Morbidity & Mortality: 2012 Chart Book on Cardiovascular, Lung, and Blood Diseases

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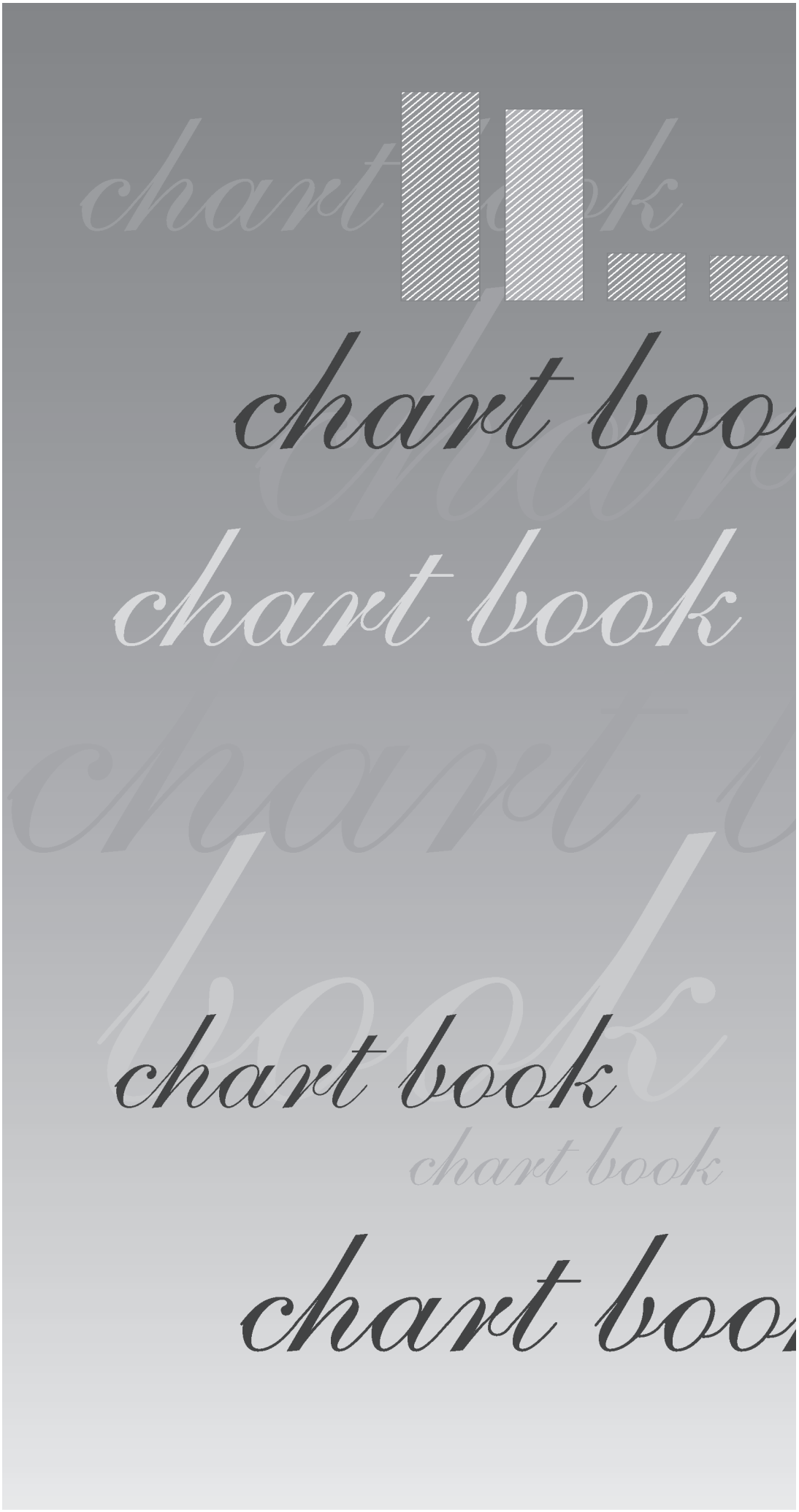

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National Institutes of Health

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.

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 Dr. Michael Mussolino of the NHLBI for his time and effort in developing the material presented in this *Chart Book.*

Also, I would like to acknowledge Ms. Nancy Eng of the NHLBI who has for many years demonstrated extraordinary dedication to ensuring the quality of both the *Chart Book* and the NHLBI *Fact Book.*

[signed]
Susan B. Shurin, M.D.
Acting Director
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Contents

List of Charts

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. The first table in each chapter contains a list of diseases and their diagnostic codes from the 9th revision of the clinical modification of the International Classification (ICD-9-CM), hospitalizations and physician office visit data in 2009 for those codes, codes from the 10th revision of the *International Classification of Diseases* (ICD-10) of the World Health Organization (WHO), and mortality in 2008 for those codes.[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, 1999–2008; the annual National Hospital Discharge Survey (NHDS); the annual National Ambulatory Medical Care Survey; and the National Hospital Ambulatory Care Survey. International mortality data came from the WHO Mortality database.

It is beyond the scope of the *Chart Book* to cite all of the NCHS and Bureau of the Census publications, data tapes, and Websites 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.

Economic Cost

Estimates of the direct costs of cardiovascular, lung, and blood diseases for 2008 appear in Chapter 2, along with indirect costs of mortality from the diseases. The estimates are not comparable to the direct costs included in previous NHLBI *Chart Books* and in NHLBI *Fact Books* before 2010. The estimates in this *Chart Book* are the national health expenditures provided on the Website of the Medical Expenditure Panel Survey, Agency for Healthcare Research and Quality (AHRQ), for 2008.[4]

Indirect costs of lost productivity due to premature mortality are based on mortality data from the NCHS and the present value of lifetime earnings estimates by age and sex from the Institute for Health and Aging, University of California at San Francisco.[5] The values include a 3-percent discount rate to adjust for the effect of inflation on income over a lifetime. The cost estimates were determined by multiplying the age-, sex-, and cause-specific numbers of deaths in 2008 by the estimated present value of lifetime earnings of persons by age and sex in 2007 and then inflating these value by 3 percent for 2008.

Annual estimates of indirect costs of lost productivity due to morbidity are not provided in this *Chart Book* because they would have been developed from very old data.

Quality of Data

Data quality issues discussed below include accuracy of diagnosis, data comparability, and ICD classification.

Prevalence

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

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

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

Methodological problems in data collection preclude the presentation of hospital data by race.[6]

In 1988, the NCHS redesigned the NHDS to link it with other surveys conducted by the NCHS and to improve efficiency. Changes in the NHDS caused a shift in the trend data between 1987 and 1988 for some diseases.[7] A break was inserted in the trend lines between the transitional years to draw attention to when the change occurred.

Cause-of-Death Statistics

Limitations of cause-of-death statistics, other than those associated with 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 limitations 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.

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 is presented in this book only for 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.[8]

ICD Revisions

Revisions in the ICD codes (Appendix A) have affected the comparability of 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 to alert the reader of the issue. 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 3–57), NCHS-derived comparability ratios (as shown in Appendix B) have been applied to the death rates coded by ICD-9.[9]

Data Presentation

Mortality data (rates per population) are generally expressed by age, race/ethnicity, and sex. Age-adjusted mortality data (rates per population or percent change) are expressed by race/ethnicity and sex and in a few cases by States. Prevalence data are given as a percent of a 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.[10–12] The European standard population is applied for age adjustment of international mortality statistics.[13]

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.[14] 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.

An exception to the use of log-linear regression to calculate percent change is made for Chart 3–6, where the percent change and other calculations are based on the actual death rates.

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. The international chart for asthma, however, includes individuals of all ages.

Demographic Characteristics

The *Chart Book* provides prevalence and mortality information for various racial and ethnic groups. Several charts show comparisons between blacks and whites. Prior to 1968, mortality data are presented for nonwhites instead of blacks.

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.[15]

State Mortality

Death rates for total population by State are shown in maps for CVD, CHD, stroke, and COPD.[16] 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). This is true even for stroke mortality in Southern States, which is not just high for blacks. Although rankings of certain States for CHD mortality differ considerably from rankings for total heart disease, their overall geographic patterns are not very different.[17]

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.[18–21] Individuals with multiple CVD are counted for each condition that applies to them, but only once in the estimate for total CVD.

Table 2–1. Prevalence of CVD, U.S.

CVD	82,600,000
Hypertension	76,400,000
CHD	16,300,000
Acute Myocardial Infarction (AMI)	7,900,000
Angina Pectoris	9,000,000
Stroke	7,000,000
Heart Failure	5,700,000
Congenital Heart Defects	1,000,000
Atrial Fibrillation	2,200,000
Peripheral Arterial Disease	8,500,000

Table 2–2 contains estimates for the annual occurrence of CVD in the United States.[22–24]

Table 2–2. Incidence and Recurrence of CVD, U.S.

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

Table 2–3 contains estimates for the prevalence of selected lung diseases in the United States.[25–26]

Table 2–3. Prevalence of Selected Lung Diseases, U.S.

COPD	
Physician-diagnosed	14,800,000
Undiagnosed	12,000,000
Asthma	
Lifetime	39,900,000
Current	24,600,000
Attack	13,000,000
Cystic fibrosis	30,000
Respiratory distress syndrome	
Infants	40,000
Adults	150,000
Obstructive sleep apnea	12,000,000

In this chapter, charts showing leading causes of death combine asthma and status asthmaticus with COPD and list the category as *chronic lower respiratory diseases* (CLRD).

Blood Diseases

An estimated 70,000–100,000 Americans, most of whom are black, 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 thalassemia.

Population

Population estimates in Chart 2–1 are based on the 2000 U.S. Census and population surveys and projections. Estimates in Charts 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., 2009

In 2009, 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.[27]

	Total Population			Male			Female		
	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65
Total	309.6	37.2	13.0	152.8	36.0	11.3	156.8	38.3	14.7
White	245.9	38.3	14.2	122.1	37.1	12.3	123.8	39.4	16.0
Hispanic	(45.8)	(29.4)	(6.0)	(23.7)	(28.9)	(5.0)	(22.0)	(29.9)	(7.0)
Non-Hispanic	(200.1)	(40.3)	(16.1)	(98.4)	(39.0)	(14.0)	(101.8)	(41.5)	(18.0)
Black	40.1	33.3	8.7	19.2	31.8	7.0	20.9	34.7	10.2
Hispanic	(2.0)	(26.6)	(4.8)	(1.0)	(25.7)	(4.0)	(1.0)	(27.5)	(5.6)
Non-Hispanic	(38.0)	(33.7)	(8.9)	(18.2)	(32.1)	(7.2)	(19.9)	(35.1)	(10.4)
American Indian	3.2	31.9	7.6	1.6	31.3	6.7	1.6	32.6	8.5
Asian*	15.0	35.5	9.7	7.2	36.0	8.7	7.7	37.9	10.7
Hispanic†	49.9	29.1	5.8	25.8	28.7	4.9	24.1	29.6	6.9

* Asian includes Native Hawaiian and other Pacific Islanders.
† 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 20.0% Hispanic, 13.0% black, and 6.0% Asian, and 15.9% will be aged 65 and older.[28]

	Total Population			Male			Female		
	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65	Pop. (Mil.)	Mean Age	Percent ≥65
Total	346.7	38.2	15.9	170.8	37.2	14.3	175.9	39.2	17.4
White	269.8	39.2	17.2	133.9	38.2	15.6	135.9	40.1	18.8
Hispanic	(63.7)	(30.8)	(7.5)	(32.2)	(30.3)	(6.5)	(31.5)	(31.4)	(8.5)
Non-Hispanic	(206.1)	(41.7)	(20.2)	(101.7)	(40.6)	(18.5)	(104.4)	(42.8)	(21.9)
Black	44.9	35.3	11.3	21.5	33.7	9.3	23.3	36.7	13.2
Hispanic	(2.6)	(29.5)	(6.7)	(1.3)	(28.4)	(5.7)	(1.3)	(30.5)	(7.7)
Non-Hispanic	(42.2)	(35.6)	(11.6)	(20.2)	(34.0)	(9.6)	(22.0)	(37.1)	(13.5)
American Indian*	3.8	33.7	10.8	1.9	33.0	9.8	1.9	34.5	11.9
Asian*	20.7	37.8	12.6	9.7	36.7	11.4	11.0	38.7	13.6
Hispanic†	69.2	30.6	7.4	35.0	30.1	6.4	34.2	31.2	8.4

* 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., 2008

In 2008, average life expectancy at birth was 78 years—80.5 years for females compared with 75.5 for males, and 78.4 years for whites compared with 74.3 years for blacks.[29]

Age (Years)	Total	Male	Female	Total White	White Male	White Female	Total Black	Black Male	Black Female
Birth	78.0	75.5	80.5	78.4	75.9	80.8	74.3	70.9	77.4
15	63.8	61.3	66.1	64.0	61.6	66.3	60.6	57.2	63.6
35	44.7	42.6	46.7	44.9	42.8	46.9	41.8	39.0	44.3
65	18.7	17.2	19.9	18.7	17.3	19.9	17.5	15.5	18.9
75	11.7	10.6	12.5	11.6	10.6	12.4	11.3	10.0	12.2

Chart 2–4
Age–Adjusted Death Rates for All Causes by Race and Sex, U.S., 1950–2008

From 1950 to 2008, 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.[16, 30, 31]

	Deaths/100,000 Population			
Year	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
2007	1,184.4	890.5	793.8	634.8
2008	1,150.5	889.3	778.4	636.9

* Nonwhite from 1950 to 1967.

Chart 2–5
Unadjusted Death Rates for Selected Causes, U.S., 1950–2008

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 through mid-2000s.[16, 30, 31]

	Deaths/100,000 Population				
Year	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
2007	134.7	45.1	52.6	134.0	41.3
2008	133.3	44.1	52.2	133.8	45.3

* The comparability ratio 1.0502 was applied to stroke death rates reported in vital statistics from 1979 to 1998. Similarly, the comparability ratio 1.0499 was applied to COPD death rates.

Chart 2–6
Number of Days of Inpatient Hospital Care by Major Diagnosis, U.S., 1990–2009

From 1990 to 2009, cardiovascular disease ranked first and respiratory disease ranked second (third in 1994) in the number of days for which patients received hospital care.[32]

	Days of Care (Millions)							
Year	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
2007	26.6	16.9	17.0	15.3	15.1	9.3	7.7	7.6
2008	27.9	19.3	14.6	16.1	16.2	9.8	8.4	7.1
2009	28.7	19.2	14.1	16.9	15.9	9.7	8.7	7.7

Chart 2–7
Age-Adjusted Death Rates by Major Diagnosis, U.S., 1990–2008

From 1990 to 2008, age-adjusted death rates for cardiovascular and respiratory diseases ranked first and third, respectively.[30, 31]

	Deaths/100,000 Population							
Year	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	30.3	16.7	5.0
2001	328.2	200.9	81.6	56.1	34.3	30.3	17.9	5.0
2002	319.0	198.1	81.4	56.7	34.4	30.0	19.1	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
2007	251.2	182.9	71.6	60.1	31.2	27.9	27.4	4.4
2008	244.8	179.8	75.5	58.9	30.6	27.9	30.9	4.3

Chart 2–8
Leading Causes of Death, U.S., 2008

In 2008, heart disease, CLRD, and stroke were the first, third, and fourth leading causes of death, respectively.[31]

Cause of Death	Number
Total Deaths	2,471,984
Heart Disease*	**616,828**
Cancer	565,469
Chronic Lower Respiratory Diseases	**141,090**
Cerebrovascular Diseases (Stroke)	**134,148**
Accidents	121,902
Alzheimer's Disease	82,435
Diabetes	70,553
Influenza and Pneumonia	56,284
Nephritis	48,237
Septicemia	35,927
All Other Causes of Death	599,111

* Includes 405,309 deaths from CHD.

Chart 2–9
Leading Causes of Death by Age and Rank, U.S., 2008

In 2008, 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 seventh for those aged 45–64 years and fourth for those aged 65 years and older. CLRD ranked fourth for those aged 45–64 years and third for those aged 65 years and older.[31]

	Age (Years)			
Cause of Death	**1–24**	**25–44**	**45–64**	**≥65**
Heart Disease	**5**	**3**	**2**	**1**
Cancer	4	2	1	2
Cerebrovascular Diseases (Stroke)	**8**	**8**	**7**	**4**
Accidents	1	1	3	9
Chronic Lower Respiratory Diseases	**9**	**—**	**4**	**3**
Influenza and Pneumonia	7	10	—	7
Diabetes Mellitus	—	9	5	6
Suicide	3	4	8	—
Chronic Liver Disease	—	7	6	—
Nephritis and Nephrosis	—	—	10	8
Homicide	2	5	—	—
Septicemia	10	—	9	10
Congenital Malformations	6	—	—	—
HIV Disease	—	6	—	—
Alzheimer's Disease	—	—	—	5

Chart 2–10
Leading Causes of Death, White Males, U.S., 2008

In 2008, among white males, heart disease, CLRD, and stroke were the first, fourth, and fifth leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Heart Disease	**25.6**
Cancer	24.3
Accidents	6.4
Chronic Lower Respiratory Diseases	**5.9**
Stroke	**4.2**
Diabetes	2.7

Chart 2–11
Leading Causes of Death, White Females, U.S., 2008

In 2008, heart disease was the leading cause of death among white females. CLRD and stroke were tied for the third leading cause of death.[31]

Cause of Death	Percent of All Deaths
Heart Disease	**24.6**
Cancer	21.6
Chronic Lower Respiratory Diseases	**6.4**
Stroke	**6.4**
Alzheimer's Disease	5.0
Accidents	3.6

Chart 2–12
Leading Causes of Death, Black Males, U.S., 2008

In 2008, among black males, heart disease and stroke were the first and fourth leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Heart Disease	**24.0**
Cancer	22.4
Accidents	5.7
Stroke	**4.9**
Homicide	4.9
Diabetes	3.7

Chart 2–13
Leading Causes of Death, Black Females, U.S., 2008

In 2008, among black females, heart disease and stroke were the first and third leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Heart Disease	**24.9**
Cancer	21.8
Stroke	**6.7**
Diabetes	4.7
Nephritis	3.3
Accidents	2.8

Chart 2–14
Leading Causes of Death, Asian Males, U.S., 2008

In 2008, among Asian males, heart disease, stroke, and CLRD were the second, third, and sixth leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Cancer	27.0
Heart Disease	**24.2**
Stroke	**6.5**
Accidents	5.2
Diabetes	3.7
Chronic Lower Respiratory Diseases	**3.6**

Chart 2–15
Leading Causes of Death, Asian Females, U.S., 2008

In 2008, among Asian females, heart disease and stroke were the second and third leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Cancer	26.9
Heart Disease	**22.3**
Stroke	**8.9**
Diabetes	3.9
Accidents	3.3
Influenza/Pneumonia	3.2

Chart 2–16
Leading Causes of Death, Hispanic Males, U.S., 2008

In 2008, among Hispanic males, heart disease and stroke were the first and fourth leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Heart Disease	**20.2**
Cancer	19.9
Accidents	10.9
Stroke	**4.4**
Diabetes	4.3
Homicide	3.6

Chart 2–17
Leading Causes of Death, Hispanic Females, U.S., 2008

In 2008, among Hispanic females, heart disease, stroke, and CLRD were the second, third, and sixth leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Cancer	21.8
Heart Disease	**21.6**
Stroke	**6.0**
Diabetes	5.2
Accidents	4.4
Chronic Lower Respiratory Diseases	**3.1**

Chart 2–18
Leading Causes of Death, American Indian Males, U.S., 2008

In 2008, among American Indian males, heart disease was the leading cause of death.[31]

Cause of Death	Percent of All Deaths
Heart Disease	**18.7**
Cancer	17.8
Accidents	14.2
Chronic Liver Disease	5.0
Diabetes	4.8
Suicide	4.0

Chart 2–19
Leading Causes of Death, American Indian Females, U.S., 2008

In 2008, among American Indian females, heart disease and CLRD were the second and sixth leading causes of death, respectively.[31]

Cause of Death	Percent of All Deaths
Cancer	19.3
Heart Disease	**17.1**
Accidents	7.9
Diabetes	5.9
Chronic Liver Disease	5.1
Chronic Lower Respiratory Diseases	**4.7**

Chart 2–20
Prevalence of Leading Chronic Conditions Causing Limitation of Activity, U.S., 2010

In 2010, heart disease was the third most prevalent chronic condition causing activity limitation. Hypertension, lung conditions, and stroke were also common.[25]

Chronic Condition	Prevalence (Millions)
Back/Neck Conditions	7.5
Arthritis/Rheumatism	6.8
Heart Condition	**4.2**
Depression/Anxiety	**4.0**
Musculoskeletal Condition	3.8
Diabetes	**3.6**
Hypertension	3.6
Nervous System Problem	**3.3**
Lung/Breathing Problem	**3.1**
Fracture/Bone/Joint Injury	2.8
Vision Problem	2.3
Stroke	**1.7**
Cancer	1.5

Chart 2–21
Age-Adjusted Percent of Population Currently Smoking by Race and Sex, Ages 18 and Older, U.S., 1965–2010

From 1965 to 1990, the percent of the population aged 18 years and older who reported that they smoke cigarettes decreased significantly.[25] From 1991 to 2010, the percent of the population who reported that they smoke declined modestly.[25, 33]

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
2008	24.7	23.0	17.4	19.5
2009	23.1	23.6	18.5	18.7
2010	23.3	21.4	16.6	18.3

Chart 2–22
Age-Adjusted Percent of Population With High Serum Cholesterol* by Race and Sex, Ages 20–74, U.S., 1976–1980 to 2005–2008

From 1976–1980 to 1999–2004, the prevalence of high total serum cholesterol declined for each sex and racial/ethnic group. In 2005–2008, the prevalence continued to decline for black and white males and females but increased for Mexican-American females.[18]

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
1999–2004	17.0	17.6	13.2	15.0	16.6	12.8
2005–2008	14.2	16.7	9.6	12.6	17.0	13.9

* 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 2005–2008

From 1976–1980 to 2005–2008, the prevalence of overweight increased for males and females of each racial/ethnic group.[18]

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
1999–2004	68.9	56.6	61.8	77.4	73.2	71.5
2005–2008	72.3	59.2	70.8	78.7	78.7	75.7

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

Chart 2–24
Economic Cost of Cardiovascular, Lung, and Blood Diseases, U.S., 2008

In 2008, the total cost of cardiovascular, lung, and blood diseases was approximately $432 billion, including $290 billion in health care expenditures and $142 billion in lost productivity.[4, 5, 31]

	Dollars (Billions)		
Disease	Total	Direct	Mortality
Total CVD	297.7	179.3	118.4
Heart Disease	190.3	95.6	94.7
Stroke	34.3	18.8	15.5
Hypertension	50.6	47.4	3.2
Other CVD	22.5	17.5	5.0
Hyperlipidemia	39.8	38.6	1.2
COPD/Asthma	68.0	53.7	14.3
Pneumonia	20.4	14.0	6.4
Anemias	5.9	4.7	1.2

Chart 2–25
Direct Cost of Cardiovascular, Lung, and Blood Diseases, U.S., 2008

In 2008, hospital inpatient care was the largest type of direct cost for health care expenditures related to cardiovascular, lung, and blood diseases. However, prescription medication accounted for the highest expenditures for hyperlipidemia, hypertension, and COPD/asthma.[4]

	Dollars (Billions)					
Disease	Total	Hospital Inpatient Stays	Emergency Room Visits	Outpatient or Office-Based Providers	Prescription Medicines	Home Health Care
Total CVD	179.3	79.7	10.8	36.4	33.0	19.5
Heart Disease	95.6	54.0	7.3	16.9	9.7	7.6
Stroke	18.8	9.1	0.9	1.8	1.2	5.8
Hypertension	47.4	6.2	1.7	13.0	21.3	5.1
Other CVD	17.5	10.4	0.9	4.7	0.7	0.8
Hyperlipidemia	38.6	1.3	0.1	9.0	27.1	1.0
COPD/Asthma	53.7	13.1	3.1	13.2	20.4	4.0
Pneumonia	14.0	11.9	0.6	0.8	0.3	0.5
Anemias	4.7	3.2	0.1	1.1	0.2	0.2

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 2008 specific to CVD, heart disease, and stroke deaths, respectively.[31] Chart 3–4 lists CVD; ICD-9-CM codes for CVD; 2009 estimates of hospital discharges, lengths of stay, and physician office visits for those diagnostic codes; ICD-10 codes for CVD; and the number of deaths in 2008 for those codes.[31, 32, 34] Subsequent charts display morbidity and mortality for total CVD and selected subgroups.

Coronary Heart Disease

CHD includes AMI and angina pectoris. In this chapter, charts provide information about 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 have 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.

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.

Cardiomyopathy

In 2008, 23,932 deaths were attributed to cardiomyopathy, although no consensus exists on classification and diagnostic criteria for the disease. This limitation has little effect on any mortality differences influenced by age, race, or sex.

Atrial Fibrillation

In 2008, 15,383 deaths were attributed to atrial fibrillation as the underlying cause. Normally, the disorder is not intrinsically a fatal condition, although it does predispose individuals to potentially fatal conditions such as stroke.

Cerebrovascular Diseases (Stroke)

Cerebrovascular disease (i.e., stroke) is the fourth 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.

Peripheral Artery Disease

The ICD term *diseases of arteries* is used to refer to peripheral arterial 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
Deaths From Cardiovascular Diseases, Percent by Subgroup, U.S., 2008

Cause of Death	Percent
CHD	49.9
Stroke	16.5
Other CVD	15.6
Hypertensive Diseases	7.5
Heart Failure (Underlying)*	7.0
Diseases of Arteries	3.4

* Heart failure as an underlying cause or otherwise mentioned on the death certificate accounted for 35% (281,437) of total CVD deaths.

Total deaths = 811,940 (100%), including 3,415 due to congenital CVD defects.

Compiled from Vital Statistics of the United States, NCHS.

Chart 3–2
Deaths From Heart Disease, Percent by Subgroup, U.S., 2008

Cause of Death	Percent
Other CHD	43.8
AMI	21.6
Hypertensive	9.2
Rheumatic/Congenital	8.0
Heart Failure (Underlying)*	6.9
Rhythmic	5.7
Other	3.9
Cardiomyopathy	1.0

* Heart failure as an underlying cause or otherwise mentioned on the death certificate accounted for 45% (281,437) of total heart disease deaths.

Total deaths = 619,574 (100%), including 2,746 from congenital CVD defects.

Compiled from Vital Statistics of the United States, NCHS.

Chart 3–3
Deaths From Stroke, Percent by Subgroup, U.S., 2008

Cause of Death	Percent
Stroke, Unspecified	52.7
Other Hemorrhage	20.7
Other Cerebrovascular	17.6
Cerebral Infarction	4.9
Subarachnoid Hemorrhage	4.1

Total deaths = 134,148 (100%).

Compiled from Vital Statistics of the United States, NCHS.

Chart 3–4
Number of Hospitalizations, Physician Office Visits,* and Deaths for Cardiovascular Diseases, U.S., 2008–2009

Diagnostic Category	ICD-9-CM Codes	Hospitalizations for 2009: First-Listed Discharges (1,000)	Hospitalizations for 2009: Length of Stay (Days)	Physician Office Visits for 2009 (1,000)	ICD-10 Codes	Deaths for 2008
Total	390–405, 410–449, 451–459, 745–747	6,217	4.7	94,871	I00–I99, Q20–Q28	811,940
Heart disease:	390–398, 402, 404, 410–429	3,994	4.6	27,697	I00–I09, I11, I13, I20–I51	616,828
Rheumatic heart disease	390–398	38	7.5	254	I00–I09	3,141
Hypertensive heart disease	402, 404	84	5.3	334	I11, I13	35,263
Coronary heart disease:	410–414, 429.2	1,537	4.1	12,817	I20–I25	405,309
AMI	410	634	5.0	311	I21, I22	133,958
Angina pectoris, stable	413	34	4.9	931	I20.1–I20.9	126
Angina pectoris, unstable	411	49	2.2	91	I20.0	36
Atherosclerotic CVD	429.2	—	—	—	I25.0	58,625
Other CHD	412, 414	820	3.5	11,484	Other I23–I25	212,564
Diseases of pulmonary circulation:	415–417	182	5.8	590	I26–I28	12,927
Pulmonary embolism	415.1	158	5.7	487	I26	7,158
Other	415.0, 415.2–417	24	6.9	103	I27–I28	5,769
Subacute bacterial endocarditis	421	11	13.5	7	I33.0	1,143
Cardiomyopathy	425	52	4.6	841	I42	23,932
Atrial fibrillation and flutter	427.3	467	4.1	5,560	I48	15,383
Other arrythmic disorders	Other 427	323	3.5	2,276	Other I43–I49	27,299
Heart failure:	428	1,094	5.2	3,041	I50	56,830
Congestive heart failure	428.0	468	5.0	2,996	I50.0	51,693
Left heart failure and unspecified	428.1–428.9	626	5.4	46	I50.1–I50.9	5,137
Other heart disease	Other 420–429	206	5.8	1,976	Other I30–I51	35,601
Other hypertensive disease	401, 403, 405	499	3.3	53,586	I10, I12, I15	25,742
Cerebrovascular diseases (stroke)	430–438	971	5.3	3,327	I60–I69	134,148
Diseases of arteries:	440–449	331	5.9	2,948	I70–I78	27,765
Peripheral arterial disease	440.20–440.24, 440.30–440.32, 440.4, 440.9, 443.9, 445.02	166	6.0	1,155	I70.2, I70.9, I73.9, I74.3, I74.4	14,501
Aortic aneurysm	441	84	5.7	684	I71	11,079
Other diseases of arteries	Other 440–449	82	5.7	1,108	Other I70–I78	2,185
Deep vein thrombosis	451.1	3	4.3	148	I80.2	2,352
Other and unspecified CVD	Other 451–459	368	4.0	6,782	Other I80–I99	1,690
Congenital malformations of CV system:	745–747	52	7.3	383	Q20–Q28	3,415
Congenital heart disease	745, 746	35	6.5	280	Q20–Q24	2,746
Other congenital cardiovascular disease	747	17	8.8	103	Q25–Q28	669

* 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%.

Compiled from references 31, 32, and 34.

Chart 3–5
Change in Age-Adjusted Death Rates for Cardiovascular and Non-Cardiovascular Diseases, U.S., 1950–2008

The death rate for CHD increased almost 10% from 1950 to its peak in 1968; by 2008, it was approximately 72% lower than it was in 1950. Stroke mortality, on the other hand, declined for most of those years and by 2008 was 77% lower than it was in 1950. By comparison, the death rate for non-CVD causes in 2008 decreased by only 15% since 1950.[30, 31]

	Percent Change		
Year	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
2007	-71.3	-76.6	-15.8
2008	-72.1	-77.5	-15.1

* 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 2008

From 1968 to 2008, the death rate for CVD declined nearly 68%, compared with a nearly 6% decline in the rate for all non-CVD causes. Mortality for CHD and stroke each declined approximately 75%.[30, 31]

Cause of Death	Deaths/100,000 Pop.		1968–2008 Difference	Percent Change
	1968	2008		
All causes	1,304.5	758.4	-546.1	-41.9
CVD*	759.5	244.8	-514.7	-67.8
CHD	482.6	122.7	-359.9	-74.6
Stroke	162.5	40.7	-121.8	-75.0
Other CVD	114.4	81.4	-33.0	-28.8
Non-CVD	545.0	513.6	-31.4	-5.8

* 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., 1968–2008

From 1968 to 2008, the death rate for total CVD, CHD, and stroke declined. The 1999–2008 average annual percent declines in the age-adjusted death rates were 4.2% for CVD, 5.3% for CHD, and 5% for stroke.[30, 31]

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
1979–1988	-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
1999–2008	-1.8	-4.2	-5.3	-5.0	-1.7	-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., 1999–2008

From 1999 to 2008, average annual percent declines in mortality for CVD, CHD, and stroke within sex groups were usually greater in whites than in blacks. Within racial groups, the decline in CHD mortality was greater in females than in males.[30, 31]

Cause of Death	All Causes	Black Male	White Male	Black Female	White Female
All Causes	-1.8	-2.4	-2.0	-2.1	-1.6
CVD*	-4.2	-3.4	-4.3	-4.0	-4.3
Heart Disease	-4.0	-3.5	-4.0	-4.2	-4.2
CHD	-5.2	-4.7	-5.0	-5.6	-5.6
Stroke	-4.9	-4.2	-5.3	-4.4	-4.9
Non-CVD	-0.4	-1.7	-0.7	-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., 1979–2008

Although age-adjusted death rates for CVD declined considerably between 1979 and 2008, the total number of CVD deaths did not begin to decline until 2000.[30, 31]

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
2007	810	251.2
2008	806	244.8

Chart 3–10
Percent of All Deaths Due to Cardiovascular Diseases* by Age, U.S., 2008

In 2008, the percent of deaths due to CVD increased with age among adults: more than 19% for those aged 35–44 years and nearly 43% for those aged 85 years and older.[31]

Age (Years)	Percent of All Deaths
<1	7.6
1–4	9.7
5–14	8.5
15–24	5.0
25–34	10.3
35–44	19.3
45–54	25.3
55–64	28.0
65–74	29.1
75–84	34.2
≥85	42.6

* Includes congenital malformations of the circulatory system.

Chart 3–11
Age-Adjusted Death Rates for Cardiovascular Diseases* by State, U.S., 2005–2007

In 2005–2007, CVD mortality was generally highest in the Southern United States.[16]

Rank	State	Deaths/100,000 Population
1	Mississippi	355.1
2	Alabama	330.7
3	Oklahoma	327.2
4	West Virginia	314.7
5	Louisiana	313.0
6	Arkansas	312.2
7	Tennessee	310.6
8	Kentucky	310.0
9	Michigan	295.8
10	Missouri	292.7
11	Georgia	289.0
12	Ohio	285.9
13	Indiana	285.2
14	Nevada	284.1
15	New York	278.6
16	South Carolina	277.1
17	Pennsylvania	273.3
18	North Carolina	272.0
19	Maryland	271.2
20	Illinois	269.5
21	Texas	267.3
22	Delaware	266.0
23	Rhode Island	262.3
24	Virginia	257.9
25	New Jersey	256.4
26	Kansas	256.0
27	California	254.8
28	Iowa	249.8
29	Wyoming	245.4
30	Wisconsin	243.8
31	Idaho	237.1
32	North Dakota	236.2
33	Maine	236.1
34	Nebraska	234.7
35	Washington	234.7
36	South Dakota	234.2
37	Oregon	232.7
38	New Hampshire	232.3
39	Connecticut	231.5
40	Florida	228.1
41	Vermont	227.5
42	Montana	226.9
43	Massachusetts	224.7
44	New Mexico	224.7
45	Alaska	221.0
46	Colorado	215.8
47	Arizona	215.7
48	Utah	211.0
49	Hawaii	207.7
50	Minnesota	194.7

* Excludes congenital malformations of the circulatory system.

Chart 3–12
Percent Decline in Age-Adjusted Death Rates for Cardiovascular Diseases* by State, U.S., 1996–1998 to 2005–2007

From 1996–1998 to 2005–2007, the smallest percent declines in death rates for CVD tended to be in the Southern United States.[16]

Rank	State	Percent Decline
1	Minnesota	-35.4
2	Vermont	-34.9
3	New Hampshire	-34.3
4	Nebraska	-33.8
5	South Carolina	-32.8
6	Connecticut	-32.6
7	Maine	-31.6
8	South Dakota	-31.6
9	Florida	-31.4
10	Virginia	-31.0
11	New York	-31.0
12	Arizona	-30.9
13	Alaska	-30.7
14	Massachusetts	-30.7
15	Hawaii	-30.5
16	Illinois	-30.3
17	North Dakota	-30.1
18	Wisconsin	-30.0
19	Oregon	-29.8
20	North Carolina	-29.7
21	New Jersey	-29.5
22	Colorado	-29.4
23	Pennsylvania	-29.3
24	Utah	-29.2
25	Texas	-29.0
26	Georgia	-29.0
27	Montana	-28.9
28	Iowa	-28.8
29	Ohio	-28.0
30	Indiana	-27.9
31	California	-27.7
32	Missouri	-27.6
33	Washington	-27.2
34	Delaware	-27.1
35	West Virginia	-26.9
36	Tennessee	-26.9
37	Kentucky	-26.5
38	Kansas	-26.3
39	Michigan	-26.2
40	Idaho	-26.0
41	New Mexico	-25.9
42	Rhode Island	-25.5
43	Nevada	-25.3
44	Wyoming	-24.6
45	Maryland	-24.4
46	Arkansas	-24.3
47	Louisiana	-23.8
48	Mississippi	-23.7
49	Oklahoma	-22.8
50	Alabama	-19.1

* Excludes congenital malformations of the circulatory system.

Chart 3–13
Age-Adjusted Death Rates for Heart Disease by Race/Ethnicity and Sex, U.S., 2008

In 2008, heart disease mortality was 54% higher in males than in females. Within sex groups, it was highest in non-Hispanic blacks and lowest in Asians.[31]

	Deaths/100,000 Population	
Race/Ethnicity	Male	Female
Total	232.3	150.4
Black*	301.9	201.1
White*	235.9	150.0
American Indian	149.1	94.5
Hispanic	151.9	104.6
Asian	124.7	81.7

* Non-Hispanic.

Chart 3–14
Death Rates for Heart Disease in Males by Age and Race/Ethnicity, U.S., 2008

In 2008, heart disease mortality in males was highest in non-Hispanic blacks across all age groups.[31]

	Deaths/100,000 Population				
Age (Years)	Black*	White*	American Indian	Hispanic	Asian
45–54	206.7	122.5	122.4	67.6	51.6
55–64	504.3	274.4	236.7	195.3	134.6
65–74	999.1	595.1	530.6	452.1	317.5
75–84	1,996.6	1,641.1	928.8	1,139.9	899.0

* Non-Hispanic.

Chart 3–15
Death Rates for Heart Disease in Females by Age and Race/Ethnicity, U.S., 2008

In 2008, heart disease mortality was highest in non-Hispanic blacks across all age groups, and the disparity in mortality between non-Hispanic blacks and other racial and ethnic groups was as great or greater for females than for males (also see Chart 3–14).[31]

	Deaths/100,000 Population				
Age (Years)	Black*	White*	American Indian	Hispanic	Asian
45–54	115.1	43.3	40.0	24.3	13.4
55–64	246.2	106.3	106.5	79.6	51.3
65–74	535.9	299.1	265.7	245.7	163.8
75–84	1,353.7	1,052.9	717.6	768.8	614.2

* Non-Hispanic.

Chart 3–16
Age-Adjusted Prevalence of Acute Myocardial Infarction by Race and Sex, Ages 25–74, U.S., 1971–1975 to 2005–2008

From 1971–1975 to 2005–2008, the prevalence of AMI declined in whites. In blacks, it rose from 1976–1980 to 1988–1994 but then declined through 2005–2008. The prevalence of AMI mostly declined from 1971–1975 to 2005–2008 in males, but only declined in 1976–1980 in females, followed by little change.[18]

	Percent of Population			
Years	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
1999–2004	3.09	3.15	4.36	1.87
2005–2008	2.69	2.66	3.46	2.04

Chart 3–17
Prevalence of Acute Myocardial Infarction by Age and Sex, U.S., 1999–2008

In 1999–2008, the prevalence of AMI was much higher in males than in females and increased substantially with age.[18]

	Percent of Population	
Age (Years)	Male	Female
35–44	1.05	0.48
45–54	3.22	1.89
55–64	9.48	3.72
65–74	14.53	6.46
≥75	19.40	10.29

Chart 3–18
Prevalence of Acute Myocardial Infarction by Age and Race, U.S., 1999–2008

In 1999–2008, the prevalence of AMI was relatively similar between blacks and whites for three of the five age groups. For those in the 35–44 age group, the prevalence was 45% higher in blacks than in whites, but in the 65–74 age group, it was 27% higher in whites than in blacks.[18]

	Percent of Population	
Age (Years)	Black	White
35–44	1.42	0.78
45–54	2.71	2.65
55–64	6.93	6.39
65–74	7.78	10.71
≥75	14.07	14.52

Chart 3–19
Prevalence of Angina Pectoris by Age and Sex, U.S., 2001–2008

In 2001–2008, the prevalence of angina pectoris, which increased substantially with age, was slightly higher in females than in males aged 35–54 years, but was higher in males than in females aged 65 years and older.[18]

	Percent of Population	
Age (Years)	Male	Female
35–44	1.6	2.1
45–54	4.3	5.0
55–64	7.2	7.0
65–74	12.0	10.4
≥75	13.5	11.9

Chart 3–20
Prevalence of Angina Pectoris by Age and Race, U.S., 2001–2008

In 2001–2008, the prevalence of angina pectoris was higher in blacks than in whites aged 35–64 years, but was higher in whites than in blacks aged 65 years and older.[18]

	Percent of Population	
Age (Years)	Black	White
35–44	2.9	1.8
45–54	6.4	4.4
55–64	8.7	6.7
65–74	9.4	11.2
≥75	8.7	13.2

Chart 3–21
Emergency Department Visit Rates for Coronary Heart Disease by Sex, U.S., 1997–1999 to 2006–2008

From 1997–1999 to 2006–2008, emergency department visit rates for CHD decreased more than 40% for males and about 50% for females.[35]

	Visits/10,000 Population	
Years	Male	Female
1997–1999	45.2	31.0
2000–2002	39.9	25.7
2003–2005	26.1	19.6
2006–2008	25.7	15.9

Chart 3–22
Hospitalization Rates for Acute Myocardial Infarction, Ages 45–64 and 65 and Older, U.S., 1965–2009

From 1965 to the mid-1970s, hospitalization rates for AMI increased for those aged 45–64 years and then remained stable before declining in the mid-1990s through 2009. For those aged 65 years and older, hospitalization rates increased from 1965 to 1986; the rates began to decline in the early 2000s and continued to decline through 2009.[32]

	Hospitalizations/10,000 Population	
Year	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	29.2	105.7
2007	25.8	91.4
2008	28.0	101.8
2009	25.9	98.7

Chart 3–23
Hospital Case-Fatality Rates for Acute Myocardial Infarction, Ages Younger Than 65 and 65 and Older, U.S., 1970–2009

From 1970 to 2009, hospital case-fatality rates for AMI declined substantially for those younger than 65 years of age and for those aged 65 years and older.[32]

	Percent Discharged Dead	
Year	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
2007	3.2	9.0
2008	2.1	9.8
2009	1.9	7.6

Chart 3–24
Age-Adjusted Death Rates for Coronary Heart Disease, Actual and Expected, U.S., 1950–2008

CHD accounted for 405,000 deaths in 2008. It would have accounted for 1,579,000 deaths if CHD mortality had remained at its 1968 peak.[30, 31]

	Deaths/100,000 Population		
Year	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
2007	126.0	584.3	482.6
2008	122.7	587.3	482.6

Chart 3–25
Age-Adjusted Death Rates for Coronary Heart Disease by Race/Ethnicity and Sex, U.S., 1999–2008

From 1999 to 2008, CHD mortality declined in non-Hispanic blacks, non-Hispanic whites, Hispanics, Asians, and American Indians, both male and female.[30, 31]

	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
2007	194.8	168.8	112.2	122.2	91.8
2008	187.2	165.5	105.1	111.6	92.7

	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
2007	123.4	95.2	65.6	77.8	55.0
2008	117.4	93.2	57.9	72.1	54.2

* Non-Hispanic.

Chart 3–26
Age-Adjusted Death Rates for Coronary Heart Disease by Race and Sex, U.S., 1950–2008

In the 1950s and 1960s, death rates for CHD increased in males, both black and white, and in black females, but were relatively stable in white females. Since then, rates for individual race and sex groups have declined appreciably.[30, 31]

	Deaths/100,000 Population			
Year	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
2007	191.6	165.6	121.5	94.2
2008	183.7	161.7	115.6	91.9

* Nonwhite from 1950 to 1967.

Chart 3–27
Deaths and Age-Adjusted Death Rates for Coronary Heart Disease, U.S., 1980–2008

The number of deaths and the age-adjusted death rates for CHD have decreased almost every year since 1980. In 2008, the number of deaths and the death rates for CHD were approximately 36% and 64% lower, respectively, than they were in 1980.[30, 31]

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
2007	406	126.0
2008	405	122.7

Chart 3–28
Average Annual Percent Change in Age-Adjusted Death Rates for Coronary Heart Disease by Race and Sex, U.S., 1950–2008

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 1999–2008 period.[30, 31]

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
1979–1988	-2.8	-1.8	-3.1	-1.5	-2.6
1989–1998	-2.8	-2.4	-2.9	-2.3	-2.8
1999–2008	-5.2	-4.7	-5.0	-5.6	-5.6

* Nonwhite from 1950 to 1967.

Chart 3–29
Average Annual Percent Change in Death Rates for Coronary Heart Disease by Age, Race, and Sex, U.S., 1999–2008

From 1999 to 2008, among blacks and whites and males and females, 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.[30, 31]

Age (Years)	Black Male	White Male	Black Female	White Female
35–44	-3.2	-2.3	-3.3	-0.6
45–54	-3.2	-2.5	-3.1	-1.1
55–64	-4.2	-4.1	-5.4	-4.9
65–74	-4.7	-5.9	-6.5	-6.3
75–84	-4.5	-5.2	-5.7	-5.6
≥85	-6.2	-5.3	-5.4	-5.9

Chart 3–30
Age-Adjusted Death Rates for Coronary Heart Disease by Race/Ethnicity and Sex, U.S., 2008

In 2008, CHD mortality was approximately 73% higher in males than in females. Within sex groups, it was highest in non-Hispanic blacks and lowest in Asians.[31]

	Deaths/100,000 Population	
Race/Ethnicity	Male	Female
Total	161.2	93.0
Black*	187.2	117.4
White*	165.5	93.0
American Indian	105.1	57.9
Hispanic	111.6	72.1
Asian	92.7	54.2

* Non-Hispanic.

Chart 3–31
Death Rates for Coronary Heart Disease in Males by Age and Race/Ethnicity, U.S., 2008

In 2008, CHD mortality in males increased with age for non-Hispanic blacks, non-Hispanic whites, Hispanics, American Indians, and Asians. Mortality was highest in non-Hispanic blacks at all ages and lowest in Asians aged 45–74 years.[31]

	Deaths/100,000 Population				
Age (Years)	Black*	White*	American Indian	Hispanic	Asian
45–54	113.8	86.9	84.9	47.0	37.7
55–64	311.6	205.7	171.0	145.7	105.7
65–74	649.4	441.8	392.8	348.3	248.6
75–84	1,301.6	1,171.4	690.1	851.6	695.3

* Non-Hispanic.

Chart 3–32
Death Rates for Coronary Heart Disease in Females by Age and Race/Ethnicity, U.S., 2008

In 2008, CHD mortality in females increased with age for non-Hispanic blacks, non-Hispanic whites, Hispanics, American Indians, and Asians. At all ages, mortality was highest in non-Hispanic blacks and lowest in Asians.[31]

Age (Years)	Deaths/100,000 Population				
	Black*	White*	American Indian	Hispanic	Asian
45–54	54.2	25.7	24.5	13.4	6.9
55–64	140.3	69.8	59.2	52.5	31.1
65–74	323.1	198.0	169.8	169.5	112.4
75–84	832.7	670.3	457.8	539.3	421.1

* Non-Hispanic.

Chart 3–33
Age-Adjusted Death Rates for Coronary Heart Disease by State, U.S., 2005–2007

In 2005–2007, 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.[16]

Rank	State	Deaths/100,000 Population
1	New York	181.1
2	Oklahoma	177.8
3	Rhode Island	171.0
4	Tennessee	167.8
5	West Virginia	161.5
6	Arkansas	159.8
7	Michigan	158.4
8	Missouri	153.1
9	Ohio	152.0
10	Kentucky	149.3
11	Mississippi	148.6
12	Maryland	144.9
13	Delaware	144.5
14	New Jersey	142.2
15	Iowa	141.1
16	Louisiana	139.4
17	Pennsylvania	138.4
18	California	136.4
19	Indiana	135.9
20	South Dakota	134.9
21	Texas	134.6
22	Illinois	134.3
23	North Dakota	130.3
24	North Carolina	128.9
25	Florida	127.9
26	New Hampshire	121.7
27	Vermont	121.2
28	South Carolina	119.9
29	Arizona	119.6
30	Washington	118.0
31	Alabama	117.8
32	Nevada	116.0
33	Virginia	115.6
34	Wisconsin	114.8
35	New Mexico	114.5
36	Maine	114.1
37	Kansas	113.5
38	Wyoming	111.4
39	Connecticut	110.5
40	Idaho	109.5
41	Georgia	108.3
42	Massachusetts	106.9
43	Oregon	99.1
44	Colorado	97.6
45	Montana	97.2
46	Nebraska	95.0
47	Alaska	87.6
48	Hawaii	82.0
49	Minnesota	81.2
50	Utah	77.3

Chart 3–34
Age-Adjusted Death Rates* for Coronary Heart Disease by Country and Sex, Ages 35–74, 2006–2009†

In 2006–2009, among 17 industrialized countries, the United States ranked sixth highest for CHD mortality in males and fourth highest in females.[36]

	Deaths/100,000 Population	
Country	**Male**	**Female**
Hungary (2009)	319.1	113.7
Romania (2009)	276.4	109.5
Czech Republic (2009)	198.6	69.9
Poland (2008)	180.0	51.6
Finland (2009)	170.0	36.1
United States of America (2008)	149.2	59.5
United Kingdom‡ (2009)	125.8	38.5
Germany (2006)	125.3	38.2
Sweden (2008)	109.4	35.5
Denmark (2006)	84.8	32.4
Norway (2009)	84.6	26.3
Spain (2008)	77.6	18.7
Italy (2007)	75.6	22.2
Netherlands (2009)	64.6	20.6
France (2007)	57.1	12.1
Japan (2009)	46.5	12.8
Republic of Korea (2009)	41.0	13.3

* Age-adjusted to European standard.
† Data for years indicated in parentheses.
‡ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 3–35
Change in Age-Adjusted Death Rates* for Coronary Heart Disease in Males by Country, Ages 35–74, 1999–2009†

From 1999 to 2009, when compared with the United States, 8 of the 15 countries shown had a steeper average annual decline in CHD mortality in males.[36]

Country	Average Annual Percent Change‡
Denmark (1999–2006)	-8.8
Netherlands (1999–2009)	-8.6
Norway (1999–2009)	-7.4
United Kingdom§ (2001–2009)	-6.5
Germany (1999–2006)	-5.7
Poland (1999–2008)	-5.1
France (2000–2007)	-5.1
Finland (1999–2009)	-4.9
United States of America (1999–2008)	-4.6
Spain (1999–2008)	-4.4
Czech Republic (1999–2009)	-4.3
Romania (1999–2009)	-2.5
Hungary (1999–2009)	-1.8
Japan (1999–2009)	-1.8
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.
§ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 3–36
Change in Age-Adjusted Death Rates* for Coronary Heart Disease in Females by Country, Ages 35–74, 1999–2009†

From 1999 to 2009, when compared with the United States, 9 of the 15 countries shown had a steeper average annual decline in CHD mortality in females.[36]

Country	Average Annual Percent Change‡
Netherlands (1999–2009)	-9.0
Denmark (1999–2006)	-9.0
Norway (1999–2009)	-8.3
United Kingdom§ (2001–2009)	-8.0
Germany (1999–2006)	-7.2
Finland (1999–2009)	-6.5
Poland (1999–2008)	-6.1
France (2000–2007)	-6.0
Spain (1999–2009)	-5.2
United States of America (1999–2008)	-5.1
Czech Republic (1999–2009)	-4.9
Romania (1999–2009)	-4.1
Japan (1999–2009)	-3.3
Hungary (1999–2009)	-2.9
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.
§ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 3–37
Age-Adjusted Prevalence of Heart Failure by Race and Sex, Ages 25–74, U.S., 1988–1994 to 2005–2008

From 1988–1994 to 2005–2008, the prevalence of HF increased in blacks (except the decrease in 1999–2004) and decreased slightly in whites; it remained stable in males but decreased slightly in females.[18]

	Percent of Population			
Years	Black	White	Male	Female
1988–1994	3.00	1.80	2.30	1.70
1999–2004	2.44	1.69	2.22	1.37
2005–2008	3.82	1.54	2.35	1.47

Chart 3–38
Hospitalization Rates for Heart Failure, Ages 45–64 and 65 and Older, U.S., 1971–2009

From 1971 to 1993, hospitalization rates for HF increased in those aged 45–64 years and then remained stable through 2009. For those aged 65 years and older, rates peaked in 1998 and then fluctuated through 2009.[32]

	Hospitalizations/10,000 Population	
Year	Ages 45–64 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
2007	29.7	189.9
2008	29.0	192.3
2009	34.8	197.5

Chart 3–39
Hospital Case-Fatality Rates for Heart Failure, Ages 45–64 and 65 and Older, U.S., 1980–2009

From 1980 to 2009, hospital case-fatality rates for HF were rather erratic for those aged 45–64 years and those aged 65 years and older; overall however, the rates declined appreciably for both groups during the period.[32]

	Percent Discharged Dead	
Year	Ages 45–64 Years	Ages ≥65 Years
1980	5.8	12.1
1981	10.1	11.8
1982	4.3	11.3
1983	6.7	10.9
1984	4.9	9.2
1985	4.5	9.0
1986	3.8	10.3
1987	3.2	9.3
1988	5.7	9.4
1989	4.7	7.6
1990	5.0	8.4
1991	3.8	8.8
1992	2.8	8.0
1993	2.6	7.2
1994	2.4	7.1
1995	3.7	5.1
1996	3.7	5.4
1997	1.6	5.6
1998	2.3	5.0
1999	1.3	6.4
2000	1.2	5.0
2001	2.5	4.6
2002	1.5	4.4
2003	1.9	5.0
2004	1.8	4.3
2005	1.8	3.6
2006	1.7	3.4
2007	1.2	3.5
2008	0.8	3.3
2009	1.7	4.2

Chart 3–40
Age-Adjusted Death Rates for Heart Failure as the Underlying Cause by Race and Sex, U.S., 1981–2008

From 1981 to 1988, death rates with HF as the underlying cause increased in blacks and whites, for both males and females. Rates stabilized in the early 1990s and slightly decreased in the 2000s. Mortality was highest in black males and lowest in white females.[30, 31]

	Deaths/100,000 Population			
Year	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	20.1	19.3	18.1
2007	22.3	18.7	18.4	16.3
2008	22.1	18.2	17.4	15.9

Chart 3–41
Age-Adjusted Death Rates for Any Mention of Heart Failure by Race and Sex, U.S., 1981–2008

From 1989 to 2008, death rates with any mention of HF on the death certificate declined in blacks and whites, for both males and females. During this period, within sex groups, the rates were similar for blacks and whites.[30, 31] This is in contrast to HF solely as the underlying cause (see Chart 3–40).

	Deaths/100,000 Population			
Year	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
2007	104.2	99.2	82.5	76.7
2008	102.7	98.9	78.8	75.9

Chart 3–42
Age-Adjusted Death Rates for Heart Failure as the Underlying Cause by Race/Ethnicity and Sex, U.S., 2008

In 2008, 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.[31]

	Deaths/100,000 Population	
Race/Ethnicity	Male	Female
Total	18.2	15.8
Black*	22.7	17.7
White*	18.8	16.4
American Indian	11.4	11.8
Hispanic	9.5	8.9
Asian	5.8	5.8

* Non-Hispanic.

Chart 3–43
Age-Adjusted Death Rates for Any Mention of Heart Failure by Race/Ethnicity and Sex, U.S., 2008

In 2008, 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.[31]

	Deaths/100,000 Population	
Race/Ethnicity	Male	Female
Total	97.7	75.2
Black*	105.0	80.4
White*	101.7	77.5
American Indian	67.4	56.8
Hispanic	56.8	48.3
Asian	43.3	33.4

* Non-Hispanic.

Chart 3–44
Death Rates for Heart Failure as the Underlying Cause by Age, Race, and Sex, U.S., 2008

In 2008, 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.[31]

	Deaths/100,000 Population			
Age (Years)	Black Male	White Male	Black Female	White Female
25–44	2.0	0.4	1.0	0.2
45–54	9.1	2.7	5.6	1.4
55–64	25.6	9.2	14.3	5.2
65–74	62.9	31.9	39.3	21.7
75–84	168.2	135.7	130.1	107.3

Chart 3–45
Death Rates for Any Mention of Heart Failure by Age, Race, and Sex, U.S., 2008

In 2008, within sex groups, mortality for any mention of HF on the death certificate was higher in blacks than in whites at all ages, with one exception: Among those aged 75–84 years, white males and black males had similar death rates. Within racial groups, death rates for HF were higher in males than in females.[31]

	Deaths/100,000 Population			
Age (Years)	Black Male	White Male	Black Female	White Female
25–44	9.6	2.6	5.8	1.5
45–54	42.1	15.3	27.7	8.4
55–64	123.2	55.7	75.2	32.6
65–74	314.3	202.6	194.5	130.5
75–84	782.8	789.3	582.0	559.0

Chart 3–46
Age-Adjusted Death Rates for Cardiomyopathy by Race and Sex, U.S., 2008

In 2008, the death rate for cardiomyopathy was approximately two times higher in males than in females and nearly two times higher in blacks than in whites.[31]

	Deaths/100,000 Population	
Race	**Male**	**Female**
Total	10.47	5.02
White	9.76	4.60
Black	18.86	8.94

Chart 3–47
Death Rates for Cardiomyopathy by Age, Race, and Sex, U.S., 2008

In 2008, within sex groups, cardiomyopathy mortality was much higher in blacks than in whites at all ages. Within racial groups, cardiomyopathy mortality was higher in males than in females.[31]

	Deaths/100,000 Population			
Age (Years)	**Black Male**	**White Male**	**Black Female**	**White Female**
35–44	10.4	3.1	3.9	1.3
45–54	19.3	6.6	9.1	2.4
55–64	32.5	11.5	14.2	4.6
65–74	56.7	25.1	23.6	10.9
75–84	99.7	65.4	52.1	30.6

Chart 3–48
Hospitalizations for Atrial Fibrillation by Primary and Secondary Diagnosis, U.S., 1982–2009

From 1988 to 2009, the number of hospitalizations for atrial fibrillation, as either a primary or secondary diagnosis, more than doubled.[32]

Year	Hospitalizations (Thousands)	
	Primary Diagnosis	Secondary Diagnosis
1982	115	429
1983	114	473
1984	111	553
1985	142	612
1986	149	692
1987	146	749
1988	171	819
1989	162	887
1990	180	922
1991	210	1,031
1992	227	1,133
1993	240	1,214
1994	276	1,309
1995	270	1,348
1996	286	1,527
1997	319	1,692
1998	327	1,772
1999	347	1,871
2000	357	1,869
2001	385	1,939
2002	418	2,096
2003	429	2,260
2004	403	2,335
2005	411	2,461
2006	418	2,440
2007	480	2,244
2008	429	1,901
2009	406	1,918

Chart 3–49
Hospitalization Rates for Atrial Fibrillation by Age, U.S., 1982–2009

From 1988 to 2003, hospitalization rates for atrial fibrillation more than doubled for both age groups and did not begin to decline until 2008.[32]

	Hospitalizations/10,000 Population	
Year	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
2007	15.9	89.2
2008	14.1	75.0
2009	12.2	72.7

Chart 3–50
Age-Adjusted Prevalence of Stroke by Race and Sex, Ages 25–74, U.S., 1971–1975 to 2005–2008

From 1971–1975 to 2005–2008, the prevalence of stroke increased in blacks and whites. It increased in males until 1999–2004; in females it was stable from 1971–1975 to 1988–1994 and then increased through 2005–2008.[18]

	Percent of Population			
Years	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
1999–2004	3.49	1.85	1.85	2.26
2005–2008	3.74	2.04	1.92	2.55

Chart 3–51
Prevalence of Stroke by Age and Sex, U.S., 1999–2008

In 1999–2008, the prevalence of stroke, which increased markedly with age, was higher in females than in males for all age groups except one. In the 65–74 age group, the prevalence was slightly higher in males than in females.[18]

	Percent of Population	
Age (Years)	Male	Female
35–44	0.7	1.3
45–54	1.4	2.6
55–64	3.1	3.7
65–74	7.5	6.5
≥75	12.1	12.8

Chart 3–52
Prevalence of Stroke by Age and Race, U.S., 1999–2008

In 1999–2008, the prevalence of stroke, which increased significantly with age, was higher in blacks than in whites at all ages.[18]

	Percent of Population	
Age (Years)	Black	White
35–44	1.6	1.1
45–54	4.0	1.7
55–64	6.2	3.0
65–74	11.0	6.3
≥75	15.4	12.6

Chart 3–53
Emergency Department Visit Rates for Stroke by Age, U.S., 1997–1999 to 2006–2008

From 1997–1999 to 2006–2008, emergency department visit rates for stroke decreased for all age groups. The greatest decrease occurred among those aged 75 years and older.[35]

	Visits/10,000 Population				
Years	Ages 45–54 Years	Ages 55–64 Years	Ages 65–74 Years	Ages 75–84 Years	Ages ≥85 Years
1997–1999	22.3	44.2	87.0	202.5	300.8
2000–2002	14.1	41.0	83.7	183.8	287.8
2003–2005	15.9	36.0	72.6	128.7	167.9
2006–2008	17.8	35.1	69.9	142.7	194.6

Chart 3–54
Hospitalization Rates for Stroke, Ages 45–64 and 65 and Older, U.S., 1971–2009

Hospitalization rates for stroke in those aged 45–64 years increased from 1971 to the mid-1980s and then remained relatively stable through 2009. For those aged 65 years and older, the rates generally rose from 1971 to 1997 and subsequently declined through 2007.[32]

	Hospitalizations/10,000 Population	
Year	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
2007	29.1	147.2
2008	31.1	164.6
2009	34.7	163.1

Chart 3–55
Hospital Case-Fatality Rate for Stroke, Ages Younger Than 65 and 65 and Older, U.S., 1971–2009*

Hospital case-fatality rates for stroke in patients younger than 65 years declined appreciably from 1971 to 1983 and then fluctuated through 2009. For those aged 65 years and older, the rates continued to decline through 1997 and then fluctuated before declining from 2005 to 2009.[32]

	Percent Discharged Dead	
Year	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
2007	4.7	6.1
2008	3.3	5.8
2009	4.0	5.8

* Estimates are not available for 1976 and 1977.

Chart 3–56
Age-Adjusted Death Rates for Stroke by Race and Sex, U.S., 1950–2008

For all groups, the steep decline in stroke mortality that occurred in the 1970s and mid-1980s slowed through the 1990s and 2000s.[30, 31]

	Deaths/100,000 Population			
Year	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
2007	67.1	40.2	55.0	39.9
2008	62.1	39.0	53.4	38.6

* Nonwhite from 1950 to 1967.

Chart 3–57
Deaths and Age-Adjusted Death Rates for Stroke, U.S., 1979–2008*

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 1997 through 2008.[30, 31]

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
2007	136	42.2
2008	134	40.8

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

Chart 3–58
Age-Adjusted Death Rates for Stroke by Race/Ethnicity and Sex, U.S., 1999–2008

From 1999 to 2008, stroke mortality declined for non-Hispanic blacks, non-Hispanic whites, American Indians, Hispanics, and Asians, both males and females. Blacks continue to have the highest mortality rates.[30, 31]

	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
2007	68.5	40.3	31.1	34.5	35.5
2008	63.4	39.2	24.5	33.1	34.0

	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
2007	56.1	40.3	28.4	30.8	33.2
2008	54.5	39.0	24.0	28.9	32.1

* Non-Hispanic.

Chart 3–59
Average Annual Percent Change in Age-Adjusted Death Rates for Stroke by Race and Sex, U.S., 1960–2008

The steep average annual declines in stroke mortality that occurred in black and white males and females from 1968 to 1988 were followed by modest reductions for several years. Appreciable annual declines resumed in 1999 through 2008.[30, 31]

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
1979–1988	-3.7	-3.0	-3.9	-3.0	-3.7
1989–1998	-0.9	-1.6	-1.1	-1.7	-0.7
1999–2008	-4.7	-4.1	-5.3	-4.2	-4.8

* Nonwhite from 1960 to 1967.

Chart 3–60
Age-Adjusted Death Rates for Stroke by Race/Ethnicity and Sex, U.S., 2008

In 2008, stroke mortality was about the same in males as in females. By race/ethnicity, death rates were highest in non-Hispanic blacks and lowest in American Indians.[31]

	Deaths/100,000 Population	
Race/Ethnicity	Male	Female
Total	41.0	39.9
Black*	63.4	54.5
White*	39.2	39.0
American Indian	24.5	24.0
Hispanic	33.1	28.9
Asian	34.0	32.1

* Non-Hispanic.

Chart 3–61
Death Rates for Stroke in Males by Age and Race/Ethnicity, U.S., 2008

In 2008, death rates for stroke in males increased with age for each racial/ethnic group. Stroke mortality was much higher in non-Hispanic blacks than in other groups.[31]

	Deaths/100,000 Population				
Age (Years)	Black*	White*	American Indian	Hispanic	Asian
45–54	42.2	11.2	15.0	15.2	13.4
55–64	92.3	29.4	30.3	35.0	32.1
65–74	210.1	89.8	96.3	89.3	90.9
75–84	453.1	321.8	170.1	273.1	257.8

* Non-Hispanic.

Chart 3–62
Death Rates for Stroke in Females by Age and Race/Ethnicity, U.S., 2008

In 2008, death rates for stroke in females increased with age for each racial/ethnic group. Stroke mortality was much higher in non-Hispanic blacks than in other groups.[31]

	Deaths/100,000 Population				
Age (Years)	Black*	White*	American Indian†	Hispanic	Asian
45–54	31.5	9.3	10.7	10.3	10.7
55–64	60.5	22.1	26.0	21.2	26.0
65–74	132.8	73.9	55.7	66.9	77.7
75–84	405.4	304.9	207.9	239.2	238.1

* Non-Hispanic.
† Data unreliable for American Indian females aged 45–54 years.

Chart 3–63
Age-Adjusted Death Rates for Stroke by State, U.S., 2005–2007

In 2005–2007, stroke mortality was highest in many of the Southeastern states, most of which comprise "the stroke belt."[16]

Rank	State	Deaths/100,000 Population
1	Arkansas	58.3
2	Alabama	56.9
3	Tennessee	56.3
4	Oklahoma	55.2
5	South Carolina	54.2
6	Mississippi	54.1
7	North Carolina	53.4
8	Louisiana	52.7
9	Georgia	51.4
10	Kentucky	49.8
11	Missouri	49.7
12	West Virginia	49.4
13	Oregon	49.4
14	Texas	49.1
15	Idaho	49.1
16	Virginia	48.6
17	Indiana	48.5
18	Alaska	48.1
19	Kansas	47.3
20	Ohio	46.6
21	Illinois	45.8
22	Michigan	45.7
23	California	45.0
24	Nebraska	44.9
25	Wisconsin	44.7
26	Iowa	44.6
27	Pennsylvania	44.5
28	Maryland	44.4
29	South Dakota	44.0
30	Washington	43.8
31	Hawaii	43.1
32	Wyoming	43.1
33	North Dakota	43.0
34	Montana	42.5
35	Maine	41.7
36	Delaware	41.5
37	Nevada	41.3
38	Minnesota	40.2
39	Colorado	39.9
40	Utah	39.6
41	New Mexico	38.4
42	Massachusetts	37.7
43	Vermont	37.7
44	New Jersey	36.5
45	Connecticut	35.9
46	Florida	35.6
47	New Hampshire	35.5
48	Arizona	35.0
49	Rhode Island	34.9
50	New York	29.5

Chart 3–64
Age-Adjusted Death Rates* for Stroke by Country and Sex, Ages 35–74, 2006–2009†

In 2006–2009, among 17 industrialized countries, the United States ranked 12th highest in stroke mortality in males and 7th highest in females. Eastern European countries had markedly higher death rates for stroke compared with other countries.[35]

	Deaths/100,000 Population	
Country	Male	Female
Romania (2009)	200.2	116.2
Hungary (2009)	121.1	56.0
Poland (2008)	100.8	50.1
Republic of Korea (2009)	65.9	33.2
Czech Republic (2009)	64.4	34.8
Japan (2009)	52.2	22.7
Denmark (2006)	45.6	32.1
Finland (2009)	43.8	23.0
Germany (2006)	34.5	20.1
Spain (2008)	33.7	17.8
Sweden (2008)	31.0	18.5
United States of America (2008)	30.0	23.5
United Kingdom‡ (2009)	29.9	22.5
Italy (2007)	29.9	18.2
Norway (2009)	29.0	15.2
France (2007)	26.5	13.9
Netherlands (2009)	24.6	20.1

* Age adjusted to European standard.
† Data for years indicated in parentheses.
‡ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 3–65
Change in Age-Adjusted Death Rates* for Stroke in Males by Country, Ages 35–74, 1999–2009†

From 1999–2001 to 2006–2009, the United States ranked last among 15 industrialized countries in the average annual decline in stroke mortality in males.[36]

Country	Average Annual Percent Change‡
Republic of Korea (1999–2006)	-7.7
United Kingdom§ (2001–2009)	-6.7
Czech Republic (1999–2009)	-6.7
Netherlands (1999–2009)	-6.5
Germany (1999–2006)	-6.1
Hungary (1999–2009)	-5.9
Norway (1999–2009)	-5.7
France (2000–2007)	-4.9
Finland (1999–2009)	-4.6
Denmark (1999–2006)	-4.2
Spain (1999–2008)	-4.0
Japan (1999–2009)	-3.6
Poland (1999–2008)	-3.6
Romania (1999–2009)	-3.4
United States of America (1999–2008)	-3.4

* Age adjusted to European standard.
† Data for years indicated in parentheses.
‡ Based on a log linear regression of the actual rates.
§ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 3–66
Change in Age-Adjusted Death Rates* for Stroke in Females by Country, Ages 35–74, 1999–2009†

From 1999–2001 to 2006–2009, the United States ranked next to last among 15 industrialized countries in the average annual decline in stroke mortality in females.[36]

Country	Average Annual Percent Change‡
Republic of Korea (1999–2006)	-9.1
Czech Republic (1999–2009)	-7.8
Hungary (1999–2009)	-7.2
United Kingdom§ (2001–2009)	-6.8
Germany (1999–2006)	-6.3
Netherlands (1999–2009)	-6.0
Poland (1999–2008)	-5.8
Finland (1999–2009)	-5.5
Norway (1999–2009)	-5.4
France (2000–2007)	-4.7
Japan (1999–2009)	-4.7
Spain (1999–2008)	-4.6
Romania (1999–2009)	-4.5
United States of America (1999–2008)	-3.6
Denmark (1999–2006)	-3.4

* Age adjusted to European standard.
† Data for years indicated in parentheses.
‡ Based on a log linear regression of the actual rates.
§ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 3–67
Prevalence of Hypertension* and Prehypertension† by Age, U.S., 1999–2008

In 1999–2008, 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.[18]

	Percent of Population	
Age (Years)	Hypertension	Prehypertension
18–29	4.1	26.4
30–39	10.3	29.0
40–49	24.0	33.2
50–59	40.0	30.6
60–69	59.6	22.3
70–79	70.3	16.5
≥80	74.1	14.9

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

Chart 3–68
Age-Adjusted Prevalence of Hypertension* by Race/Ethnicity and Sex, Ages 20–74, U.S., 1999–2008

In 1999–2008, the prevalence of hypertension was appreciably higher in non-Hispanic blacks than in non-Hispanic whites or Mexican-Americans. Within racial groups, the prevalence of hypertension was fairly similar in males and females.[18]

	Percent of Population	
Race/Ethnicity	Male	Female
Black†	36.0	38.2
White†	26.1	23.3
Mexican-American	21.8	21.7

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

Chart 3–69
Age-Adjusted Prevalence of Hypertension* by Race/Ethnicity and Sex, Ages 20–74, U.S., 1976–1980 to 2005–2008

From 1976–1980 to 1988–1994, the prevalence of hypertension decreased substantially in both non-Hispanic black and white males and females and then remained relatively stable through 2005–2008. In Mexican-American males, the prevalence decreased in 1999–2004 and remained stable through 2005–2008. The prevalence in Mexican-American females was stable throughout the entire period.[18]

	Percent of Population					
Years	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
1999–2004	25.1	23.4	35.0	37.6	21.9	22.6
2005–2008	27.4	23.1	37.2	39.1	21.8	20.7

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

Chart 3–70
Hypertensive* Population Aware, Treated, and Controlled, Ages 18–74, U.S., 1971–1974 to 2005–2008

In 2005–2008, 93% of persons with a high level of hypertension (≥160/≥95 mmHg) were aware of their condition compared with 54% in 1971–1974. The percent of persons on medication with their condition controlled increased from 16% in 1971–1974 to 81% in 2005–2008.[18]

	Percent of Hypertensive Population			
Years	Unaware	On Medication Controlled	On Medication Uncontrolled	No Medication Uncontrolled
1971–1974	46	16	21	17
1976–1980	27	34	12	27
1988–1994	12	65	14	9
1999–2004	10	73	12	5
2005–2008	7	81	8	4

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

Chart 3–71
Hypertensive* Population Aware, Treated, and Controlled, Ages 18–74, U.S., 1976–1980 to 2005–2008

In 2005–2008, among individuals with hypertension (≥140/≥90 mmHg), 79% were aware of their condition; 70% were on treatment for it; and 49% had it controlled. These percentages are appreciably greater than the comparable figures (51%, 31%, and 10%, respectively) for 1976–1980.[18]

	Percent of Hypertensive Population			
Years	Unaware	On Medication Controlled	On Medication Uncontrolled	No Medication Uncontrolled
1976–1980	49	10	21	20
1988–1994	30	28	25	17
1999–2004	27	39	23	11
2005–2008	21	49	21	10

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

Chart 3–72
Emergency Department Visit Rates for Hypertension by Age, U.S., 1997–1999 to 2006–2008

From 1997–1999 to 2006–2008, the rate of emergency department visits for hypertension increased 45% for those aged 25–44 years. Those aged 65 years and older had the highest rates.[35]

	Visits/10,000 Population		
Years	Ages 25–44 Years	Ages 45–64 Years	Ages ≥65 Years
1997–1999	15.2	34.3	55.8
2000–2002	17.6	40.6	55.2
2003–2005	18.3	38.8	70.9
2006–2008	27.4	44.6	61.3

Chart 3–73
Age-Adjusted Death Rates for Diseases of the Arteries by Race and Sex, U.S., 2008

In 2008, death rates for diseases of the arteries within sex groups were slightly higher in blacks than in whites. Overall, death rates were nearly 44% higher in males than in females.[31]

	Deaths/100,000 Population		
Sex	Total	White	Black
Male	10.2	10.3	11.4
Female	7.1	7.1	8.3

Chart 3–74
Death Rates for Diseases of the Arteries by Age, Race, and Sex, U.S., 2008

In 2008, death rates for diseases of the arteries within racial groups were higher in males than in females at all ages. Within sex groups, blacks had slightly higher rates than whites.[31]

	Deaths/100,000 Population			
Age (Years)	Black Male	White Male	Black Female	White Female
35–44	3.1	1.2	1.1	0.5
45–54	6.6	3.2	2.7	1.4
55–64	13.7	9.3	8.0	4.5
65–74	33.9	30.0	22.1	15.6
75–84	85.5	81.0	58.6	55.2

Chart 3–75
Percent of Deaths From Congenital Malformations of the Circulatory System, Age Under 1, U.S., 1940–2008

The percentage of deaths from congenital malformations of the circulatory system for infants aged less than 1 year declined from 82% in 1940 to 45% in 2008.[29–31]

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
2007	45.6
2008	44.7

Chart 3–76
Infant Mortality From Congenital Malformations of the Circulatory System by Race, U.S., 1970–2008

In blacks and whites, infant congenital heart disease mortality declined from 1970 to 2008. Mortality from other congenital malformations of the circulatory system began to decline in the mid-1980s and remained relatively stable during the 2000s.[29–31]

	Deaths/100,000 Live Births			
Year	Heart Black	Heart White	Other CVD Black	Other CVD White
1970	113.4	120.2	19.8	19.8
1971	105.2	114.2	20.9	22.4
1972	106.5	114.7	17.9	16.1
1973	103.3	107.8	19.6	20.7
1974	100.1	100.0	22.1	19.6
1975	92.3	96.6	24.0	21.9
1976	87.6	91.5	25.5	21.0
1977	84.6	90.6	27.4	22.0
1978	83.6	85.2	33.0	23.6
1979	80.3	83.3	32.5	22.8
1980	78.9	80.3	34.4	24.5
1981	73.7	74.2	37.8	22.7
1982	76.6	77.1	39.7	21.7
1983	74.1	70.3	36.9	23.6
1984	74.9	69.8	32.1	20.3
1985	72.7	69.2	25.6	17.4
1986	69.2	65.1	25.4	14.5
1987	71.4	62.0	21.7	14.5
1988	64.6	67.7	20.5	14.0
1989	71.2	62.1	18.4	11.1
1990	72.2	61.3	16.7	11.4
1991	70.3	56.3	17.7	10.7
1992	71.8	55.0	15.3	10.1
1993	64.7	54.0	14.6	9.6
1994	62.1	53.4	16.0	9.5
1995	58.5	50.1	10.1	7.7
1996	58.5	48.7	11.4	8.5
1997	51.3	45.2	11.3	7.9
1998	51.3	44.5	12.3	7.2
1999	47.9	40.0	9.4	4.9
2000	50.9	38.6	7.9	4.7
2001	51.3	37.0	6.4	4.5
2002	50.4	35.7	8.4	5.0
2003	45.8	33.8	6.5	5.7
2004	45.3	32.8	10.7	5.5
2005	38.1	33.3	9.6	5.3
2006	43.4	31.5	9.2	5.0
2007	41.7	30.3	9.9	5.2
2008	38.8	30.0	7.8	4.9

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 2008 by major lung subgroups.[31] Chart 4–2 lists selected lung diseases; ICD-9-CM codes for the lung diseases; 2009 estimates of hospital discharges, lengths of stay, and physician office visits for those diagnostic codes; ICD-10 codes for the lung diseases; and number of deaths in 2008 for those codes.[31, 32, 34] Subsequent charts display morbidity and mortality for total lung diseases and specific subgroups: COPD, asthma, 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 as "the physiologic finding of nonreversible pulmonary function impairment."[26]

Data used for the COPD prevalence charts in this *Chart Book* were obtained from the NHIS and are based on self-reports of lifetime prevalence of COPD as determined by a physician. In 2010, an estimated 14.8 million individuals were identified with COPD.[25] Additionally, based on spirometry readings of lung function in the 1988–1994 NHANES, COPD was estimated to go undiagnosed in 12 million people.[26]

Asthma

Three different prevalence estimates derived from NHIS data are presented in this chapter. Since 1997, NHIS has gathered information about lifetime asthma and asthma attacks or episodes from the Sample Adult Core and Sample Child Core questionnaires. A "yes" response to the question, "Has a doctor or other health professional ever told you that you had asthma?" determined lifetime prevalence. Those who responded "yes" to the lifetime asthma question were then asked, "During the past 12 months, have you had an episode of asthma or an asthma attack?" A "yes" response to the 12-month question determined asthma attack prevalence. Since 2001, current asthma status has also been collected. To determine current asthma, persons answering "yes" to the lifetime asthma question must also have answered "yes" to the question, "Do you still have asthma?"

Chart 4–1
Deaths From Lung Diseases, Percent by Subgroup, U.S., 2008

Cause of Death	Percent
COPD	56.7
Asthma	1.4
Influenza and Pneumonia	23.2
External Agents	7.3
Neonatal Pulmonary Disorders	1.8
Cardiopulmonary Diseases	5.3
Other	4.3

Total Deaths = 242,350 (100%)

Compiled from Vital Statistics of the United States, NCHS.

Chart 4–2
Number of Hospitalizations, Physician Office Visits,* and Deaths for Lung Diseases,† U.S., 2008–2009

Diagnostic Category	ICD-9-CM Codes	Hospitalizations for 2009		Physician Office Visits for 2009 (1,000)	ICD-10 Codes	Deaths for 2008
		First-Listed Discharges (1,000)	Length of Stay (Days)			
Total		3,468	5.6	38,270		242,350
Acute lower respiratory infections:	466, 480–487	1,385	4.9	10,678	J09–J18, J20, J21	56,519
Influenza and pneumonia	480–487	1,226	5.1	6,319	J09–J18	56,284
Acute bronchitis	466	159	3.4	4,359	J20	160
Acute bronchiolitis	included in 466	—	—	—	J21	75
Chronic lower respiratory diseases:	490–496	1,218	4.7	25,956	J40–J47	141,090
COPD:	490–492, 494–496	739	4.9	15,392	J40–J44, J47	137,693
Chronic bronchitis	490, 491	648	4.7	9,280	J40–J42	731
Emphysema	492	15	4.3	747	J43	12,448
Other COPD	495, 496	67	7.5	5,153	J44	123,527
Bronchiectasis	494	9	5.1	212	J47	987
Asthma	493	479	4.3	10,564	J45	3,131
Status asthmaticus	included in 493	—	—	—	J46	266
Cystic fibrosis	277.0	14	8.8	—	E84	491
Lung disease due to external agents	500–508	182	7.5	110	J60–J70	17,613
Adult respiratory distress syndrome	518.5	11	10.3	—	J80	1,608
Pulmonary edema	518.4	7	6.0	—	J81	561
Interstitial lung diseases:	011, 012, 135, 446.2, 446.4, 518.8	411	8.1	811	A15, A16, A19, A31.0, D86, J96, J99, M31.0, M31.3	6,650
Sarcoidosis	135	7	7.0	96	D86	890
Respiratory tuberculosis	011, 012	6	11.0	120	A15, A16, A19, A31.0	734
Respiratory failure	518.8	394	8.1	525	J96	4,668
Pulmonary manifestations of connective tissue disorders	446.2, 446.4	4	5.8	70	J99, M31.0, M31.3	358
Cardiopulmonary diseases:	415.1–417	181	5.8	590	I26, I27	12,854
Pulmonary embolism	415.1	158	5.7	487	I26	7,158
Other pulmonary heart disease	415.2–417	23	6.5	103	I27	5,696
Selected HIV-related and other pulmonary infections	114–116, 117.3, 117.5, 117.7, 136.3	7	7.4	86	B38–B40, B44–B46, B59	560
Neonatal pulmonary disorders:	748.4–748.6, 769, 770, 798.0	52	14.5	39	P22, P23, P25–P28, Q33, R95	4,404
Respiratory distress syndrome	769	14	22.8	—	P22	630
Sudden infant death syndrome	798.0	—	—	—	R95	2,353
Congenital malformation of the lung	748.4–748.6	2	27.5	—	Q33	345
Bronchopulmonary dysplasia	770.7	5	3.4	—	P27.1	217
Atelectasis of newborn	770.4, 770.5	—	—	—	P28.0, P28.1	335
Other perinatal respiratory diseases	770.1–770.3, 770.6, 770.8, 770.9	31	11.7	39	P23, P25, P26, P27.0, P27.8, P27.9, P28.2–P28.9	524

* 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.

Compiled from references 31, 32, and 34.

Chart 4–3
Age-Adjusted Death Rates for Lung Diseases by Race and Sex, U.S., 2008

In 2008, lung disease mortality was higher in males than in females. Within sex groups, it was similar between black males and white males and slightly higher in white females than in black females.[31]

	Deaths/100,000 Population		
Sex	Total	White	Black
Male	87.5	88.7	87.6
Female	66.3	68.4	58.9

Chart 4–4
Death Rates for Lung Diseases by Age, Race, and Sex, U.S., 2008

In 2008, the male–female gap in mortality from lung diseases generally increased with age. Within racial groups, the rate was higher in black males than in white males aged 74 years and younger; it was higher in black females than in white females aged 64 years and younger.[31]

	Deaths/100,000 Population			
Age (Years)	Black Male	White Male	Black Female	White Female
35–44	13.8	6.3	12.4	6.0
45–54	37.2	20.6	32.7	19.1
55–64	102.1	71.8	69.8	59.3
65–74	262.9	251.1	171.8	208.8
75–84	664.7	736.7	383.1	547.4

Chart 4–5
Prevalence of Chronic Obstructive Pulmonary Disease* by Age, U.S., 1997–2010

From 1997 to 2010, the prevalence of physician-diagnosed COPD fluctuated for all age groups.[25]

	Percent of Population		
Year	Ages 18–44 Years	Ages 45–64 Years	Ages ≥65 Years
1997	4.3	7.1	10.5
1998	3.7	6.7	9.9
1999	3.8	6.0	9.5
2000	3.7	6.7	10.1
2001	4.6	7.7	10.4
2002	3.6	6.7	9.1
2003	3.0	6.0	9.4
2004	3.3	6.2	9.7
2005	3.4	6.2	9.6
2006	3.0	7.0	10.0
2007	2.4	5.8	8.6
2008	3.3	6.5	9.3
2009	3.0	7.2	10.7
2010	3.2	6.4	9.8

* Physician-diagnosed COPD only.

Chart 4–6
Prevalence of Chronic Obstructive Pulmonary Disease* by Age, Race, and Sex, U.S., 2010

In 2010, within racial groups, the prevalence of COPD was higher in females than in males, except in blacks aged 65 years and older. Differences were observed between races: In males and females aged 45–64 years and in females aged 65 years and older, the prevalence of COPD was higher in whites than in blacks.[25]

	Percent of Population			
Age (Years)	Black Male	White Male	Black Female	White Female
18–44	2.3	2.4	4.3	4.2
45–64	4.0	5.5	6.8	7.7
≥65	11.1	8.8	6.9	11.2

* Physician-diagnosed COPD only.

Chart 4–7
Hospitalization Rates for Chronic Obstructive Pulmonary Disease, Ages 45–64 and 65 and Older, U.S., 1995–2009

From 1995 to 2009 hospitalization rates for COPD were stable for those aged 45–64 years; for those aged 65 years and older, however, rates have fluctuated since 2001.[32]

	Hospitalizations/10,000 Population	
Year	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
2007	26.5	110.1
2008	27.5	123.9
2009	30.1	121.3

Chart 4–8
Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by Race and Sex, U.S., 1960–2008

From 1960 to 1990, COPD mortality increased in black males, followed by a gradual turnaround and decline in the 2000s. In white males, COPD mortality peaked in 1985, remained stable throughout the 1990s, and declined during the 2000s. In white and black females, the rates increased until 1999 and then stabilized.[16, 30, 31, 37]

	Deaths/100,000 Population			
Year	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
2007	37.1	49.2	18.9	37.5
2008	39.4	52.8	21.2	40.9

* Nonwhite from 1960 to 1967.

Chart 4–9
Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by Race/Ethnicity and Sex, U.S., 1999–2008

From 1999 to 2008, COPD mortality in males generally 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.[16, 30, 31]

	Male (Deaths/100,000 Population)			
Year	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
2007	37.9	51.2	22.0	18.3
2008	40.2	55.2	21.8	19.8

	Female (Deaths/100,000 Population)			
Year	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
2007	19.2	39.4	13.0	8.0
2008	21.6	43.0	14.2	8.4

* Non-Hispanic.

Chart 4–10
Death Rates for Chronic Obstructive Pulmonary Disease in White Males by Age, U.S., 1960–2008

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. Beginning in 2007, the rates began to increase again.[16, 30, 31, 37]

	Deaths/100,000 Population			
Year	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	1018.6
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
2007	43.2	172.6	455.7	781.3
2008	46.1	181.9	489.1	861.0

Chart 4–11
Death Rates for Chronic Obstructive Pulmonary Disease in Black* Males by Age, U.S., 1960–2008

In black males, the 1960–2008 death rates for COPD changed from an increasing to a declining trend. In successive age groups, the change occurred later but was increasingly prominent.[16, 30, 31, 37]

	Deaths/100,000 Population			
Year	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
2007	40.3	133.4	339.8	509.1
2008	44.3	143.6	348.9	554.3

* Nonwhite from 1960 to 1967.

Chart 4–12
Death Rates for Chronic Obstructive Pulmonary Disease in White Females by Age, U.S., 1960–2008

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.[16, 30, 31, 37]

	Deaths/100,000 Population			
Year	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
2007	37.2	143.6	338.5	535.2
2008	39.7	156.8	367.9	589.9

Chart 4–13

Death Rates for Chronic Obstructive Pulmonary Disease in Black* Females by Age, U.S., 1960–2008

From the early 1980s to 2008, death rates for COPD increased in the black females aged 75 years and older. During the same period, the trend of increasing death rates changed to a stable one for those younger than 75 years of age.[16, 30, 31, 37]

	Deaths/100,000 Population			
Year	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
2007	22.9	72.6	152.9	250.6
2008	26.2	79.8	169.6	305.8

* Nonwhite from 1960 to 1967.

Chart 4–14
Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by State, U.S., 2005–2007

In 2005–2007, death rates for COPD tended to be highest in the Mountain States and Appalachia.[16]

Rank	State	Deaths/100,000 Population
1	Oklahoma	59.1
2	Wyoming	58.5
3	West Virginia	57.2
4	Kentucky	57.0
5	Montana	53.4
6	Nevada	51.0
7	Indiana	50.3
8	Kansas	49.3
9	Ohio	49.2
10	Colorado	48.5
11	Maine	48.3
12	Tennessee	48.3
13	Arkansas	48.2
14	Vermont	48.1
15	Alabama	47.6
16	Idaho	47.5
17	Mississippi	46.9
18	Missouri	46.7
19	North Carolina	45.9
20	Oregon	44.8
21	Nebraska	44.7
22	Iowa	44.5
23	New Hampshire	44.4
24	Georgia	44.0
25	New Mexico	43.5
26	South Dakota	43.2
27	South Carolina	42.6
28	Washington	42.3
29	Michigan	41.9
30	Arizona	41.9
31	Delaware	40.5
32	Texas	40.3
33	Louisiana	39.8
34	Alaska	39.3
35	Wisconsin	38.3
36	California	37.9
37	Virginia	37.6
38	Illinois	36.6
39	Pennsylvania	36.5
40	Rhode Island	36.4
41	Florida	36.3
42	Connecticut	34.1
43	Maryland	34.0
44	Minnesota	33.4
45	Massachusetts	33.3
46	North Dakota	33.0
47	New Jersey	30.7
48	Utah	30.6
49	New York	29.7
50	Hawaii	17.7

Chart 4–15
Age-Adjusted Death Rates* for Chronic Obstructive Pulmonary Disease by Country and Sex, Ages 35–74, 2006–2009†

In 2006–2009, among 16 industrialized countries, the United States ranked highest in COPD mortality for males and second highest for females.[36]

	Deaths/100,000 Population	
Country	**Male**	**Female**
United States of America (2008)	40.1	33.4
Romania (2009)	39.1	9.0
Denmark (2006)	32.2	38.0
Poland (2008)	29.1	8.7
Czech Republic (2009)	28.5	10.0
United Kingdom‡ (2009)	28.2	22.0
Norway (2009)	24.3	22.1
Spain (2008)	22.5	3.2
Netherlands (2009)	21.3	17.6
Germany (2006)	21.0	9.5
Finland (2009)	18.8	7.3
Sweden (2008)	13.5	14.1
Italy (2009)	12.5	4.1
Republic of Korea (2009)	12.0	2.2
France (2007)	9.5	2.2
Japan (2009)	4.3	0.8

* Age-adjusted to European standard.
† Data for years indicated in parentheses.
‡ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 4–16
Age-Adjusted Death Rates for Chronic Obstructive Pulmonary Disease by Race/Ethnicity and Sex, U.S., 2008

In 2008, COPD mortality was approximately one-third higher in males than in females. Within sex groups, it was highest among non-Hispanic whites and lowest among Asians.[31]

	Deaths/100,000 Population				
Sex	**Total**	**White***	**Black***	**Hispanic**	**Asian**
Male	50.6	55.2	40.2	21.8	19.8
Female	37.9	43.0	21.6	14.2	8.4

* Non-Hispanic.

Chart 4–17
Death Rates for Chronic Obstructive Pulmonary Disease by Age, Race, and Sex, U.S., 2008

In 2008, COPD mortality increased with age for all racial and sex groups. Within age groups, it was highest in white males aged 65 years and older and lowest in black females aged 45 years and older.[31]

	Deaths/100,000 Population			
Age (Years)	Black Male	White Male	Black Female	White Female
35–44	1.74	1.11	1.28	1.29
45–54	10.32	9.55	7.56	8.86
55–64	44.28	46.08	26.22	39.71
65–74	143.55	181.87	79.79	156.77
75–84	348.89	489.13	169.62	367.94

Chart 4–18
Prevalence of Asthma by Age, U.S., 1997–2010

Lifetime (1997–2010) and current prevalence (2001–2010) of asthma rose in both age groups, but the trends in 12-month asthma attack prevalence (1997–2010) were relatively stable. All prevalence measures were higher in the younger age group than in the older group.[25]

	12-Month Attack Prevalence (% of Population)		Lifetime Prevalence (% of Population)		Current Prevalence (% of Population)	
Year	Ages <18 Years	Ages ≥18 Years	Ages <18 Years	Ages ≥18 Years	Ages <18 Years	Ages ≥18 Years
1997	5.4	3.7	11.4	9.0	—	—
1998	5.3	3.4	12.1	9.0	—	—
1999	5.3	3.4	10.8	8.5	—	—
2000	5.5	3.5	12.4	9.3	—	—
2001	5.7	3.8	12.7	10.9	8.7	6.9
2002	5.8	3.7	12.2	10.7	8.3	6.8
2003	5.4	3.3	12.5	9.7	8.5	6.4
2004	5.4	3.6	12.2	9.9	8.5	6.7
2005	5.2	3.9	12.7	10.7	8.9	7.2
2006	5.5	3.8	13.5	11.0	9.3	7.3
2007	5.2	3.8	13.1	10.9	9.1	7.3
2008	5.6	3.8	13.8	12.5	9.4	7.3
2009	5.5	3.9	13.8	13.1	9.6	7.7
2010	5.7	4.2	13.6	12.7	9.4	8.2

Chart 4–19
Prevalence of Asthma by Race, Ages Younger Than 18, U.S., 1997–2010

Lifetime (1997–2010), current (2001–2010), and attack prevalence (1997–2010) of asthma rose in non-Hispanic blacks younger than 18 years of age but remained relatively stable in non-Hispanic whites in the same age group. All three measures of asthma prevalence showed higher rates in non-Hispanic blacks than in non-Hispanic whites younger than 18 years of age.[25]

	12-Month Attack Prevalence (% of Population)		Lifetime Prevalence (% of Population)		Current Prevalence (% of Population)	
Year	Black*	White*	Black*	White*	Black*	White*
1997	6.7	5.2	13.6	11.2	—	—
1998	6.8	5.2	15.7	12.0	—	—
1999	7.4	5.0	13.8	10.2	—	—
2000	7.7	5.3	16.3	12.1	—	—
2001	7.8	5.7	16.0	12.2	11.4	8.6
2002	8.3	5.5	17.3	11.6	12.4	8.0
2003	8.2	4.9	17.6	11.4	13.7	7.6
2004	8.0	5.4	17.5	11.8	12.8	8.2
2005	6.7	4.8	17.4	11.5	13.1	8.0
2006	7.4	5.3	16.6	13.0	12.8	8.8
2007	7.8	4.4	19.6	11.2	15.4	7.4
2008	9.3	5.2	21.2	13.0	15.7	8.8
2009	9.5	5.0	21.9	12.4	17.1	8.6
2010	8.8	5.2	21.2	12.2	15.7	8.2

* Non-Hispanic.

Chart 4–20
Prevalence of Asthma by Race, Ages 18 and Older, U.S., 1997–2010

Lifetime (1997–2010) and current prevalence (2001–2010) of asthma rose in non-Hispanic blacks and non-Hispanic whites aged 18 years and older. Attack prevalence (1997–2010) was stable in both groups.[25]

	12-Month Attack Prevalence (% of Population)		Lifetime Prevalence (% of Population)		Current Prevalence (% of Population)	
Year	Black*	White*	Black*	White*	Black*	White*
1997	3.8	3.8	9.6	9.4	—	—
1998	4.1	3.5	10.9	9.0	—	—
1999	3.2	3.5	8.6	8.8	—	—
2000	3.3	3.6	9.4	9.7	—	—
2001	4.3	4.0	11.1	11.3	7.4	7.1
2002	4.2	3.9	12.2	11.0	8.2	7.0
2003	3.7	3.4	10.7	10.1	7.2	6.7
2004	4.3	3.7	11.3	10.2	7.9	7.0
2005	3.9	4.1	11.9	11.2	8.5	7.5
2006	3.7	4.0	12.2	11.4	7.8	7.7
2007	4.0	4.0	10.5	11.6	8.0	7.7
2008	4.3	3.9	13.8	13.0	8.3	7.6
2009	4.0	4.0	14.3	13.6	8.7	8.1
2010	4.9	4.2	15.6	12.8	10.7	8.1

* Non-Hispanic.

Chart 4–21
Prevalence of Current Asthma by Race/Ethnicity and Sex, Ages Younger Than 18, U.S., 2010

In 2010, among children younger than 18 years of age, current asthma prevalence was 22% higher in males than in females. Within sex groups, the prevalence of current asthma was highest in non-Hispanic blacks.[25]

	Percent of Population			
Sex	**Total**	**Black***	**White***	**Hispanic**
Male	10.5	18.0	9.1	9.7
Female	8.2	13.7	7.3	6.3

* Non-Hispanic.

Chart 4–22
Prevalence of Current Asthma by Race/Ethnicity and Sex, Ages 18 and Older, U.S., 2010

In 2010, among adults aged 18 years and older, current asthma prevalence was nearly 45% higher in females than in males. Within sex groups, it was highest in non-Hispanic blacks and lowest in Hispanics.[25]

	Percent of Population			
Sex	**Total**	**Black***	**White***	**Hispanic**
Male	5.8	7.5	5.7	4.9
Female	10.4	13.2	10.3	9.1

* Non-Hispanic.

Chart 4–23
Physician Office Visits for Asthma, U.S., 1990–2009

From 1990 to 2009, the number of physician office visits for asthma was erratic with no obvious trend.[34]

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
2007	13.9
2008	8.9
2009	10.6

Chart 4–24
Emergency Department Visit Rates for Asthma by Age and Sex, U.S., 1997–1999 to 2006–2008

From 1997–1999 to 2006–2008, within age groups, emergency department visit rates for asthma were higher for males than females younger than 18 years of age but higher for females than males ages 18 years and older.[35]

	Visits/10,000 Population			
Year	Male, Ages <18 Years	Female, Ages <18 Years	Male, Ages ≥18 Years	Female, Ages ≥18 Years
1997–1999	136.8	88.7	41.3	76.7
2000–2002	121.5	72.1	33.2	68.8
2003–2005	108.9	91.1	38.4	57.1
2006–2008	108.9	70.4	32.8	62.0

Chart 4–25
Emergency Department Visit Rates for Asthma by Age and Sex, U.S., 2006–2008

In 2006–2008, emergency department visit rates for asthma declined in males with age.[35]

	Visits/10,000 Population	
Age (Years)	Male	Female
0–4	165.7	86.2
5–9	125.9	79.3
10–17	63.4	55.4
18–24	58.3	83.0
25–44	38.0	74.6
45–64	23.7	56.5

Chart 4–26
Hospitalizations for Asthma by Primary and Secondary Diagnosis, U.S., 1980–2009

From 1980 to 2009, the number of hospitalizations with asthma as the primary diagnosis remained relatively stable, but it increased significantly as a secondary diagnosis.[32]

	Hospitalizations (Thousands)	
Year	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
2007	456	1,469
2008	451	1,565
2009	479	1,545

Chart 4–27
Hospitalization Rates for Asthma by Age, U.S., 1980–2009

From 1980 to 2009, hospitalization rates for asthma were lowest among those aged 15–44 years.[32]

	Hospitalizations/10,000 Population			
Year	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
2007	21.9	6.9	16.0	25.4
2008	18.2	7.6	17.0	25.2
2009	19.1	7.7	16.7	29.0

Chart 4–28
Age-Adjusted Death Rates for Asthma by Race/Ethnicity and Sex, U.S., 2008

In 2008, asthma mortality for males was at least 2.5 times higher in non-Hispanic blacks than in the other racial/ethnic groups. In females, asthma mortality was more than 2 times higher in non-Hispanic blacks than in the other racial/ethnic groups. Overall, asthma mortality was 48% higher in females than in males.[31]

	Deaths/100,000 Population				
Sex	Total	Black*	White*	Hispanic	Asian
Male	0.8	2.2	0.6	0.8	0.9
Female	1.2	2.7	1.0	1.1	1.3

* Non-Hispanic.

Chart 4–29
Age-Adjusted Death Rates for Asthma by Race and Sex, Ages 1–24, U.S., 1980–2008

From 1980 to the mid-1990s, death rates for asthma, although erratic, tended to rise in all groups aged 1–24 years and subsequently began to decline in the 2000s.[16, 30, 31]

	Deaths/100,000 Population			
Year	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
2007	1.13	0.19	0.63	0.12
2008	1.17	0.17	0.87	0.13

Chart 4–30
Age-Adjusted Death Rates for Asthma by Race and Sex, U.S., 1980–2008

From 1980 to the mid-1990s, death rates for asthma rose in blacks and whites, both male and female, but then declined through 2008. Within sex groups, blacks had higher asthma mortality rates than whites.[16, 30, 31]

	Deaths/100,000 Population			
Year	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
2007	2.46	0.66	2.56	1.04
2008	2.13	0.63	2.67	1.02

Chart 4–31
Death Rates for Asthma by Age, Race, and Sex, U.S., 1999–2008

In 1999–2008, 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.[16, 30, 31]

	Deaths/100,000 Population			
Ages (Years)	Black Male	White Male	Black Female	White Female
1–4	1.00	0.13	0.46	0.08
5–9	0.93	0.13	0.50	0.10
10–14	1.41	0.21	0.85	0.14
15–19	1.35	0.23	0.68	0.17
20–24	1.46	0.30	1.01	0.23
25–34	2.14	0.35	1.33	0.39
35–44	2.56	0.51	2.83	0.79
45–54	3.55	0.75	5.20	1.29
55–64	4.65	0.99	6.24	1.80
65–74	5.94	1.76	7.63	3.13
75–84	7.24	3.73	9.13	6.41

Chart 4–32
Age-Adjusted Death Rates* for Asthma by Country and Sex, 2006–2009†

In 2006–2009, among 15 countries, the United States ranked 11th in asthma mortality for males and 7th for females.[36]

	Deaths/100,000 Population	
Country	Male	Female
Poland (2008)	1.79	1.02
Norway (2009)	1.52	1.69
Romania (2009)	1.45	0.86
Germany (2006)	1.42	1.17
Denmark (2006)	1.07	1.24
United Kingdom‡ (2009)	0.97	1.40
France (2007)	0.95	1.13
Finland (2009)	0.89	1.21
Japan (2009)	0.85	0.75
Sweden (2008)	0.82	0.89
United States of America (2008)	0.77	1.16
Czech Republic (2009)	0.76	0.69
Spain (2008)	0.64	1.33
Italy (2007)	0.43	0.47
Netherlands (2009)	0.22	0.32

* Age-adjusted to European standard.
† Data for years indicated in parentheses.
‡ Death rate is for the United Kingdom, not just England and Wales as in previous editions of the *Chart Book*.

Chart 4–33
Infant Mortality Rate for Respiratory Distress Syndrome, U.S., 1968–2007

Infant mortality for RDS declined steeply from 1974 to the mid-1990s, followed by a slow but appreciable decline through 2007.[38, 39]

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
2007	18.5

Chart 4–34
Infant Mortality Rate for Respiratory Distress Syndrome by Race, U.S., 1980–2007

From 1980 to 2007, infant mortality for RDS decreased appreciably in blacks and whites, with rates remaining higher in blacks.[38, 39]

	Deaths/100,000 Live Births	
Year	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
2007	41.4	14.4

Chart 4–35
Infant Mortality Rate for Respiratory Distress Syndrome by Race/Ethnicity,* U.S., 2007

In 2007, infant mortality for RDS was highest in blacks and lowest in Asians, among the racial/ethnic groups shown.[39]

Race/Ethnicity	Deaths/100,000 Live Births
All	18.5
Black†	42.4
Total Hispanic	14.9
Mexican-American	14.8
White†	14.6
Asian	12.2

* Data are not available for American Indians, Central and South Americans, and Puerto Ricans.
† Non-Hispanic.

Chart 4–36
Infant Mortality Rate for Sudden Infant Death Syndrome by Race/Ethnicity, U.S., 2007

In 2007, mortality for SIDS was highest in American Indians and lowest in Central and South Americans.[38]

Race/Ethnicity	Deaths/100,000 Live Births
All	57.0
American Indian or Alaska Native	141.6
Black*	107.9
Puerto Rican	58.4
White*	58.0
Total Hispanic	29.2
Mexican-American	27.6
Asian	21.6
Central and South American	15.3

* 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 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 2008 by blood disease subgroups. Chart 5–2 lists specific blood diseases; the ICD-9-CM codes of the blood diseases; 2009 estimates of hospital discharges, lengths of stay, and physician office visits for those diagnostic codes; ICD-10 codes for the blood diseases; and the number of deaths in 2008 for those codes.

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. To increase data reliability for race and sex comparisons, average annual death rates over a 4- to 5-year period were used instead of rates from a single year.

Chart 5–1
Deaths From Blood Diseases, Percent By Subgroup, U.S., 2008

Blood Diseases	Percent
Aplastic Anemia	9.5
Sickle Cell Anemia	5.0
Other Diseases of Blood and Blood-Forming Organs	17.5
Hemochromatosis	1.9
Diseases of White Blood Cells	4.5
Purpura and Other Hemorrhagic Conditions	8.3
Coagulation Defects	17.9
Other Anemias	35.3

Total Deaths = 10,066 (100%)
Compiled from Vital Statistics of the United States, NCHS

Chart 5–2
Number of Hospitalizations, Physician Office Visits,* and Deaths for Blood Diseases, U. S., 2008–2009†

Diagnostic Category	ICD-9 Codes	Hospitalizations for 2009		Physician Office Visits for 2009 (1,000)	ICD-10 Codes	Deaths for 2008
		First-Listed Discharges (1,000)	Length of Stay (Days)			
Total	280–289, 275	609	4.3	6,812	D50–D89, E83.1	10,066
Anemias	280–285	429	4.3	4,997	D50–D64	5,018
Iron deficiency anemia	280	88	3.3	916	D50	189
Other deficiency anemia	281	9	2.7	238	D51, D52	54
Thalassemia‡	282.4	14	3.1	68	D56	19
Sickle cell anemia	282.6	69	5.0	24	D57.0, D57.1	501
Aplastic anemia	284	40	4.9	20	D60, D61	960
Other and unspecified anemias	Other 282, 283, 285	209	4.6	3,731	Residual	3,295
Coagulation defects	286	10	5.5	203	D65–D68	1,800
Hemophilia: Factor VIII	286.0	2	10.5	52	D66	71
Hemophilia: Factor IX	286.1	—	—	—	D67	2
Other	286.2–286.9	8	4.1	151	Residual	1,727
Purpura and other hemorrhagic conditions	287	43	3.4	463	D69	831
Primary thrombocytopenia	287.3	17	3.4	267	D69.3, D69.4	363
Unspecified thrombocytopenia	287.4	3	6.0	—	D69.5, D69.6	436
Other	287.0–287.2; 287.5–287.9	23	3.2	196	Residual	32
Diseases of white blood cells	288	74	4.1	619	D70–D72	458
Other diseases of blood and blood-forming organs	289	20	3.2	163	D73–D89	1,766
Hemochromatosis	275	33	6.5	367	E83.1	193

* 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%.
† Compiled from references 31, 32, and 34: NHLBI tabulation of NHDS, NAMCS, and NCHS mortality.
‡ Cooley's anemia has been changed to thalassemia, which is the correct disease for the ICD-9 and ICD-10 codes in the table.
Compiled from references 31, 32, and 34.

Chart 5–3
Hospitalizations for Aplastic Anemia by Primary and Secondary Diagnosis, U.S., 1988–2009

In 2009, the number of hospitalizations for aplastic anemia as a primary diagnosis was more than twice as high as it was in 1990; as a secondary diagnosis, it was 2.5 times higher in 2009 than in 1990.[16, 32]

	Hospitalizations (Thousands)	
Year	Primary Diagnosis	Secondary Diagnosis
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
2007	26	150
2008	31	231
2009	40	219

Chart 5–4
Age-Adjusted Death Rates* for Aplastic Anemia By Race And Sex, U.S., 2004–2007

In 2004–2007, mortality from aplastic anemia was similar in blacks and whites. Overall, it was 20% higher in males than in females.[16]

	Deaths/100,000 Population		
Sex	Total	White	Black
Male	0.35	0.35	0.37
Female	0.29	0.29	0.30

* Average annual rates.

Chart 5–5
Death Rates* for Aplastic Anemia by Age, Race, and Sex, U.S., 2004–2007†

In 2004–2007, mortality from aplastic anemia was higher in black males than in white males. Within racial groups, it was higher in black males than in black females aged 45 years and older and in white males than in white females aged 65 years and older.[16, 32]

	Deaths/100,000 Population			
Age (Years)	Black Male	White Male	Black Female	White Female
35–44	0.13	0.06	0.14	0.05
45–54	0.17	0.11	0.14	0.12
55–64	0.43	0.29	0.26	0.32
65–74	1.07	0.96	0.96	0.80
75–84	2.72	2.44	1.59	1.85

* Average annual rates.
† Rates are unreliable for black males aged 35–54 years and black females aged 35–64 years.

Chart 5–6
Hospitalization Rates for Sickle Cell Anemia in Blacks, Ages Younger Than 15 and 15–44, U.S., 1988–2009

Hospitalization rates for sickle cell anemia in blacks varied considerably between 1988 and 2009. Except in 1989 and 1990, rates in the 15–44 age group were higher than those in the younger than 15 age group; overall rates increased for the older group but not for the younger group.[32]

	Hospitalizations/10,000 Population	
Year	Ages <15 Years	Ages 15–44 Years
1988	1.88	2.03
1989	2.50	2.27
1990	2.66	2.38
1991	2.10	2.41
1992	1.96	2.06
1993	1.59	2.22
1994	1.35	2.77
1995	2.22	2.62
1996	1.56	2.47
1997	1.89	2.56
1998	1.56	2.78
1999	1.66	2.52
2000	2.10	2.54
2001	1.91	3.01
2002	2.60	2.92
2003	1.60	3.08
2004	1.60	3.18
2005	2.80	3.84
2006	1.70	3.19
2007	1.98	3.92
2008	1.96	4.47
2009	2.30	3.99

Chart 5–7
Age-Adjusted Death Rates* for Sickle Cell Anemia in Blacks by Sex, U.S., 1980–1984 to 2003–2007

From 1980–1984 to 1990–1994, death rates for sickle cell anemia rose for black males and females. Since then, death rates slowly declined for black males through 2003–2007; in black females, rates remained unchanged before declining in 2003–2007.[16]

	Deaths/100,000 Population	
Years	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
2003–2007	1.29	1.17

* Average annual rates.

Chart 5–8
Death Rates* for Sickle Cell Anemia in Blacks by Age and Sex, U.S., 2004–2007†

In 2004–2007, sickle cell anemia mortality was somewhat similar in males and females. Death rates were relatively high for individuals aged 25–64 years; few individuals live long enough to die of old age.[16]

	Deaths/100,000 Population	
Age (Years)	Black Male	Black Female
1–4	0.45	0.35
5–14	0.19	0.18
15–24	1.06	0.84
25–34	2.06	1.66
35–44	2.38	1.87
45–54	1.79	1.91
55–64	1.39	1.51
65–74	0.54	1.01
75–84	0.48	0.23

* Average annual rates.
† Rates are unreliable for black males aged 5–14 and 65–74 years and black females aged 5–14 and 75–84 years.

Appendices

A. International Classification of Diseases

B. 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 malformations of the circulatory system [e]	†	†	746–747	745–747	Q20–Q28
Chronic lower respiratory diseases [f]	†	†	†	490–496	J40–J47
Chronic obstructive pulmonary disease [g]	500–502, 527.1	500–502, 527.1	490–492, 519.3	490–492, 494–496	J40–J44, J47
Asthma [h]	241	241	493	493	J45, J46
Respiratory distress syndrome [i]	†	†	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-9 term is chronic obstructive pulmonary disease and allied conditions.

[g] 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.

[h] The ICD-6 through ICD-9 term is asthma; the ICD-10 terms are asthma and status asthmaticus.

[i] The ICDA-8 terms are hyaline membrane disease and respiratory distress syndrome. The ICD-9 term is respiratory distress syndrome. The ICD-10 term 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
RDS†	P22	769	2,904	3,144	0.9237

* From a sample of deaths in 1996.[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.[11]
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.[31]
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.[40]
Comparability ratio:	A comparability ratio is the number of deaths from a cause as coded by an ICD revision divided by the number of deaths from the closest similar cause as coded by the proceeding ICD revision. A sample of death certificates from a chosen year is used for the calculation. The ratios measure discontinuities in mortality trends that result from the introduction of a new ICD revision.[9]
Emergency department:	An emergency department is a hospital facility that is staffed 24 hours a day and provides unscheduled outpatient services to patients whose conditions require immediate care.[40]
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.[40]
Incidence:	Incidence is the number of cases with onset during a specified period of time, usually a year.[40]
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.[40]
Limited in activity:	Also called chronic activity limitation, it refers to the limitation of a person's usual activity due to a chronic condition.[40]

Appendix C

Definition of Terms (continued)

Morbidity:	Morbidity refers to incidence, prevalence, hospitalizations, and physician office visits.
Prevalence:	The prevalence of a condition is the number of persons who have the condition at a given time.[40]
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.[40]
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.[40]

Appendix D

Abbreviations*

AMI	acute myocardial infarction
BP	blood pressure
CHD	coronary heart disease
CLRD	chronic lower respiratory diseases
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
NAMCS	National Ambulatory Medical Care Survey
NCHS	National Center for Health Services
NHAMCS	National Hospital Ambulatory Medical Care Survey
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
FIN	Finland
FRA	France
GER	Germany
HUN	Hungary
ITA	Italy
JPN	Japan
KOR	Republic of Korea
NOR	Norway
NTH	Netherlands
POL	Poland
ROM	Romania
SPA	Spain
SWE	Sweden
UK	United Kingdom
USA	United States of America

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