.0	742.7	654.1	666.6	448.6

* Non-Hispanic.

Chart 3–32**Age-Adjusted Death Rates for Coronary Heart Disease by State, U.S., 2003–2005**

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

Rank	State	Deaths/100,000 Population
1	Oklahoma	204.9
2	New York	202.0
3	Rhode Island	189.3
4	Tennessee	188.2
5	West Virginia	182.2
6	Arkansas	172.9
7	Michigan	172.8
8	Missouri	168.2
9	Delaware	167.0
10	Ohio	166.5
11	Kentucky	166.4
12	Mississippi	164.7
13	New Jersey	161.3
14	Louisiana	160.4
15	Maryland	159.6
16	Pennsylvania	156.8
17	California	154.2
18	Texas	153.8
19	Iowa	153.1
20	Illinois	152.6
21	Indiana	152.3
22	Florida	149.2
23	South Dakota	145.9
24	North Carolina	145.1
25	New Hampshire	143.5
26	North Dakota	141.6
27	Arizona	138.4
28	South Carolina	137.3
29	Vermont	133.0
30	Alabama	131.7
31	Washington	131.3
32	Wisconsin	129.3
33	Virginia	129.2
34	Nevada	129.1
35	Connecticut	128.4
36	Maine	128.4
37	Kansas	126.7
38	Georgia	126.6
39	New Mexico	126.6
40	Idaho	123.9
41	Wyoming	121.8
42	Massachusetts	119.3
43	Oregon	111.3
44	Colorado	111.1
45	Nebraska	107.4
46	Montana	107.2
47	Alaska	101.3
48	Hawaii	92.0
49	Minnesota	91.9
50	Utah	90.1

Chart 3–33

Age-Adjusted Death Rates* for Coronary Heart Disease by Country and Sex, Ages 35–74, 2007

In 2006–2007, among 16 industrialized countries, the United States ranked sixth highest for CHD mortality in males and fourth highest in females.⁴⁵

Country	Deaths/100,000 Population	
	Male	Female
Romania	287.6	117.4
Czech Republic	223.9	78.4
Poland (2006) [†]	198.5	57.5
Scotland	195.3	67.5
Finland	180.1	41.2
United States of America (2006) [†]	162.2	65.1
England and Wales	138.3	43.4
Germany (2006) [†]	125.2	38.2
Sweden (2006) [†]	118.7	39.1
Norway (2006) [†]	97.1	32.3
Denmark (2006) [†]	84.8	32.4
Italy (2006) [†]	80.1	23.1
Netherlands	71.7	25.3
France (2006) [†]	58.4	13.0
Republic of Korea (2006) [†]	51.4	20.0
Japan	47.7	14.2

* Age adjusted to European standard.

[†] Data for 2006.

Chart 3–34

Change in Age-Adjusted Death Rates* for Coronary Heart Disease in Males by Country, Ages 35–74, 1999–2007[†]

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.⁴⁵

Country	Average Annual Percent Change [‡]
Denmark (1999–2006)	-8.8
Netherlands (1999–2007)	-8.8
Norway (1999–2006)	-8.4
England and Wales (2001–2007)	-7.0
Germany (1999–2006)	-5.7
Poland (1999–2006)	-5.5
Finland (1999–2007)	-5.3
France (2000–2006)	-5.2
United States of America (1999–2006)	-4.7
Czech Republic (1999–2007)	-4.6
Romania (1999–2007)	-2.4
Japan (1999–2007)	-1.7
Republic of Korea (1999–2006)	-1.1

* Age adjusted to European standard.

[†] Data for years indicated in parentheses.

[‡] Based on a log linear regression of the actual rates.

Chart 3–35
Change in Age-Adjusted Death Rates* for Coronary Heart Disease in Females by Country, Ages 35–74, 1999–2007†

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

Country	Average Annual Percent Change‡
Norway (1999–2006)	-9.7
Denmark (1999–2006)	-9.0
Netherlands (1999–2007)	-9.0
England and Wales (2001–2007)	-8.6
Germany (1999–2006)	-7.2
Finland (1999–2007)	-7.0
Poland (1999–2006)	-6.5
France (2000–2006)	-5.9
Czech Republic (1999–2007)	-5.2
United States of America (1999–2006)	-5.0
Romania (1999–2007)	-4.0
Japan (1999–2007)	-3.2
Republic of Korea (1999–2006)	-1.7

* Age adjusted to European standard.

† Data for years indicated in parentheses.

‡ Based on a log linear regression of the actual rates.

Chart 3–36
Age-Adjusted Prevalence of Heart Failure by Race and Sex, Ages 25–74, U.S., 1971–1975 to 2003–2006

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

Years	Percent of Population			
	Black	White	Male	Female
1971–1975	1.5	1.0	1.1	1.1
1976–1980	1.1	0.9	1.2	0.8
1988–1994	3.0	1.8	2.3	1.7
1999–2002	2.6	1.5	2.1	1.2
2003–2006	3.1	1.9	2.6	1.5

Chart 3–37**Hospitalization Rates for Congestive Heart Failure, Ages Younger Than 65 and 65 and Older, U.S., 1971–2006**

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.^{33, 34}

Year	Hospitalizations/10,000 Population	
	Ages <65 Years	Ages ≥65 Years
1971	9.5	60.1
1972	11.3	73.3
1973	12.0	78.2
1974	12.8	82.7
1975	13.2	88.3
1976	13.7	97.3
1977	14.2	106.4
1978	14.9	112.5
1979	15.5	127.7
1980	14.3	133.5
1981	15.6	130.8
1982	16.2	132.6
1983	20.1	132.7
1984	20.6	151.7
1985	21.4	156.3
1986	23.1	158.2
1987	22.7	161.8
1988	24.4	175.5
1989	25.6	168.5
1990	26.0	182.0
1991	27.0	193.6
1992	31.5	206.4
1993	34.1	207.6
1994	29.8	210.0
1995	27.2	208.0
1996	28.5	202.7
1997	31.3	223.2
1998	30.6	226.7
1999	29.4	221.1
2000	31.9	220.2
2001	31.2	216.8
2002	32.8	201.4
2003	36.6	222.0
2004	33.0	225.0
2005	32.5	218.5
2006	32.9	216.6

Chart 3–38
Hospital Case-Fatality Rates for Congestive Heart Failure, Ages Younger Than 65 and 65 and Older, U.S., 1982–2006

Hospital case-fatality rates for congestive HF declined appreciably from 1982 to 2006 for those younger than 65 years and 65 years and older.^{33, 34}

Year	Percent Discharged Dead	
	Ages <65 Years	Ages ≥65 Years
1982	4.5	10.5
1983	5.9	10.7
1984	5.2	9.8
1985	4.5	9.0
1986	3.7	9.9
1987	4.6	7.9
1988	5.4	9.3
1989	4.1	7.6
1990	4.0	8.1
1991	3.9	8.9
1992	2.7	8.0
1993	2.6	7.2
1994	2.2	7.1
1995	3.4	5.0
1996	3.3	5.4
1997	1.6	5.6
1998	2.3	4.8
1999	1.3	6.0
2000	1.5	5.0
2001	2.4	4.6
2002	1.1	4.4
2003	3.0	5.0
2004	2.0	4.3
2005	1.7	3.6
2006	1.6	3.4

Chart 3–39**Age-Adjusted Death Rates for Heart Failure as the Underlying Cause by Race and Sex, U.S., 1981–2006**

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

Year	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
1981	23.3	18.6	18.3	13.5
1982	23.8	19.2	19.1	14.2
1983	25.3	20.4	19.7	15.3
1984	26.9	21.1	21.0	16.0
1985	27.8	21.5	22.0	17.0
1986	28.2	22.7	23.4	17.7
1987	27.9	22.4	21.7	18.1
1988	28.5	23.1	22.7	18.4
1989	25.2	19.9	21.2	16.5
1990	24.3	19.1	19.1	15.9
1991	22.7	19.1	19.1	16.1
1992	22.0	19.1	18.4	16.1
1993	23.8	21.0	20.2	18.0
1994	22.7	20.4	18.6	17.5
1995	23.1	20.4	18.8	17.7
1996	22.7	20.4	18.8	17.4
1997	21.9	20.4	19.0	17.8
1998	23.2	20.2	19.2	18.0
1999	25.3	21.4	20.9	19.3
2000	24.1	21.6	20.7	19.3
2001	24.4	21.2	20.6	19.3
2002	23.3	20.5	20.5	18.6
2003	23.5	20.7	20.5	18.4
2004	23.4	20.0	19.3	18.1
2005	23.0	20.0	20.4	18.1
2006	23.0	20.0	19.3	18.1

Chart 3–40**Age-Adjusted Death Rates for Any Mention of Heart Failure by Race and Sex, U.S., 1981–2006**

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

Year	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
1981	146.1	162.4	114.5	116.4
1982	141.6	159.8	112.1	115.2
1983	142.5	159.0	113.1	115.7
1984	140.4	157.2	112.4	114.5
1985	145.3	156.4	114.1	113.8
1986	145.1	152.0	115.1	112.4
1987	141.3	148.9	112.2	111.0
1988	146.2	149.4	118.2	111.5
1989	141.5	143.6	118.1	108.8
1990	142.7	144.3	114.1	107.9
1991	138.3	141.9	112.0	106.1
1992	136.4	140.4	107.2	104.0
1993	138.3	143.1	112.3	107.7
1994	132.6	138.0	107.1	103.6
1995	132.7	135.9	105.6	102.5
1996	129.2	132.1	103.1	99.1
1997	124.1	129.7	102.0	97.9
1998	125.8	126.7	103.0	96.2
1999	121.9	123.3	98.9	94.7
2000	121.4	122.5	100.5	95.2
2001	118.6	117.5	96.6	92.6
2002	113.1	114.3	95.9	89.4
2003	112.0	113.2	93.6	88.6
2004	111.0	109.3	89.8	85.4
2005	112.4	108.7	91.0	85.4
2006	105.9	103.7	84.4	80.3

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

Race/Ethnicity	Deaths/100,000 Population	
	Male	Female
Total	20.0	17.9
Black*	23.6	19.6
White*	20.7	18.5
American Indian	13.3	11.5
Hispanic	10.6	9.4
Asian	6.6	6.2

* Non-Hispanic.

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

Race/Ethnicity	Deaths/100,000 Population	
	Male	Female
Total	102.5	79.8
Black*	108.0	85.8
White*	106.0	81.7
American Indian	72.3	58.4
Hispanic	64.7	52.8
Asian	48.0	37.5

* Non-Hispanic.

Chart 3–43**Death Rates for Heart Failure as the Underlying Cause by Age, Race, and Sex, U.S., 2006**

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
25–44	1.9	0.4	1.1	0.3
45–54	11.1	2.8	6.0	1.5
55–64	23.4	9.8	16.3	6.1
65–74	63.3	35.5	43.2	25.9
75–84	164.8	151.2	137.0	123.1

Chart 3–44**Death Rates for Any Mention of Heart Failure by Age, Race, and Sex, U.S., 2006**

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
25–44	8.9	2.7	6.1	1.7
45–54	48.6	15.8	29.3	8.9
55–64	120.0	58.1	80.7	35.4
65–74	324.5	217.0	214.2	141.7
75–84	792.8	827.4	608.9	586.3

Chart 3–45**Age-Adjusted Death Rates for Cardiomyopathy by Race and Sex, U.S., 2006**

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

Race	Deaths/100,000 Population	
	Male	Female
Total	11.00	5.60
White	10.20	5.10
Black	19.30	9.90

Chart 3–46**Death Rates for Cardiomyopathy by Age, Race, and Sex, U.S., 2006**

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
35–44	10.7	3.4	4.5	1.5
45–54	21.3	6.6	8.6	2.8
55–64	35.8	11.7	15.2	4.9
65–74	56.7	26.2	26.4	12.0
75–84	94.7	68.8	57.6	33.7

Chart 3–47**Hospitalizations for Atrial Fibrillation by Primary and Secondary Diagnosis, U.S., 1982–2006**

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}

Year	Hospitalizations (Thousands)	
	Primary Diagnosis	Secondary Diagnosis
1982	115	429
1983	115	473
1984	111	553
1985	142	612
1986	150	693
1987	146	749
1988	171	820
1989	162	888
1990	181	922
1991	210	1,031
1992	227	1,133
1993	240	1,215
1994	277	1,309
1995	270	1,348
1996	286	1,528
1997	319	1,692
1998	327	1,774
1999	347	1,872
2000	399	2,001
2001	416	2,097
2002	465	2,258
2003	470	2,434
2004	444	2,492
2005	454	2,641
2006	461	2,621

Chart 3–48
Hospitalization Rates for Atrial Fibrillation by Age, U.S., 1982–2006

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}

Year	Hospitalizations/10,000 Population	
	Ages 45–64 Years	Ages ≥65 Years
1982	6.8	28.3
1983	7.0	27.4
1984	6.3	26.7
1985	8.7	34.0
1986	8.2	37.0
1987	6.8	35.9
1988	8.5	40.2
1989	8.4	36.8
1990	9.6	40.2
1991	10.1	47.9
1992	10.4	51.1
1993	9.9	54.3
1994	10.6	62.4
1995	10.5	60.5
1996	11.4	62.3
1997	11.6	70.5
1998	13.5	68.6
1999	12.4	74.2
2000	14.8	84.4
2001	13.2	88.1
2002	14.6	96.9
2003	18.0	90.5
2004	15.3	84.6
2005	14.6	88.9
2006	15.6	86.2

Chart 3–49

Age-Adjusted Prevalence of Stroke by Race and Sex, Ages 25–74, U.S., 1971–1975 to 2003–2006

From 1971–1975 to 2003–2006, the prevalence of stroke mostly increased in blacks, whites, and females. In males, the prevalence increased from 1971–1975 to 1988–1994 and then decreased in 1999–2002.¹⁷

Years	Percent of Population			
	Black	White	Male	Female
1971–1975	2.12	1.30	1.45	1.32
1976–1980	2.21	1.40	1.57	1.37
1988–1994	2.53	1.61	2.01	1.41
1999–2002	3.44	1.67	1.79	1.98
2003–2006	3.34	2.01	1.75	2.70

Chart 3–50

Prevalence of Stroke by Age and Sex, U.S., 1999–2006

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

Age (Years)	Percent of Population	
	Male	Female
35–44	0.8	1.1
45–54	1.0	2.6
55–64	2.8	4.0
65–74	7.3	5.8
≥75	12.5	11.9

Chart 3–51

Prevalence of Stroke by Age and Race, U.S., 1999–2006

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

Age (Years)	Percent of Population	
	Black	White
35–44	1.6	1.0
45–54	3.6	1.4
55–64	5.9	3.0
65–74	10.4	5.8
≥75	14.9	12.2

Chart 3–52**Hospitalization Rates for Stroke, Ages 45–64 and 65 and Over, U.S., 1971–2006**

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}

Year	Hospitalizations/10,000 Population	
	Ages 45–64 Years	Ages ≥65 Years
1971	30.1	192.6
1972	34.8	207.1
1973	35.0	211.0
1974	35.2	214.9
1975	34.8	202.1
1976	33.9	207.3
1977	34.8	204.8
1978	35.4	204.1
1979	37.4	237.1
1980	38.5	231.6
1981	39.7	226.2
1982	40.6	230.1
1983	41.5	234.1
1984	42.9	237.8
1985	42.9	240.3
1986	39.5	231.0
1987	42.3	223.0
1988	37.2	190.4
1989	33.6	192.6
1990	33.2	193.1
1991	33.5	201.5
1992	35.6	193.6
1993	34.7	192.0
1994	35.1	204.4
1995	34.8	209.8
1996	34.8	214.7
1997	36.5	228.6
1998	38.2	218.7
1999	36.3	205.5
2000	37.4	204.1
2001	31.6	194.1
2002	34.4	187.9
2003	33.6	190.5
2004	30.8	175.6
2005	29.5	170.2
2006	31.3	161.8

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}

Year	Percent Discharged Dead	
	Ages <65 Years	Ages ≥65 Years
1971	17.7	20.1
1972	16.7	20.8
1973	15.2	20.2
1974	13.4	16.9
1975	12.9	17.8
1976	—	—
1977	—	—
1978	11.3	15.5
1979	9.5	14.0
1980	7.0	14.8
1981	9.6	11.5
1982	7.3	11.5
1983	5.9	10.7
1984	6.3	10.1
1985	6.2	9.5
1986	6.9	9.9
1987	7.2	9.8
1988	5.9	11.1
1989	5.2	9.1
1990	6.0	8.9
1991	6.1	8.9
1992	7.4	7.3
1993	5.4	7.8
1994	5.9	7.2
1995	5.9	7.7
1996	4.9	7.0
1997	6.3	6.2
1998	6.1	6.6
1999	5.4	7.6
2000	5.8	6.6
2001	6.5	6.1
2002	5.3	6.9
2003	3.4	6.0
2004	6.5	6.8
2005	6.6	6.4
2006	3.8	6.0

* Estimates are not available for 1976 and 1977.

Chart 3–54**Age-Adjusted Death Rates for Stroke by Race and Sex, U.S., 1950–2006**

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}

Year	Deaths/100,000 Population			
	Black* Male	White Male	Black* Female	White Female
1950	231.3	182.1	240.6	169.7
1951	230.3	180.7	237.3	172.1
1952	233.7	180.1	235.0	170.0
1953	226.5	178.7	228.6	169.9
1954	221.1	173.0	223.7	163.9
1955	222.8	178.8	221.9	167.0
1956	221.8	178.8	225.0	166.9
1957	231.8	185.4	231.5	171.1
1958	237.7	184.3	229.3	172.0
1959	227.2	181.6	229.2	167.2
1960	230.4	181.6	225.2	164.9
1961	219.7	176.7	219.5	160.6
1962	229.0	178.7	225.5	161.6
1963	234.1	179.1	222.0	160.7
1964	220.5	171.9	209.6	153.5
1965	222.9	171.8	210.1	152.3
1966	222.0	171.2	205.0	152.0
1967	206.5	166.5	190.6	145.9
1968	232.8	169.2	208.9	148.4
1969	221.7	162.4	197.2	141.9
1970	206.4	153.7	189.3	135.5
1971	200.4	156.6	179.7	134.3
1972	200.8	156.2	178.8	134.2
1973	197.6	151.7	175.7	133.6
1974	184.6	144.1	160.6	125.9
1975	167.8	130.9	145.1	113.3
1976	162.3	123.3	138.2	108.3
1977	153.1	116.1	132.4	101.4
1978	145.7	107.8	124.4	95.8
1979	139.5	100.3	117.4	89.8
1980	142.0	98.7	119.6	89.0
1981	132.0	91.2	112.6	83.1
1982	123.8	86.1	105.8	78.0
1983	118.0	83.3	104.2	74.8
1984	115.0	80.2	100.2	72.9
1985	112.5	77.1	99.2	70.7
1986	110.7	73.4	93.5	67.9
1987	108.2	71.8	91.5	66.5
1988	109.5	71.4	92.4	64.9
1989	104.0	67.1	89.5	61.6
1990	102.2	65.5	84.0	60.3
1991	100.9	63.1	80.7	57.8
1992	94.7	62.2	78.1	56.6
1993	96.2	63.5	78.9	57.8
1994	96.5	63.1	78.8	57.7
1995	97.0	62.9	79.4	58.6
1996	94.4	62.6	77.3	58.0
1997	89.7	61.4	74.4	56.8
1998	88.0	58.1	73.7	55.8
1999	89.6	60.8	76.2	58.0
2000	89.6	59.8	76.2	57.3
2001	85.4	56.5	73.7	54.5
2002	81.7	54.2	71.8	53.4
2003	79.5	51.7	69.8	50.5
2004	74.9	48.1	65.5	47.2
2005	70.5	44.7	60.7	44.0
2006	67.1	41.7	57.0	41.1

* Nonwhite from 1950 to 1967.

Chart 3–55
Deaths and Age-Adjusted Death Rates for Stroke, U.S., 1979–2006*

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.^{31, 32}

Year	Deaths in Thousands	Deaths/100,000 Population
1979	178	102.0
1980	179	101.0
1981	172	94.0
1982	166	88.4
1983	163	85.3
1984	162	82.7
1985	161	80.2
1986	157	76.8
1987	157	75.2
1988	158	74.1
1989	153	70.3
1990	151	68.6
1991	150	66.1
1992	151	64.6
1993	158	65.8
1994	161	65.7
1995	166	66.3
1996	168	65.6
1997	168	64.2
1998	166	62.3
1999	167	61.6
2000	168	60.9
2001	164	57.9
2002	163	56.2
2003	158	53.5
2004	150	50.0
2005	144	46.6
2006	137	43.6

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

Chart 3–56

Age-Adjusted Death Rates for Stroke by Race/Ethnicity and Sex, U.S., 1999–2006

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

Male (Deaths/100,000 Population)					
Year	Black*	White*	American Indian	Hispanic	Asian
1999	90.6	60.8	50.0	52.6	58.7
2000	90.8	59.9	46.1	50.5	58.0
2001	86.5	56.5	37.5	48.9	55.3
2002	83.0	54.4	37.1	44.3	50.8
2003	81.0	51.9	34.9	43.0	48.4
2004	76.3	48.2	35.0	41.5	44.2
2005	71.8	44.8	31.3	38.0	41.5
2006	68.4	41.7	25.8	35.9	39.8

Female (Deaths/100,000 Population)					
Year	Black*	White*	American Indian	Hispanic	Asian
1999	77.1	58.4	46.4	42.2	49.0
2000	77.2	57.6	43.7	43.0	49.1
2001	74.8	54.8	44.0	41.6	48.2
2002	72.8	53.9	38.0	38.6	45.4
2003	70.9	50.9	34.2	38.1	42.6
2004	66.6	47.7	35.1	35.4	38.9
2005	61.7	44.4	37.1	33.5	36.3
2006	58.0	41.5	30.9	32.3	34.9

* Non-Hispanic.

Chart 3–57

Average Annual Percent Change in Age-Adjusted Death Rates for Stroke by Race and Sex, U.S., 1960–2006

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}

Years	Total Population	Black* Male	White Male	Black* Female	White Female
1960–1967	-1.4	-1.0	-1.1	-2.1	-1.6
1968–1978	-4.2	-4.4	-4.2	-5.0	-4.1
1979–1989	-3.7	-3.0	-3.9	-3.0	-3.7
1989–1998	-0.9	-1.6	-1.1	-1.7	-0.7
1999–2006	-4.9	-4.2	-5.4	-4.1	-4.9

* Nonwhite from 1960 to 1967.

Chart 3–58

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

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

Race/Ethnicity	Deaths/100,000 Population	
	Male	Female
Total	43.9	42.6
Black*	68.4	58.0
White*	41.7	41.5
American Indian	25.8	30.9
Hispanic	35.9	32.3
Asian	39.8	34.9

* Non-Hispanic.

Chart 3–59

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

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

Age (Years)	Deaths/100,000 Population				
	Black*	White*	American Indian	Hispanic	Asian
45–54	44.6	12.1	16.3	17.0	13.4
55–64	108.6	30.3	35.0	41.1	36.3
65–74	222.7	96.5	82.9	100.1	108.9
75–84	479.4	340.5	174.3	292.8	294.9

* Non-Hispanic.

Chart 3–60

Death Rates for Stroke in Females 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

Age (Years)	Deaths/100,000 Population				
	Black*	White*	American Indian†	Hispanic	Asian
45–54	32.1	10.1	—	11.8	10.4
55–64	61.5	23.5	16.2	27.8	28.8
65–74	151.8	79.0	78.8	76.9	80.8
75–84	421.9	325.9	267.6	240.6	284.2

* Non-Hispanic.

† Data unreliable for American Indian females aged 45–54 years.

Chart 3–61

Age-Adjusted Death Rates for Stroke by State, U.S., 2003–2005

In 2003–2005, stroke mortality was highest in many of the Southeastern states, most of which comprise “the stroke belt.”¹⁵

Rank	State	Deaths/100,000 Population
1	Tennessee	63.7
2	Arkansas	63.6
3	South Carolina	63.5
4	Alabama	62.9
5	Oklahoma	61.0
6	North Carolina	60.9
7	Oregon	60.6
8	Louisiana	58.5
9	Mississippi	58.2
10	Georgia	58.1
11	Kentucky	55.8
12	Virginia	55.7
13	Alaska	55.5
14	Idaho	55.3
15	West Virginia	55.1
16	Texas	54.4
17	Missouri	54.4
18	Indiana	54.2
19	Washington	54.2
20	California	52.7
21	Kansas	52.5
22	Ohio	52.3
23	Nevada	51.6
24	Michigan	51.2
25	Maryland	51.1
26	North Dakota	51.0
27	Illinois	50.9
28	Iowa	50.5
29	Wisconsin	50.0
30	Hawaii	49.9
31	Nebraska	49.7
32	South Dakota	49.6
33	Montana	49.5
34	Pennsylvania	49.2
35	Maine	48.6
36	Utah	48.2
37	Wyoming	46.7
38	Colorado	45.7
39	Minnesota	45.6
40	Delaware	44.3
41	Massachusetts	42.8
42	Vermont	42.3
43	Arizona	41.3
44	New Hampshire	41.0
45	New Mexico	40.7
46	Rhode Island	40.6
47	Florida	40.4
48	New Jersey	40.2
49	Connecticut	40.2
50	New York	33.2

Chart 3–62

Age-Adjusted Death Rates* for Stroke by Country and Sex, Ages 35–74, 2007

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.⁴⁵

Country	Deaths/100,000 Population	
	Male	Female
Romania	216.4	134.0
Poland	104.8	56.1
Republic of Korea (2006) [†]	93.1	50.8
Czech Republic	69.0	38.3
Japan	56.3	25.3
Finland	47.4	25.3
Scotland	46.1	33.0
Denmark (2006) [†]	45.6	32.1
Germany (2006) [†]	34.5	20.1
England and Wales	32.7	25.4
United States of America (2006) [†]	32.3	25.3
Italy (2006) [†]	31.9	19.3
Netherlands	28.8	22.8
Norway (2006) [†]	28.3	19.9
France (2006) [†]	27.7	15.2
Sweden (2006) [†]	19.3	21.2

* Age adjusted to European standard.

[†] Data for 2006.

Chart 3–63

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

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

Country	Average Annual Percent Change [‡]
Republic of Korea (1999–2006)	-7.7
England and Wales (2001–2007)	-7.3
Norway (1999–2006)	-6.9
Czech Republic (1999–2007)	-6.3
Netherlands (1999–2007)	-6.2
Germany (1999–2006)	-6.1
France (2000–2006)	-4.9
Finland (1999–2007)	-4.8
Denmark (1999–2006)	-4.2
Poland (1999–2006)	-3.8
Japan (1999–2007)	-3.6
United States of America (1999–2006)	-3.4
Romania (1999–2007)	-2.8

* Age adjusted to European standard.

[†] Data for years indicated in parentheses.

[‡] Based on a log linear regression of the actual rates.

Chart 3–64

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

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

Country	Average Annual Percent Change‡
Republic of Korea (1999–2006)	-9.1
Czech Republic (1999–2006)	-7.4
England and Wales (2001–2007)	-6.7
Germany (1999–2006)	-6.3
Netherlands (1999–2007)	-6.0
Finland (1999–2007)	-4.9
Japan (1999–2007)	-4.6
Norway (1999–2006)	-4.4
France (2000–2006)	-4.3
United States of America (1999–2006)	-3.6
Romania (1999–2007)	-3.5
Denmark (1999–2006)	-3.4
Poland (1999–2006)	-1.6

* Age adjusted to European standard.

† Data for years indicated in parentheses.

‡ Based on a log linear regression of the actual rates.

Chart 3–65

Prevalence of Hypertension* and Prehypertension† by Age, U.S., 1999–2006

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

Age (Years)	Percent of Population	
	Hypertension	Prehypertension
18–29	4.1	26.9
30–39	10.0	29.5
40–49	23.6	34.2
50–59	40.2	31.0
60–69	59.9	22.4
70–79	70.2	16.1
≥80	73.0	15.5

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

† Prehypertension is defined as systolic BP 120–139 mmHg or diastolic BP 80–89.

Chart 3–66**Age-Adjusted Prevalence of Hypertension* by Race/Ethnicity and Sex, Ages 20–74, U.S., 1999–2006**

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

Race/Ethnicity	Percent of Population	
	Male	Female
Black†	36.0	37.8
White†	25.6	23.1
Mexican-American	20.8	21.8

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

† Non-Hispanic.

Chart 3–67**Age-Adjusted Prevalence of Hypertension* by Race/Ethnicity and Sex, Ages 20–74, U.S., 1976–1980 to 2003–2006**

From 1976–1980 to 1988–1994, the prevalence of hypertension decreased substantially in both non-Hispanic whites and blacks and in males and females and remained relatively stable through 2003–2006. In Mexican-American males, it was stable from 1976–1980 through 1988–1994 before decreasing slightly in 1999–2002 and remaining unchanged in 2003–2006. The prevalence of hypertension was stable for the entire time in Mexican-American females.¹⁷

Years	Percent of Population					
	White† Male	White† Female	Black† Male	Black† Female	Mexican-American Male	Mexican-American Female
1976–1980	45.0	33.7	50.7	51.1	25.6	22.5
1988–1994	25.8	19.7	36.5	36.4	25.9	22.3
1999–2002	23.6	22.8	35.0	37.4	20.9	21.5
2003–2006	27.5	23.3	36.8	38.2	20.8	22.2

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

† Non-Hispanic.

Chart 3–68**Hypertensive* Population Aware, Treated, and Controlled, Ages 18–74, U.S., 1971–1972 to 2003–2006**

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

Years	Percent of Hypertensive Population			
	Unaware	On Medication Controlled	On Medication Uncontrolled	No Medication Uncontrolled
1971–1972	49	16	20	15
1974–1975	36	20	14	30
1976–1980	27	34	12	27
1988–1994	12	65	14	9
1999–2002	11	70	13	6
2003–2006	7	79	9	5

* Hypertension is defined as systolic BP \geq 160 mmHg, or diastolic BP \geq 95 mmHg, or on medication.

Chart 3–69**Hypertensive* Population Aware, Treated, and Controlled, Ages 18–74, U.S., 1976–1980 to 2003–2006**

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

Years	Percent of Hypertensive Population			
	Unaware	On Medication Controlled	On Medication Uncontrolled	No Medication Uncontrolled
1976–1980	49	10	21	20
1988–1991	27	29	26	18
1991–1994	32	27	27	14
1999–2002	30	36	23	11
2003–2006	22	45	22	11

* Hypertension is defined as systolic BP \geq 140 mmHg, or diastolic BP \geq 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

Race	Deaths/100,000 Population	
	Male	Female
Total	12.2	8.2
White	12.2	8.2
Black	13.6	10.2

Chart 3–71
Death Rates for Diseases of the Arteries by Age, Race, and Sex, U.S., 2006

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
35–44	3.3	1.3	1.2	0.6
45–54	8.6	3.8	4.2	1.5
55–64	19.3	10.7	9.0	5.8
65–74	43.4	34.4	25.3	19.0
75–84	93.1	96.5	80.8	64.1

Chart 3–72
Percent of Deaths From Congenital Malformations of the Circulatory System, Age Under 1, U.S., 1940–2006

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}

Year	Percent of Deaths
1940	82.0
1950	75.1
1960	67.3
1970	63.7
1980	57.5
1990	53.3
2000	42.7
2003	42.2
2004	42.6
2005	44.6
2006	46.2

Chart 3–73**Infant Mortality From Congenital Malformations of the Circulatory System by Race, U.S., 1970–2006**

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.^{31, 32}

Year	Deaths/100,000 Live Births			
	Heart White	Heart Black	Other CVD White	Other CVD Black
1970	120.2	113.4	19.8	19.8
1971	114.2	105.2	22.4	20.9
1972	114.7	106.5	16.1	17.9
1973	107.8	103.3	20.7	19.6
1974	100.0	100.1	19.6	22.1
1975	96.6	92.3	21.9	24.0
1976	91.5	87.6	21.0	25.5
1977	90.6	84.6	22.0	27.4
1978	85.2	83.6	23.6	33.0
1979	83.3	80.3	22.8	32.5
1980	80.3	78.9	24.5	34.4
1981	74.2	73.7	22.7	37.8
1982	77.1	76.6	21.7	39.7
1983	70.3	74.1	23.6	36.9
1984	69.8	74.9	20.3	32.1
1985	69.2	72.7	17.4	25.6
1986	65.1	69.2	14.5	25.4
1987	62.0	71.4	14.5	21.7
1988	67.7	64.6	14.0	20.5
1989	62.1	71.2	11.1	18.4
1990	61.3	72.2	11.4	16.7
1991	56.3	70.3	10.7	17.7
1992	55.0	71.8	10.1	15.3
1993	54.0	64.7	9.6	14.6
1994	53.4	62.1	9.5	16.0
1995	50.1	58.5	7.7	10.1
1996	48.7	58.5	8.5	11.4
1997	45.2	51.3	7.9	11.3
1998	44.5	51.3	7.2	12.3
1999	40.0	47.9	4.9	9.4
2000	38.6	50.9	4.7	7.9
2001	37.0	51.3	4.5	6.4
2002	35.7	50.4	5.0	8.4
2003	33.8	45.8	5.7	6.5
2004	32.8	45.3	5.5	10.7
2005	33.3	38.1	5.3	9.6
2006	31.5	43.4	5.0	9.2

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.³⁵ 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.^{34, 35, 44} 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.”²⁵

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.²⁴ Additionally, based on spirometry readings of lung function in the 1988–1994 NHANES, COPD was estimated to go undiagnosed in 12 million people.²⁵

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

Conditions	Percent
COPD	53.6
Influenza and pneumonia	25.0
External agents	8.0
Cardiopulmonary diseases	5.5
Other	4.1
Neonatal pulmonary disorders	2.1
Asthma	1.6

Total Deaths = 225,028 (100%)

Chart 4-2
Number of Hospitalizations, Physician Office Visits,* and Deaths for Lung Diseases,† U.S., 2006

Diagnostic Category	ICD-9-CM Codes	Hospitalizations		Physician Office Visits (1,000)	ICD-10 Codes	Deaths
		First-Listed Discharges (1,000)	Length of Stay (Days)			
Total		3,376	5.3	35,323		225,028
Acute lower respiratory infections:	466, 480-487	1,487	4.8	6,988	J10-J18, J20, J21	56,540
Influenza and pneumonia	480-487	1,270	5.0	4,030	J10-J18	56,326
Acute bronchitis	466	217	3.2	2,959	J20	137
Acute bronchiolitis	included in 466	—	—	—	J21	77
Chronic lower respiratory disease:	277.0, 490-496	1,125	4.0	26,939	J40-J47, E84	125,021
COPD:	490-492, 494-496	670	4.4	16,343	J40-J44, J47	120,970
Chronic bronchitis	490, 491	537	4.6	9,856	J40-J42	740
Emphysema	492	19	4.4	324	J43	12,551
Other COPD	495, 496	105	3.1	6,081	J44	106,706
Bronchiectasis	494	9	6.2	82	J47	973
Asthma	493	444	3.2	10,590	J45	3,365
Status asthmaticus	included in 493	—	—	—	J46	248
Cystic fibrosis	277.0	11	9.5	6	E84	438
Lung disease due to external agents	500-508	180	7.5	47	J60-J70	17,899
Adult respiratory distress syndrome	518.5	7	10.3	—	J80	1,609
Pulmonary edema	518.4	—	—	—	J81	572
Interstitial lung diseases:	011, 012, 135, 446.2, 446.4, 518.8	356	8.8	1,309	A15, A16, A19, A31.0, D86, J96, J99, M31.0, M31.3	5,849
Sarcoidosis	135	8	6.4	435	D86	931
Respiratory tuberculosis	011, 012	8	7.0	49	A15, A16, A19, A31.0	731
Respiratory failure	518.8	340	8.9	663	J96	3,769
Pulmonary manifestations of connective tissue disorders	446.2, 446.4	—	—	163	J99, M31.0, M31.3	418
Cardiopulmonary diseases:	415.1-417	160	5.7	264	I26, I27	12,317
Pulmonary embolism	415.1	145	5.6	128	I26	6,924
Other pulmonary heart disease	415.2-417	15	6.5	136	I27	5,393
Selected HIV-related and other pulmonary infections	114-116, 117.3, 117.5, 117.7, 136.3	—	—	76	B38-40, B44-46, B59	576
Neonatal pulmonary disorders:	748.4-748.6, 769, 770, 798.0	61	15.5	—	P22, P25-P28, Q33, R95	4,645
Respiratory distress syndrome	769	19	29.1	—	P22	825
Sudden infant death syndrome	798.0	—	—	—	R95	2,323
Congenital malformation of the lung	748.4-748.6	1	4.1	—	Q33	408
Bronchopulmonary dysplasia	770.7	—	—	—	P27.1	260
Atelectasis of newborn	770.4, 770.5	—	—	—	P28.0, P28.1	399
Other perinatal respiratory diseases	770.1-770.3, 770.6, 770.8, 770.9	27	7.6	—	P25, P26, P27.0, P27.8, P27.9, P28.2-P28.9	398

* 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.

Chart 4–3**Age-Adjusted Death Rates for Total Lung Diseases by Race and Sex, U.S., 2006**

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

Race	Deaths/100,000 Population	
	Male	Female
Total	85.7	63.8
White	86.5	65.6
Black	95.2	56.0

Chart 4–4**Death Rates for Total Lung Diseases by Age, Race, and Sex, U.S., 2006**

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
35–44	16.1	6.1	13.6	5.9
45–54	36.7	19.5	33.6	17.4
55–64	82.4	66.5	79.0	56.8
65–74	219.3	242.2	182.4	200.6
75–84	641.0	716.6	371.3	516.3

Chart 4–5**Prevalence of Chronic Obstructive Pulmonary Disease* by Age, U.S., 1997–2007**

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

Year	Percent of Population		
	Ages 18–44 Years	Ages 45–64 Years	Ages ≥65 Years
1997	4.3	7.1	10.6
1998	3.7	6.7	9.9
1999	3.9	6.1	9.5
2000	3.7	6.7	10.1
2001	4.6	7.7	10.5
2002	3.6	6.7	9.1
2003	3.1	6.0	9.4
2004	3.3	6.2	9.8
2005	3.4	6.2	9.6
2006	3.1	7.0	10.0
2007	2.4	5.8	8.6

* Physician-diagnosed COPD only.

Chart 4–6

Prevalence of Chronic Obstructive Pulmonary Disease* by Age, Race, and Sex, U.S., 2007

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

Age (Years)	Percent of Population			
	Black Male	White Male	Black Female	White Female
18–44	1.9	1.8	2.8	3.2
45–64	2.8	4.8	7.1	7.2
≥65	6.3	9.1	6.2	8.6

* Physician-diagnosed COPD only.

Chart 4–7

Hospitalization Rates for Chronic Obstructive Pulmonary Disease, Ages 45–64 and 65 and Older, U.S., 1995–2006

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}

Year	Hospitalizations/10,000 Population	
	Ages 45–64 Years	Ages ≥65 Years
1995	28.6	110.6
1996	29.8	114.0
1997	30.8	123.8
1998	31.0	132.0
1999	32.7	139.9
2000	30.8	125.9
2001	28.4	130.0
2002	30.3	123.6
2003	28.0	125.0
2004	26.6	114.6
2005	28.2	125.8
2006	27.4	115.9

Chart 4–8**Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by Race and Sex, U.S., 1960–2006**

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}

Year	Deaths/100,000 Population			
	Black* Male	White Male	Black* Female	White Female
1960	9.7	16.4	2.0	2.8
1961	10.1	17.4	2.3	2.9
1962	11.2	21.2	2.5	3.3
1963	14.2	26.0	2.9	4.1
1964	13.8	26.6	2.2	4.0
1965	15.6	30.7	2.3	4.7
1966	16.4	33.2	2.6	5.0
1967	18.1	33.6	3.2	5.2
1968	21.2	38.1	3.6	6.4
1969	22.5	37.3	3.6	6.6
1970	23.5	38.1	3.8	7.0
1971	23.5	40.8	5.2	7.5
1972	25.5	42.6	4.6	8.0
1973	25.5	44.8	4.4	8.9
1974	24.5	43.9	4.0	9.1
1975	24.7	44.9	4.7	9.5
1976	27.8	47.1	4.8	10.5
1977	27.5	46.4	5.2	10.8
1978	29.2	48.4	6.0	12.4
1979	27.9	46.2	5.3	12.0
1980	29.4	50.3	6.2	14.2
1981	32.2	50.7	6.6	15.2
1982	30.7	50.1	7.5	15.7
1983	34.1	53.3	8.1	17.7
1984	35.4	53.7	9.0	19.0
1985	37.5	56.1	9.9	20.9
1986	38.9	55.4	9.5	21.8
1987	37.8	54.4	10.8	22.5
1988	41.2	55.4	10.8	24.1
1989	40.4	53.5	12.7	25.2
1990	43.2	55.0	12.5	25.8
1991	41.5	55.1	13.2	27.2
1992	44.8	54.0	13.6	27.8
1993	44.8	57.1	14.8	31.0
1994	42.6	55.3	15.5	31.3
1995	42.5	54.7	15.6	31.4
1996	41.4	54.0	16.1	32.8
1997	41.3	54.4	16.0	33.5
1998	40.8	54.9	17.0	35.4
1999	48.0	59.0	19.3	38.0
2000	44.0	56.2	18.6	38.0
2001	43.1	54.6	18.6	38.3
2002	43.0	54.0	19.2	38.3
2003	41.5	52.9	18.7	39.0
2004	37.9	50.3	17.8	37.2
2005	41.4	52.1	19.5	39.4
2006	37.3	48.6	18.6	37.3

* Nonwhite from 1960 to 1967.

Chart 4–9**Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by Race/Ethnicity and Sex, U.S., 1999–2006**

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

Year	Male (Deaths/100,000 Population)			
	Black*	White*	Hispanic	Asian
1999	48.4	60.3	31.7	26.8
2000	44.4	57.9	27.3	26.0
2001	43.7	56.0	26.6	25.0
2002	43.5	55.5	26.2	23.5
2003	42.1	54.6	26.0	23.6
2004	38.5	52.0	22.9	20.8
2005	42.1	54.0	24.2	21.4
2006	37.7	50.5	21.2	21.1

Year	Female (Deaths/100,000 Population)			
	Black*	White*	Hispanic	Asian
1999	19.7	39.2	15.5	10.2
2000	18.9	39.2	14.6	9.9
2001	18.7	39.6	14.8	9.5
2002	19.4	39.8	14.7	7.9
2003	18.9	40.7	14.4	8.4
2004	18.1	38.8	13.5	8.3
2005	19.8	41.2	14.3	8.3
2006	18.9	39.1	13.1	7.8

* Non-Hispanic.

Chart 4–10**Death Rates for Chronic Obstructive Pulmonary Disease in White Males by Age, U.S., 1960–2006**

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}

Year	Deaths/100,000 Population			
	Ages 55–64 Years	Ages 65–74 Years	Ages 75–84 Years	Ages ≥85 Years
1960	36.1	82.8	101.8	111.2
1961	38.7	87.8	111.8	122.2
1962	44.2	107.2	136.7	154.8
1963	52.3	131.2	169.6	202.7
1964	51.8	131.6	181.9	202.3
1965	57.8	153.6	216.6	235.5
1966	61.9	161.9	244.8	258.5
1967	61.2	164.8	248.6	263.9
1968	67.3	186.7	286.5	307.8
1969	67.5	189.5	294.3	305.1
1970	68.1	196.5	311.5	280.9
1971	67.3	195.6	327.4	334.6
1972	67.7	204.8	351.4	354.8
1973	69.8	210.1	378.4	393.5
1974	64.8	204.8	380.4	379.8
1975	64.7	207.6	399.7	402.7
1976	64.0	210.7	419.7	482.8
1977	60.1	206.1	431.5	459.5
1978	60.1	213.2	430.1	515.7
1979	56.2	200.1	412.7	511.5
1980	58.1	213.2	450.3	601.1
1981	57.7	214.4	454.0	622.0
1982	55.2	205.9	462.6	616.1
1983	57.7	215.4	494.2	691.0
1984	58.8	212.7	493.9	724.4
1985	58.1	220.6	516.5	785.6
1986	57.5	216.1	513.3	772.9
1987	57.9	204.5	513.0	766.3
1988	58.6	210.7	512.0	814.6
1989	58.0	199.3	492.8	808.6
1990	56.4	203.1	503.6	830.9
1991	55.5	201.2	501.5	847.6
1992	54.2	199.2	486.3	839.1
1993	55.8	207.6	517.5	895.4
1994	53.8	200.2	496.5	886.5
1995	50.4	195.8	489.7	901.1
1996	49.5	192.1	484.6	902.9
1997	48.3	200.6	476.0	928.0
1998	47.5	201.9	481.8	914.9
1999	51.7	214.8	520.1	1,018.6
2000	47.4	198.9	498.9	966.0
2001	46.9	196.1	485.4	932.3
2002	44.8	190.4	490.6	912.9
2003	46.4	189.9	474.5	883.8
2004	42.9	178.8	459.6	827.4
2005	45.4	187.9	475.9	837.5
2006	42.1	170.2	450.1	779.5

Chart 4–11**Death Rates for Chronic Obstructive Pulmonary Disease in Black* Males by Age, U.S., 1960–2006**

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.^{15, 32, 36, 46}

Year	Deaths/100,000 Population			
	Ages 55–64 Years	Ages 65–74 Years	Ages 75–84 Years	Ages ≥85 Years
1960	24.0	42.6	36.7	66.8
1961	23.0	43.0	49.7	66.6
1962	25.6	54.1	50.3	69.0
1963	31.8	62.4	68.5	131.1
1964	34.7	58.8	71.0	68.8
1965	34.8	61.8	93.8	132.3
1966	35.5	68.3	86.0	111.1
1967	36.9	75.1	104.9	128.2
1968	47.8	84.1	126.1	114.6
1969	50.9	93.0	133.5	145.5
1970	59.4	95.0	148.5	131.8
1971	52.9	99.8	135.5	155.1
1972	55.8	105.8	171.6	153.0
1973	56.6	109.6	153.4	188.7
1974	53.3	120.4	137.8	180.2
1975	51.5	103.4	170.3	156.3
1976	55.1	118.3	179.1	197.0
1977	56.7	120.3	174.5	204.1
1978	59.7	129.9	182.4	270.7
1979	51.0	123.9	195.4	269.5
1980	61.8	133.3	217.5	255.5
1981	56.8	141.5	244.7	262.5
1982	53.0	142.8	217.0	269.0
1983	65.2	147.5	263.2	333.3
1984	59.1	161.5	282.8	311.5
1985	61.8	168.1	311.7	366.1
1986	63.1	181.4	307.7	419.0
1987	57.7	176.2	314.2	425.0
1988	60.9	189.3	360.1	430.8
1989	59.9	180.0	359.3	463.6
1990	59.4	172.4	377.2	483.3
1991	57.5	173.7	347.4	472.5
1992	56.0	166.8	345.6	536.9
1993	56.7	175.6	392.2	545.8
1994	51.4	175.0	362.9	549.9
1995	53.9	166.6	357.0	589.6
1996	53.5	155.2	371.0	552.1
1997	46.7	168.3	366.8	549.1
1998	48.5	159.0	366.8	545.1
1999	53.9	175.5	426.1	683.2
2000	48.5	169.0	363.9	667.7
2001	45.2	161.2	371.7	656.9
2002	46.6	150.7	386.1	620.0
2003	46.3	149.8	373.5	582.9
2004	44.9	134.9	327.1	551.3
2005	45.0	151.8	364.9	587.5
2006	43.3	132.1	334.7	505.8

* Nonwhite from 1960 to 1967.

Chart 4–12**Death Rates for Chronic Obstructive Pulmonary Disease in White Females by Age, U.S., 1960–2006**

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.^{15, 32, 36, 46}

Year	Deaths/100,000 Population			
	Ages 55–64 Years	Ages 65–74 Years	Ages 75–84 Years	Ages ≥85 Years
1960	4.2	8.4	18.0	36.5
1961	4.4	9.2	18.8	37.9
1962	5.2	10.2	23.4	44.7
1963	6.1	12.5	26.7	54.1
1964	6.9	13.3	26.8	49.3
1965	8.0	16.0	29.8	53.8
1966	9.2	18.1	29.8	54.1
1967	10.2	18.0	31.4	58.0
1968	13.3	22.8	38.0	70.7
1969	13.3	24.3	39.3	74.5
1970	15.3	27.9	39.9	59.1
1971	15.5	29.8	45.5	66.8
1972	17.1	34.7	47.3	65.8
1973	18.8	37.6	53.4	80.7
1974	20.0	39.7	57.4	70.2
1975	21.5	41.9	58.7	74.0
1976	21.7	46.1	68.6	86.1
1977	22.1	49.6	70.5	91.1
1978	25.3	57.0	80.5	109.6
1979	23.8	55.0	80.8	107.0
1980	26.4	66.8	97.3	134.6
1981	27.4	72.4	107.6	134.9
1982	27.0	75.8	113.0	143.4
1983	29.9	85.5	129.1	164.2
1984	31.7	89.2	143.5	182.5
1985	34.4	95.5	162.5	205.0
1986	35.2	100.9	169.8	211.8
1987	35.7	102.2	177.8	233.3
1988	37.2	109.7	195.3	247.1
1989	40.1	111.7	204.6	262.0
1990	38.3	112.4	215.5	280.7
1991	41.1	120.1	225.7	289.8
1992	39.9	120.8	235.7	305.7
1993	43.6	136.4	263.1	339.0
1994	41.4	134.6	266.7	360.6
1995	40.3	132.7	268.1	377.1
1996	40.4	138.1	281.2	396.6
1997	41.0	138.7	288.1	415.9
1998	39.3	146.4	298.0	440.9
1999	43.2	155.9	333.0	529.7
2000	41.1	155.5	331.4	527.1
2001	42.0	156.7	331.0	557.9
2002	40.5	153.7	338.2	554.5
2003	40.9	155.5	345.7	546.9
2004	39.0	148.1	329.5	521.3
2005	40.1	153.4	351.1	568.2
2006	37.8	148.0	330.1	524.8

Chart 4–13
Death Rates for Chronic Obstructive Pulmonary Disease in Black* Females by Age, U.S., 1960–2006

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.^{15, 32, 36, 46}

Year	Deaths/100,000 Population			
	Ages 55–64 Years	Ages 65–74 Years	Ages 75–84 Years	Ages ≥85 Years
1960	2.8	5.1	7.2	29.8
1961	3.0	5.5	12.8	37.5
1962	4.3	6.0	14.6	22.5
1963	4.8	8.3	10.5	42.8
1964	4.0	3.6	8.3	24.4
1965	4.7	6.5	9.4	16.3
1966	5.3	8.6	10.9	18.9
1967	5.1	9.6	13.0	22.8
1968	8.1	8.2	17.1	36.0
1969	7.2	8.7	17.2	33.9
1970	8.6	11.9	17.4	26.7
1971	9.3	15.5	18.9	26.3
1972	8.4	14.0	22.1	46.4
1973	11.4	13.2	23.3	27.3
1974	9.5	16.9	18.4	25.8
1975	9.6	16.8	22.6	26.4
1976	12.8	17.3	21.5	30.6
1977	11.5	17.9	27.4	40.1
1978	16.1	17.5	31.3	60.6
1979	13.1	21.4	30.3	41.2
1980	15.8	25.4	34.4	60.5
1981	16.9	23.9	42.9	43.4
1982	19.6	30.0	43.8	52.5
1983	18.2	30.5	50.5	86.3
1984	20.7	35.9	56.1	89.9
1985	23.2	39.1	67.1	85.7
1986	22.4	41.7	59.0	85.5
1987	23.8	44.3	73.6	105.6
1988	24.6	46.2	66.8	100.7
1989	27.9	55.8	84.2	119.6
1990	25.2	54.4	84.3	122.4
1991	24.7	60.4	84.7	133.7
1992	22.7	62.1	91.2	142.3
1993	24.5	67.0	106.2	143.0
1994	26.1	67.1	106.3	175.8
1995	24.1	65.2	116.5	172.4
1996	23.7	71.8	116.0	193.6
1997	26.0	69.9	118.0	198.6
1998	25.0	73.1	129.3	208.5
1999	27.0	78.9	154.9	233.5
2000	27.8	72.7	145.8	234.0
2001	24.8	76.0	140.1	249.5
2002	24.5	73.6	158.8	249.7
2003	26.6	75.1	144.0	242.6
2004	22.5	69.2	149.2	224.9
2005	25.3	75.2	155.8	261.1
2006	23.5	69.1	154.7	243.1

* Nonwhite from 1960 to 1967.

Chart 4–14**Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by State, U.S., 2003–2005**

In 2003–2005, death rates for COPD tended to be highest in the Mountain States.¹⁵

Rank	State	Deaths/100,000 Population
1	Wyoming	58.9
2	Nevada	58.7
3	West Virginia	58.2
4	Oklahoma	58.0
5	Kentucky	57.4
6	Montana	56.1
7	Indiana	52.3
8	Colorado	51.8
9	Tennessee	51.7
10	Maine	51.2
11	Alabama	50.0
12	Ohio	49.4
13	Mississippi	49.3
14	Vermont	48.9
15	Kansas	48.9
16	Arkansas	48.8
17	Idaho	48.3
18	Oregon	47.3
19	Missouri	46.7
20	North Carolina	46.7
21	New Mexico	46.4
22	Georgia	46.2
23	Nebraska	45.8
24	Iowa	45.3
25	New Hampshire	45.0
26	South Carolina	44.9
27	Washington	44.7
28	South Dakota	44.2
29	Arizona	44.2
30	Michigan	43.1
31	Alaska	42.6
32	Texas	42.3
33	Delaware	42.1
34	Virginia	41.9
35	California	41.6
36	Louisiana	41.1
37	Wisconsin	39.7
38	Illinois	38.9
39	Florida	38.8
40	Pennsylvania	38.7
41	Rhode Island	38.4
42	Maryland	37.4
43	Massachusetts	36.8
44	Connecticut	36.2
45	Minnesota	36.1
46	North Dakota	36.1
47	Utah	34.1
48	New York	32.9
49	New Jersey	32.6
50	Hawaii	20.6

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

Country	Deaths/100,000 Population	
	Male	Female
Scotland	39.2	33.4
United States of America (2006) [†]	37.0	35.4
Romania	35.5	8.6
Denmark (2006) [†]	32.2	38.0
Poland (2006) [†]	30.5	7.5
England and Wales	29.4	22.0
Norway (2006) [†]	26.3	21.9
Czech Republic	25.7	8.5
Netherlands	23.9	17.5
Finland	21.5	5.7
Germany (2006) [†]	21.0	9.5
Republic of Korea (2006) [†]	14.9	2.8
Sweden (2006) [†]	13.9	14.0
Italy (2006) [†]	12.8	4.0
France (2006) [†]	9.4	2.2
Japan	4.5	0.8

* Age-adjusted to European standard.

[†] Data for 2006.

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

Race/Ethnicity	Deaths/100,000 Population	
	Male	Female
Total	46.7	34.6
White*	50.5	39.1
Black*	37.7	18.8
Hispanic	21.2	13.1
Asian	21.1	7.8

* Non-Hispanic.

Chart 4–17

Death Rates for Chronic Obstructive Pulmonary Disease by Age, Race, and Sex, U.S., 2006

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
35–44	1.53	1.08	1.52	1.04
45–54	9.80	8.39	6.52	7.84
55–64	43.26	42.13	23.49	37.76
65–74	132.07	170.21	69.08	148.02
75–84	334.73	450.11	154.65	330.09

Chart 4–18

Prevalence of Asthma Ages Younger Than 18 and 18 and Older, U.S., 1980–2007

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}

Year	12-Month Period Prevalence		Lifetime Prevalence		Attack Prevalence		Current Prevalence	
	Ages <18 Years	Ages ≥18 Years	Ages <18 Years	Ages ≥18 Years	Ages <18 Years	Ages ≥18 Years	Ages <18 Years	Ages ≥18 Years
1980	3.6	3.0	—	—	—	—	—	—
1981	3.8	3.2	—	—	—	—	—	—
1982	4.0	3.3	—	—	—	—	—	—
1983	4.5	3.6	—	—	—	—	—	—
1984	4.3	3.4	—	—	—	—	—	—
1985	4.8	3.3	—	—	—	—	—	—
1986	5.1	3.7	—	—	—	—	—	—
1987	5.3	3.6	—	—	—	—	—	—
1988	5.0	3.8	—	—	—	—	—	—
1989	6.1	4.3	—	—	—	—	—	—
1990	5.7	3.6	—	—	—	—	—	—
1991	6.3	4.2	—	—	—	—	—	—
1992	6.3	4.4	—	—	—	—	—	—
1993	7.2	4.4	—	—	—	—	—	—
1994	6.9	5.1	—	—	—	—	—	—
1995	7.5	5.0	—	—	—	—	—	—
1996	6.2	5.3	—	—	—	—	—	—
1997	—	—	11.4	9.1	5.4	3.7	—	—
1998	—	—	12.1	9.0	5.3	3.4	—	—
1999	—	—	10.8	8.5	5.3	3.4	—	—
2000	—	—	12.4	9.3	5.5	3.5	—	—
2001	—	—	12.7	10.9	5.7	3.8	8.7	6.9
2002	—	—	12.2	10.7	5.8	3.7	8.3	6.8
2003	—	—	12.5	9.7	5.4	3.3	8.5	6.4
2004	—	—	12.2	9.9	5.4	3.6	8.5	6.7
2005	—	—	12.7	10.7	5.2	3.9	8.9	7.2
2006	—	—	13.5	11.0	5.9	3.8	9.3	7.3
2007	—	—	13.1	10.9	—	—	9.1	7.3

Chart 4–19
Prevalence of Asthma by Race, U.S., 1980–2007

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}

Year	12-Month Period Prevalence		Lifetime Prevalence		Attack Prevalence		Current Prevalence	
	Black*	White*	Black*	White*	Black*	White*	Black*	White*
1980	3.37	3.09	—	—	—	—	—	—
1981	3.60	3.20	—	—	—	—	—	—
1982	3.92	3.46	—	—	—	—	—	—
1983	4.51	3.77	—	—	—	—	—	—
1984	3.48	3.69	—	—	—	—	—	—
1985	3.97	3.73	—	—	—	—	—	—
1986	4.25	4.09	—	—	—	—	—	—
1987	4.43	4.02	—	—	—	—	—	—
1988	5.55	3.99	—	—	—	—	—	—
1989	5.31	4.71	—	—	—	—	—	—
1990	4.66	4.13	—	—	—	—	—	—
1991	5.63	4.64	—	—	—	—	—	—
1992	5.68	4.92	—	—	—	—	—	—
1993	6.14	5.02	—	—	—	—	—	—
1994	5.63	5.62	—	—	—	—	—	—
1995	6.70	5.62	—	—	—	—	—	—
1996	6.96	5.34	—	—	—	—	—	—
1997	—	—	4.60	4.10	10.70	9.70	—	—
1998	—	—	4.70	3.80	12.47	9.74	—	—
1999	—	—	4.20	3.80	10.26	9.12	—	—
2000	—	—	4.40	3.90	11.56	10.22	—	—
2001	—	—	5.20	4.20	12.50	11.50	8.3	7.5
2002	—	—	5.40	4.10	13.80	11.10	9.6	7.3
2003	—	—	4.90	3.70	12.90	10.40	9.2	6.9
2004	—	—	5.20	4.00	13.20	10.60	9.4	7.3
2005	—	—	4.55	4.12	13.50	11.30	9.9	7.6
2006	—	—	4.53	4.17	13.50	11.80	9.2	7.9
2007	—	—	5.07	4.02	—	—	—	—

* Non-Hispanic.

Chart 4–20
Prevalence of Current Asthma by Race/Ethnicity and Sex, Ages Younger Than 18, U.S., 2006

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}

Race/Ethnicity	Percent of Population	
	Male	Female
Total	11.0	7.5
Black*	14.2	11.2
White*	10.2	7.2
Hispanic	11.8	6.1

* Non-Hispanic.

Chart 4–21**Prevalence of Current Asthma by Race/Ethnicity and Sex, Ages 18 and Older, U.S., 2006**

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}

Race/Ethnicity	Percent of Population	
	Male	Female
Total	5.6	8.9
Black*	5.4	9.5
White*	6.1	9.2
Hispanic	2.9	7.4

* Non-Hispanic.

Chart 4–22**Physician Office Visits for Asthma, U.S., 1990–2006**

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

Year	Physician Office Visits (Millions)
1990	7.1
1991	8.8
1992	9.7
1993	11.3
1994	10.8
1995	9.0
1996	9.0
1997	9.8
1998	12.9
1999	9.5
2000	9.3
2001	11.3
2002	12.7
2003	12.8
2004	13.6
2005	12.8
2006	10.6

Chart 4–23**Hospitalizations for Asthma by Primary and Secondary Diagnosis, U.S., 1980–2006**

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.^{33, 34}

Year	Hospitalizations (Thousands)	
	Primary Diagnosis	Secondary Diagnosis
1980	379	192
1981	418	210
1982	434	230
1983	459	250
1984	465	274
1985	462	281
1986	477	303
1987	454	331
1988	479	349
1989	475	360
1990	476	385
1991	490	433
1992	463	493
1993	468	532
1994	451	602
1995	511	665
1996	474	709
1997	484	758
1998	423	833
1999	479	869
2000	465	926
2001	454	1,032
2002	484	1,002
2003	574	1,268
2004	497	1,373
2005	489	1,439
2006	444	1,467

Chart 4–24
Hospitalizations for Asthma by Age, U.S., 1980–2006

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.^{33, 34}

Year	Hospitalizations/10,000 Population			
	Ages <15 Years	Ages 15–44 Years	Ages 45–64 Years	Ages ≥65 Years
1980	24.3	9.5	22.9	34.5
1981	25.0	10.6	23.3	28.3
1982	29.3	9.7	22.1	30.4
1983	26.4	10.1	26.7	34.2
1984	28.9	9.9	22.8	37.3
1985	27.8	11.1	21.5	34.1
1986	30.3	10.8	22.0	33.7
1987	28.4	9.7	20.4	33.8
1988	30.9	9.6	20.2	31.0
1989	31.2	11.0	18.9	30.0
1990	30.8	10.3	18.3	32.3
1991	33.9	10.9	18.2	28.5
1992	34.6	9.9	16.5	23.7
1993	28.0	10.9	19.0	26.6
1994	29.5	10.7	15.8	23.0
1995	36.7	11.4	16.7	23.0
1996	33.8	11.1	16.4	17.4
1997	35.8	9.6	15.9	19.2
1998	27.7	8.6	16.2	17.7
1999	31.5	10.0	15.9	21.2
2000	34.7	9.2	13.7	19.5
2001	30.1	8.4	14.3	21.5
2002	30.8	8.8	16.4	22.5
2003	35.0	10.2	18.3	30.5
2004	31.2	7.3	15.9	28.7
2005	26.2	7.8	16.3	30.4
2006	23.9	7.1	16.1	23.6

Chart 4–25
Age-Adjusted Death Rates for Asthma by Race and Sex, U.S., 2006

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

Race	Deaths/100,000 Population	
	Male	Female
Total	0.9	1.3
Black*	2.6	2.9
White*	0.7	1.1
Hispanic	0.7	1.2
Asian	1.2	1.3

* Non-Hispanic.

Chart 4–26**Age-Adjusted Death Rates for Asthma by Race and Sex, Ages 1–24, U.S., 1980–2006**

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}

Year	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
1980	1.03	0.18	0.57	0.14
1981	1.17	0.20	0.48	0.22
1982	1.49	0.27	0.64	0.27
1983	1.41	0.18	0.56	0.27
1984	0.97	0.20	0.56	0.22
1985	1.53	0.20	0.83	0.28
1986	1.44	0.28	0.68	0.28
1987	1.61	0.28	0.77	0.28
1988	1.67	0.28	0.75	0.31
1989	1.59	0.32	0.62	0.31
1990	1.57	0.32	0.61	0.28
1991	1.83	0.32	0.84	0.37
1992	1.83	0.31	0.93	0.31
1993	1.75	0.33	0.81	0.37
1994	2.49	0.40	0.95	0.39
1995	2.30	0.41	0.82	0.49
1996	1.77	0.34	1.01	0.43
1997	1.96	0.44	0.77	0.33
1998	2.37	0.29	0.92	0.33
1999	1.36	0.27	0.66	0.20
2000	1.28	0.23	0.80	0.19
2001	1.13	0.18	0.88	0.15
2002	1.30	0.19	0.64	0.16
2003	1.31	0.20	0.69	0.16
2004	1.15	0.20	0.55	0.16
2005	1.24	0.16	0.65	0.11
2006	1.21	0.16	0.65	0.09

Chart 4–27**Age-Adjusted Death Rates for Asthma by Race and Sex, U.S., 1980–2006**

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.^{15, 35}

Year	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
1980	2.90	1.32	2.64	1.26
1981	3.00	1.27	2.60	1.38
1982	2.96	1.23	2.99	1.37
1983	3.37	1.36	3.35	1.54
1984	3.25	1.37	3.22	1.50
1985	3.66	1.41	3.31	1.69
1986	3.47	1.43	3.77	1.63
1987	4.18	1.46	3.92	1.84
1988	4.48	1.53	4.35	1.87
1989	4.24	1.57	4.30	2.03
1990	4.39	1.58	4.06	1.97
1991	4.25	1.55	4.23	2.09
1992	3.95	1.50	4.43	1.98
1993	4.09	1.52	4.61	2.00
1994	4.43	1.58	4.63	2.09
1995	4.50	1.54	4.85	2.19
1996	4.39	1.48	5.20	2.09
1997	4.03	1.43	4.54	2.01
1998	4.09	1.33	4.76	1.95
1999	3.53	1.02	4.09	1.68
2000	3.50	1.02	4.12	1.51
2001	3.23	0.89	3.82	1.46
2002	3.32	0.94	3.43	1.41
2003	2.91	0.88	3.31	1.67
2004	3.00	0.76	3.07	1.23
2005	2.68	0.74	3.28	1.25
2006	2.53	0.80	2.81	1.13

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.¹⁵

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
1–4	1.07	0.13	0.35	0.09
5–9	0.83	0.12	0.52	0.09
10–14	1.45	0.22	0.81	0.14
15–19	1.45	0.24	0.67	0.18
20–24	1.47	0.30	1.06	0.24
25–34	2.22	0.36	1.41	0.41
35–44	2.66	0.53	3.01	0.82
45–54	3.73	0.78	5.44	1.36
55–64	4.94	1.04	6.74	1.94
65–74	6.47	1.90	8.11	3.34
75–84	7.84	4.00	9.85	6.79

Chart 4–29 Age-Adjusted Death Rates* for Asthma by Country and Sex, 2007

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

Country	Deaths/100,000 Population	
	Male	Female
Poland (2006) [†]	1.89	1.03
Germany (2006) [†]	1.42	1.17
Romania	1.40	1.09
Scotland	1.16	1.71
Denmark (2006) [†]	1.07	1.24
England and Wales	1.03	1.51
Norway (2006) [†]	1.03	1.66
France (2006) [†]	0.99	1.10
Finland	0.94	1.32
United States of America (2006) [†]	0.94	1.34
Czech Republic	0.83	0.82
Sweden (2006) [†]	0.62	1.13
Japan	0.48	0.28
Italy (2006) [†]	0.46	0.44
Netherlands	0.23	0.33

* Age-adjusted to European standard.

[†] Data for 2006.

Chart 4–30
Infant Mortality Rate for Respiratory Distress Syndrome, U.S., 1968–2006

Infant mortality for RDS declined steeply from 1974 to 1981, followed by a slow but appreciable decline through 2006.^{31, 32}

Year	Deaths/100,000 Live Births
1968	236.2
1969	247.9
1970	261.6
1971	267.6
1972	274.8
1973	277.8
1974	263.4
1975	248.0
1976	222.9
1977	198.3
1978	179.7
1979	156.2
1980	138.1
1981	119.0
1982	109.7
1983	101.2
1984	96.9
1985	98.2
1986	90.6
1987	86.2
1988	81.4
1989	89.9
1990	68.5
1991	62.5
1992	50.8
1993	45.4
1994	39.6
1995	37.3
1996	35.0
1997	33.5
1998	32.9
1999	27.3
2000	24.4
2001	25.1
2002	23.4
2003	20.3
2004	21.3
2005	20.8
2006	19.3

Chart 4–31
Infant Mortality Rate for Respiratory Distress Syndrome by Race, U.S., 1980–2006

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

Year	Deaths/100,000 Live Births	
	Black	White
1980	187.9	125.8
1981	178.6	109.8
1982	171.3	100.3
1983	159.4	92.0
1984	149.1	89.3
1985	149.8	90.5
1986	144.2	81.5
1987	145.6	76.5
1988	142.4	70.5
1989	172.2	74.7
1990	143.8	54.6
1991	131.6	50.0
1992	143.3	41.3
1993	104.1	34.9
1994	83.4	32.1
1995	82.7	29.4
1996	79.5	27.3
1997	74.2	26.7
1998	73.9	27.6
1999	61.9	21.5
2000	55.7	19.6
2001	58.2	19.8
2002	56.9	18.4
2003	43.7	16.8
2004	49.4	17.3
2005	46.6	16.5
2006	41.9	15.5

Chart 4–32

Infant Mortality Rate for Respiratory Distress Syndrome by Race/Ethnicity,* U.S., 2005

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

	Deaths/100,000 Live Births
All	20.8
Black	47.1
Hispanic	16.3
Central and South American	20.6
White†	16.6
Mexican-American	13.4
Asian Pacific Islanders	15.1

* No data for American Indians and Puerto Ricans.

† Non-Hispanic.

Chart 4–33

Infant Mortality Rate for Sudden Infant Death Syndrome by Race/Ethnicity, U.S., 2005

In 2005, mortality for SIDS was highest in American Indians and lowest in Asian Pacific Islanders.⁴⁸

	Deaths/100,000 Live Births
All	54.0
American Indian	111.6
Black	99.4
White†	55.4
Puerto Rican	39.5
Mexican-American	28.6
Hispanic	28.1
Asian Pacific Islanders	23.8

* No data for Central and South Americans.

† Non-Hispanic.

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

Blood Diseases	Percent
Other anemias	29.0
Other diseases of blood and blood-forming organs	20.4
Coagulation defects	19.1
Aplastic anemia	10.0
Purpura and other hemorrhagic conditions	9.1
Sickle cell anemia	5.2
Diseases of white blood cells	4.9
Hemochromatosis	2.4

Total Deaths = 9,050 (100%)

Chart 5–2

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

Diagnostic Category	ICD-9-CM Codes	Hospitalizations		Physician Office Visits (1,000)	ICD-10 Codes	Deaths
		First-Listed Discharges (1,000)	Length of Stay (Days)			
Total	280–289, 275	465	4.3	5,503	D50–D89, E83.1	9,050
Anemias	280–285	312	4.0	3,855	D50–D64	3,996
Iron deficiency anemia	280	94	3.5	451	D50	161
Other deficiency anemia	281	—	—	382	D51, D52	53
Cooley's anemia	282.4	9	3.9	7	D56	21
Sickle cell anemia	282.6	57	4.9	104	D57.0, D57.1	473
Aplastic anemia	284	28	5.9	247	D60, D61	901
Other and unspecified anemias	Residual	124	3.6	2,663	Residual	2,387
Coagulation defects	286	13	5.2	113	D65–D68	1,725
Hemophilia: Factor VIII	286.0	—	—	—	D66	59
Hemophilia: Factor IX	286.1	—	—	13	D67	3
Other	Residual	13	5.2	100	Residual	1,706
Purpura and other hemorrhagic conditions	287	35	5.0	490	D69	822
Primary thrombocytopenia	287.3	15	4.7	133	D69.3, D69.4	326
Unspecified thrombocytopenia	287.4	—	—	—	D69.5, D69.6	457
Other	Residual	20	5.3	357	Residual	39
Diseases of white blood cells	288	66	5.0	253	D70–D72	447
Other diseases of blood and blood-forming organs	289	22	4.0	378	D73–D89	1,844
Hemochromatosis	275	17	4.6	414	E83.1	216

* 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%.

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}

Year	Number (Thousands)	
	Primary Diagnosis	Secondary Diagnosis
1982	18	29
1983	20	38
1984	20	41
1985	16	45
1986	18	46
1987	19	63
1988	14	81
1989	15	73
1990	18	86
1991	24	93
1992	23	124
1993	25	119
1994	20	113
1995	23	130
1996	23	146
1997	23	134
1998	28	143
1999	32	151
2000	28	140
2001	28	141
2002	29	154
2003	35	158
2004	29	176
2005	30	179
2006	28	171

Chart 5–4
Age-Adjusted Death Rates* for Aplastic Anemia by Race and Sex, U.S., 2003–2006

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

Race	Deaths/100,000 Population	
	Male	Female
Total	0.35	0.29
White	0.35	0.28
Black	0.37	0.31

* Average annual rates.

Chart 5–5
Death Rates* for Aplastic Anemia by Age, Race, and Sex, U.S., 2003–2006

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

Age (Years)	Deaths/100,000 Population			
	Black Male	White Male	Black Female	White Female
35–44	0.13	0.06	0.12	0.06
45–54	0.19	0.12	0.14	0.11
55–64	0.38	0.28	0.35	0.32
65–74	1.23	0.96	0.78	0.74
75–84	2.35	2.46	1.68	1.85

* Average annual rates.

Chart 5–6
Hospitalization Rates for Sickle Cell Anemia in Blacks, Ages Younger Than 15 and 15–44, U.S., 1982–2006

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}

Year	Hospitalizations/10,000 Population	
	Ages <15 Years	Ages 15–44 Years
1982	11.7	21.0
1983	12.9	20.6
1984	14.2	21.6
1985	12.8	17.8
1986	17.9	21.6
1987	16.5	21.2
1988	18.8	20.3
1989	25.0	22.7
1990	26.6	23.8
1991	21.0	24.1
1992	19.6	20.6
1993	15.9	22.2
1994	13.5	27.7
1995	22.2	26.2
1996	15.6	24.7
1997	18.9	25.6
1998	15.6	27.8
1999	16.6	25.2
2000	21.0	25.4
2001	19.1	30.1
2002	26.0	29.2
2003	16.0	30.8
2004	16.0	31.8
2005	28.0	38.4
2006	17.0	31.9

Chart 5–7**Age-Adjusted Death Rates* for Sickle Cell Anemia in Blacks by Sex, U.S., 1980–1984 to 2003–2006**

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 2003–2006.¹⁵

Year	Deaths/100,000 Population	
	Male	Female
1980–1984	1.22	0.92
1985–1989	1.30	1.03
1990–1994	1.48	1.26
1995–1998	1.43	1.26
1999–2002	1.33	1.26
2003–2006	1.30	1.20

* Average annual rates.

Chart 5–8**Death Rates* for Sickle Cell Anemia in Blacks by Age and Sex, U.S., 2003–2006**

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.¹⁵

Age (Years)	Deaths/100,000 Population	
	Black Male	Black Female
1–4	0.51	0.31
5–14	0.21	0.23
15–24	1.07	0.95
25–34	2.13	1.75
35–44	2.25	1.85
45–54	1.72	2.06
55–64	1.58	1.45
65–74	0.51	0.95
75–84	0.48	0.16

* Average annual rates.

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)

Diagnostic Term in Chart Book	ICD-6 1949–1957	ICD-7 1958–1967	ICDA-8 1968–1978	ICD-9 1979–1998	ICD-10 1999–
Cardiovascular diseases ^a	330–334, 400–468	330–334, 400–468	390–458	390–459	I00–I99
Heart disease	400–402, 410–443	400–402, 410–443	390–398	390–398, 402, 404–429	I00–I09, I11, I13, I20–I51
Coronary heart disease ^b	420, 422	420, 422	410–413	410–414, 429.2	I20–I25
Acute myocardial infarction	*	*	410	410	I21, I22
Heart failure ^c	†	†	427.0, 427.1	428	I50
Congestive heart failure	†	†	427.0	428	I50.1
Cardiomyopathy	†	†	†	425	I42
Cerebrovascular disease (stroke) ^d	330–334	330–334	430–438	430–438	I60–I69
Diseases of arteries	450–456	450–456	440–448	440–448	I70–I78
Congenital anomalies of the circulatory system ^e	†	†	746–747	745–747	Q20–Q28
Chronic obstructive pulmonary disease ^f	500–502, 527.1	500–502, 527.1	490–492, 519.3	490–492, 494–496	J40–J44, J47
Asthma ^g	241	241	493	493	J45, J46
Neonatal respiratory distress syndrome ^h	†	†	776.1, 776.2	769	P22
Sudden infant death syndrome	†	†	†	†	R95

^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.

Cause of Death	Codes of the Classification of International Diseases		Number of Deaths*		Comparability Ratio†
	ICD-10	ICD-9	ICD-10	ICD-9	
Major cardiovascular diseases	I00–I78	390–434, 436–448	942,439	945,945	0.9963
Diseases of the heart	I00–I09, I11, I13, 120–I51	390–398, 402, 404, 410–429	719,631	730,444	0.9852
Coronary heart disease	I20–I25	410–414, 429.2	543,063	542,728	1.0006
Heart failure	I50	428	48,876	47,052	1.0388
Cerebrovascular Disease (stroke)	I60–I69	430–434, 436–438	166,837	158,855	1.0502
COPD	J40–J44	490–492, 494, 496	104,775	99,797	1.0499
Asthma	J45–J46	493	4,971	5,614	0.8855
Neonatal RDS‡	P22	769	2,904	3,144	0.9237

* From a sample of deaths in 1996.⁸

† 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 preceding 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)

Prevalence:	The prevalence of a condition is the number of persons who have the condition at a given time. ³⁷
Relative standard error:	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. ³⁷
Underlying cause of death:	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. ³⁷

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)

CZR	Czech Republic
DEN	Denmark
EW	England/Wales
FIN	Finland
FRA	France
GER	Germany
ITA	Italy
JPN	Japan
KOR	Republic of Korea
NOR	Norway
NTH	Netherlands
POL	Poland
ROM	Romania
SCO	Scotland
SWE	Sweden
USA	United States of America

Appendix E

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