2001 Technical notes

Nature and sources of data

Data in this report are based on information from all death certificates filed in the 50 States and the District of Columbia and are processed by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS). Data for 2001 are based on records of deaths that occurred during 2001 and were received as of October 24, 2002. The U.S. Standard Certificate of Death--which is used as a model by the States--was last revised in 1989; for additional details see the 1989 revision of the U.S. standard certificates and reports (28) and Technical Appendix of *Vital Statistics of the United States, 1989,* Volume II, Mortality, part A (29). Data for Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Northern Marianas are included in tables showing data by State, but are not included in U.S. totals.

Mortality statistics are based on information coded by the States and provided to the National Center for Health Statistics (NCHS) through the Vital Statistics Cooperative Program (VSCP) and from copies of the original certificates received by NCHS from the State registration offices. In 2001 all the States and the District of Columbia participated in this program and submitted part or all of the mortality data for 2001 in electronic data files to NCHS. All States provided precoded medical (cause-of-death) data to NCHS except Illinois, Kentucky, New Jersey, Ohio, and West Virginia, and the District of Columbia. For 2001 all States submitted precoded demographic data for all deaths.

Data for the entire United States refer to events occurring within the United States. Data shown for geographic areas are by place of residence. Beginning with 1970, mortality statistics for the United States exclude deaths of nonresidents of the United States. All data exclude fetal deaths.

Mortality statistics for Puerto Rico, Virgin Islands, American Samoa, and Northern Marianas exclude deaths of nonresidents of Puerto Rico, Virgin Islands, American Samoa, and Northern Marianas, respectively. For Guam, however, mortality statistics exclude deaths that occurred to a resident of any place other than Guam or the United States.

Cause-of-death classification

The mortality statistics presented in this report were compiled in accordance with World Health Organization (WHO) regulations, which specify that member nations classify and code causes of death in accordance with the current *revision* of the *International Classification of Diseases*.(ICD). The ICD provides the basic guidance used in virtually all countries to code and classify causes of death. Effective with deaths occurring in 1999, the United States began using the Tenth Revision of this classification (ICD-10) (7). For earlier years causes of death were classified according to the revisions then in use--1979-98, Ninth Revision; 1968-78, Eighth Revision, adapted for use in the United States; 1958-67, Seventh Revision; and 1949-57, Sixth Revision.

Changes in classification of causes of death due to these revisions may result in discontinuities in cause-of-death trends. Consequently, cause-of-death comparisons among revisions require consideration of comparability ratios and, where available, estimates of their standard errors. Comparability ratios between the Ninth and Tenth Revisions, between the Eighth and Ninth Revisions, between the Seventh and Eighth Revisions, and between the Sixth and Seventh Revisions may be found in other NCHS reports (20,30-32).

The ICD not only details disease classification but also provides definitions, tabulation lists, the format of the death certificate, and the rules for coding cause of death. Cause-of-death data presented in this publication were coded by procedures outlined in annual issues of the *NCHS Instruction Manual* (33,34). It includes rules for selecting the underlying cause of death for tabulation purposes, definitions, tabulation lists, and regulations on the use of the ICD.

Before data for 1968, mortality medical data were based on manual coding of an underlying cause of death for each certificate in accordance with WHO rules. Effective with data year 1968, NCHS converted to computerized coding of the underlying cause and manual coding of all causes (multiple causes) on the death certificate. In this system, called “Automated Classification of Medical Entities” (ACME) (35), multiple cause codes serve as inputs to the computer software that employs WHO rules to select the underlying cause. All cause-of-death data in this report are coded using

ACME.

The ACME system is used to select the underlying cause of death for all death certificates in the United States. In addition, NCHS has developed two computer systems as inputs to ACME. Beginning with 1990 data, the Mortality Medical Indexing, Classification, and Retrieval system (MICAR) (36,37), was introduced to automate coding multiple causes of death. In addition, MICAR provides more detailed information on the conditions reported on death certificates than is available through the International Classification of Diseases (ICD) code structure. Then, beginning with data year 1993, SuperMICAR, an enhancement of the MICAR system, was introduced. SuperMICAR allows for literal entry of the multiple cause-of-death text as reported by the certifier. This information is then automatically processed by the MICAR and ACME computer systems. Records that cannot be automatically processed by MICAR or SuperMICAR are manually multiple-cause coded and then further processed through ACME.

For 2001 approximately 61 percent of the Nation's death records were multiple-cause coded using SuperMICAR and 39 percent, using MICAR only. This represents data from 37 States, New York City and the District of Columbia that were coded by SuperMICAR and data from 13 States that were coded by MICAR.

In this report tabulations of cause-of-death statistics are based solely on the underlying cause of death. The underlying cause is defined by WHO as “the disease or

injury which initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" (7). It is selected from the conditions entered by the physician 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 associated selection rules and modifications. Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. This is captured in NCHS multiple cause-of-death statistics (38-40).

Tabulation lists and cause-of-death ranking

Tabulation lists for ICD-10 are published in the NCHS Instruction Manual, Part 9, ICD-10 Cause-of-Death Lists for Tabulating Mortality Statistics, Effective 1999 (41). For this report, two tabulation lists are used, namely, the List of 113 Selected Causes of Death used for deaths of all ages, and the List of 130 Selected Causes of Infant Death used for infants. These lists are also used to rank leading causes of death for the two population groups. For the List of 113 Selected Causes of Death, the group titles Major cardiovascular diseases (ICD-10 codes I00-I78) and Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (ICD-10 codes R00-R99) are not ranked. In addition, category titles that begin with the words "Other" and "All other" are not ranked to determine the leading causes of death. When one of the titles that represents a subtotal is ranked (for example, Tuberculosis (ICD-10 codes A16-A19)), its

component parts are not ranked (in this case, Respiratory tuberculosis (ICD-10 code A16) and Other tuberculosis (ICD-10 codes A17-A19)). For the List of 130 Selected Causes of Infant Death, the same ranking procedures are used, except that the category Major cardiovascular diseases is not in the list. More detail regarding ranking procedures can be found in “Deaths: Leading Causes for 2001 (3).

Leading cause-of-death trends, discussed in this report, are based on cause-of-death data according to ICD-10 for 1999-2001, and on data for the most comparable ICD-9 cause-of-death titles for 1979-1998. Tables showing ICD-9 categories that are comparable to the ICD-10 titles in the list of 113 selected causes of death may be found in "Comparability of Cause of Death Between ICD-9 and ICD-10: Preliminary Estimates" (20) and "Deaths: Final Data for 1999" (21). Although in some cases categories from the list of 113 selected causes are identical to those in the old list of 72 selected causes of death used with ICD-9, it is important to note that many of these categories are not comparable with categories in the list of 72 selected causes even though the cause-of-death titles may be the same.

Trend data for 1978-1999 that is classified by ICD-9 but is sorted into the list of 113 selected causes of death developed for ICD-10 can be found on the mortality website at http://www.cdc.gov/nchs/data/statab/hist001.pdf

Revision of the ICD and resulting changes in classification and rules for selecting the underlying cause of death have important implications for the analysis of mortality

trends by cause of death. For some causes of death the discontinuity in trend can be substantial (20). Therefore, considerable caution should be used in analyzing cause-of-death trends for periods of time that extend across more than one revision of the ICD.

Codes for terrorism

Beginning with data for 2001, NCHS introduced categories *U01-*U03 for classifying and coding deaths due to acts of terrorism. The asterisks before the category codes indicate that they are not part of the *International Classification of Diseases, Tenth Revision* (ICD-10). Deaths classified to the terrorism categories are included in the categories for Assault (homicide) and Intentional self-harm (suicide) in the 113 cause-of-death list and in the category for Assault (homicide) in the 130 cause-of-death list for infants. Additional information on these new categories can be found at http://www.cdc.gov/nchs/about/otheract/icd9/terrorism_code.htm.

Race and Hispanic origin

Race and Hispanic origin are reported separately on the death certificate. Therefore, data shown by race include persons of Hispanic and non-Hispanic origin, and data for Hispanic origin include persons of any race. In this report, unless otherwise specified, deaths of Hispanic origin are included in the totals for each race group --- white, black, American Indian, and Asian or Pacific Islander (API) --- according to the decedent's race as reported on the death certificate. Data shown for Hispanic persons

include all persons of Hispanic origin of any race.

Mortality data for the Hispanic-origin population are based on deaths to residents of all 50 States and the District of Columbia. Data year 1997 was the first year that mortality data for the Hispanic population were available for the entire United States.

Quality of race and Hispanic origin data--Death rates for Hispanic, American Indian, and API persons should be interpreted with caution because of inconsistencies in reporting Hispanic origin or race on the death certificate as compared with race on censuses, surveys, and birth certificates. Studies have shown under-reporting on death certificates of American Indians, API, and Hispanic decedents; and undercounts of these groups in the censuses (16,42).

A number of studies have been conducted on the reliability of race reported on the death certificate by comparing race on the death certificate with that reported on another data collection instrument, such as the Census or a survey. Differences may arise because of differences in who provides race information on the compared records. Race information on the death certificate is reported by the funeral director as provided by an informant or in the absence of an informant, on the basis of observation. In contrast, race on the census or on the Current Population Survey (CPS) is obtained while the individual is alive and is self-reported or reported by another member of the household familiar with the individual and, therefore, may be considered more valid. A high level of agreement between the death certificate and the census or survey report is

essential to assure unbiased death rates by race.

Studies (42,43) show that a person self-reported as American Indian or Asian on census or survey records was sometimes reported as white on the death certificate. The net effect of misclassification is an underestimation of deaths and death rates for races other than white and black. In addition, under-coverage of minority groups in the census and resultant population estimates, introduces biases into death rates by race (6,16,44). Estimates of the approximate effect of the combined bias due to race misclassification on death certificates and under-enumeration on the 1990 census are as follows: white, -1.0 percent; black, -5.0; American Indian, +20.6; Asian or Pacific Islander, +10.7 (16).

The National Longitudinal Mortality Study (NLMS) examined the reliability of Hispanic origin reported on 43,520 death certificates with that reported on a total of 12 Current Population Surveys conducted by the U.S. Bureau of the Census for the years 1979-85 (16). In this study, agreement--on a record-by-record basis--was 89.7 percent for any report of Hispanic origin. The ratio of deaths for CPS divided by deaths for death certificate was 1.07 indicating net underreporting of Hispanic origin on death certificates by 7 percent as compared with self-reports on the surveys. Death rates for the Hispanic-origin population are also affected by under-coverage of this population group in the census and resultant population estimates; the estimated net correction, taking into account both sources of bias, is 1.6 percent (16,44).

Other races and race not stated--Beginning in 1992 all records coded as "Other

races" (0.03 percent of the total deaths in 2001) were assigned to the specified race of the previous record. Records for which race was unknown, not stated, or not classifiable (0.08 percent) were assigned the racial designation of the previous record.

Infant and maternal mortality rates--For 1989-2001, as in previous years, infant and maternal deaths continue to be tabulated by the race of the decedent. However, beginning with the 1989 data year, the method of tabulating live births by race was changed from race of parents to race of mother as stated on the birth certificate. This change affects infant and maternal mortality rates because live births are the denominators of these rates (29,45). To improve continuity and ease of interpretation, trend data by race in this report have been retabulated by race of mother for all years beginning with the 1980 data year.

Quantitatively, the change in the basis for tabulating live births by race results in more white births and fewer black births and births of other races. Consequently, infant and maternal mortality rates under the new tabulating procedure tend to be about 2 percent lower for white infants and about 5 percent higher for black infants than when they are computed by the previous method of tabulating live births by race of parents. Rates for most other minority races also are higher when computed by race of mother (45,46).

Infant mortality rates for the Hispanic-origin population are based on numbers of resident infant deaths reported to be of Hispanic origin and numbers of resident live

births by Hispanic origin of mother for the United States. In computing infant mortality rates, deaths and live births of unknown origin are not distributed among the specified Hispanic and non-Hispanic groups. In 2001 the percent of infant deaths of unknown origin was 0.9 and the percent of live births to mothers of unknown origin was 0.6 for the United States.

Small numbers of infant deaths for specific Hispanic-origin groups result in infant mortality rates subject to relatively large random variation (see "Random variation"). Infant mortality rates by Hispanic origin are less subject to reporting error when based on linked files of infant deaths and live births (27).

Infant mortality rates calculated from the general mortality file for specified race and/or Hispanic origin are in error because of reporting problems that affect the classification of race and Hispanic origin on the birth and death certificates for the same infant. Infant mortality rates by specified race and Hispanic origin are more accurate when based on the linked file of infant deaths and live births (27). The linked file computes infant mortality rates using the race and/or Hispanic origin of the mother from the birth certificate in both the numerator and denominator of the rate. In addition, mother’s race and/or Hispanic origin from the birth certificate is considered to be more accurately reported than infant’s race and/or Hispanic origin from the death certificate because, on the birth certificate, race is generally reported by the mother at the time of delivery whereas, on the death certificate, infant’s race and/or Hispanic origin is reported by an informant, usually the mother but sometimes by the funeral director.

Estimates of reporting errors have been made by comparing rates based on the linked files with those in which the race of infant death is based on information from the death certificate (16,27).

Life tables

The life table provides a comprehensive measure of the effect of mortality on life expectancy. It is composed of sets of values showing the mortality experience of a hypothetical group of infants born at the same time and subject throughout their lifetime to the age-specific death rates of a particular time period, usually a given year. Beginning with final data reported for 1997, the life table methodology was changed from previous annual reports. Previously, U.S. life tables were abridged and constructed by reference to a standard table (47). In addition, the age range for these life tables was limited to 5-year age groups ending with the age group 85 years and over.

Beginning with 1997 mortality data, a revised life table methodology was used to construct complete life tables by single years of age that extend to age 100 (48) using a methodology similar to that of the decennial life tables (49). The advantages of the new over the previous methodology are its comparability with decennial life table methodology, greater accuracy, and greater age detail. A comparison of the two methods shows small differences in resulting values for life expectancy (48). Although the new method produces complete life tables, that is, life tables by single years of age, life table data shown in this report are summarized in 5-year age groupings. To

calculate the probability of dying at each age, the revised methodology uses vital statistics death rates for ages under 85 years and mortality data from the Medicare program for ages over 85 years. Medicare data were used to model the probability of dying at ages 85 and over because the data are shown to be significantly more reliable than vital statistics data at the oldest ages (50).

The life tables presented in this report use a slight modification of the new life table method introduced in 1997 as a result of a change in the age detail of populations received from the US Census Bureau. Populations for 2000 and 2001 were provided by single year of age up to age 84, followed by "85 years and over," and as a result it was not possible to apply the same smoothing technique that has been used when population figures in single years of age up to ages "100 years and over" were available. Accordingly, Medicare data were used to estimate the probability of dying by single year of age for ages 85 to "100 years and over."

Revised life expectancies were not computed for 1991-99 because revised intercensal populations, consistent with the 2000 census, were not available by single years of age up to “100 years and over” for the 1990s’ as of the printing of this report.

Causes of death contributing to changes in life expectancy

Causes of death contributing to changes in life expectancy were estimated using a life table partitioning technique. The method partitions changes into component additive parts. This method identifies the causes of death having the greatest influence, positive or negative, on changes in life expectancy (17,51).

Injury mortality by mechanism and intent

Injury mortality data are presented using an alternative framework in table 18. In this framework, causes of injury deaths are organized principally by mechanism (e.g. firearm or poisoning), and secondarily by manner, or intent of death (e.g. unintentional, suicide, homicide, etc.).

In addition, the number of deaths for selected causes in this framework may differ from those shown in tables that use the standard mortality tabulation lists. Following WHO conventions, standard mortality tabulations (table 10) present external causes of death (ICD-10 codes *U01-*U03, V01-Y89). In contrast, the alternative framework (table 18) excludes deaths classified to Complications of medical and surgical care (ICD-10 codes Y40-Y84, Y88). For additional information on injury data presented in this framework, see http://www.cdc.gov/nchs/about/otheract/ice/matrix10.htm and “Deaths: Injuries, 2001” (4).

Codes for firearm deaths

Causes of death attributable to firearm mortality include ICD-10 codes *U01.4, Terrorism involving firearms (homicide); W32-W34, Accidental discharge of firearms; X72-X74, Intentional self-harm (suicide) by discharge of firearms; X93-X95, Assault (homicide) by discharge of firearms; Y22-Y24, Discharge of firearms, undetermined intent; and Y35.0, Legal intervention involving firearm discharge. Deaths from injury by firearms exclude deaths due to explosives and other causes indirectly related to firearms.

Codes for drug-induced deaths

Causes of death attributable to drug-induced mortality include selected codes from the ICD-10 title Mental and behavioral disorders due to psychoactive substance use, specifically, ICD-10 codes F11.0-F11.5, F11.7-F11.9, F12.0-F12.5, F12.7-F12.9, F13.0-F13.5, F13.7-F13.9, F14.0-F14.5, F14.7-F14.9, F15.0-F15.5, F15.7-F15.9, F16.0-F16.5, F16.7-F16.9, F17.0, F17.3-F17.5, F17.7-F17.9, F18.0-F18.5, F18.7-F18.9, F19.0-F19.5, and F19.7-F19.9; Accidental poisoning by and exposure to drugs, medicaments and biological substances, X40-X44; Intentional self-poisoning (suicide) by and exposure to drugs, medicaments and biological substances, X60-X64; Assault (homicide) by drugs, medicaments and biological substances, X85; and Poisoning by and exposure to drugs, medicaments and biological substances, undetermined intent, Y10-Y14. Drug-induced causes exclude accidents, homicides, and other causes indirectly related to drug use. Also excluded are newborn deaths associated with mother's drug use.

Codes for alcohol-induced deaths

Causes of death attributable to alcohol-induced mortality include ICD-10 codes F10, Mental and behavioral disorders due to alcohol use; G31.2, Degeneration of nervous system due to alcohol; G62.1, Alcoholic polyneuropathy; I42.6, Alcoholic cardiomyopathy; K29.2, Alcoholic gastritis; K70, Alcoholic liver disease; R78.0, Finding of alcohol in blood; X45, Accidental poisoning by and exposure to alcohol; X65, Intentional self-poisoning by and exposure to alcohol; and Y15, Poisoning by and

exposure to alcohol, undetermined intent. Alcohol-induced causes exclude accidents, homicides, and other causes indirectly related to alcohol use. This category also excludes newborn deaths associated with maternal alcohol use.

Marital status

Age-specific and age-adjusted death rates by marital status are shown in table 25 by race and in table 26 by Hispanic origin. Mortality data by marital status is generally of high quality. A study of death certificate data using the 1986 National Mortality Followback Survey showed a high level of consistency in reporting marital status (43). Age-adjusted death rates by marital status were computed based on the age-specific rates and the standard population for ages 25 years and over. While age-specific death rates by marital status are shown for the age group 15-24 years, they are not included in the computation of the age-adjusted rate because of their high variability, particularly for the widowed population. Also, the age groups 75-84 and 85 years and over are combined due to high variability in death rates in the 85 year and over age group, particularly for the never married population.

Educational attainment

Beginning with the 1989 data year, an item indicating decedent's educational attainment was added to the certificates of numerous States. Mortality data on educational attainment for 2001 are based on deaths to residents of the 47 States and

the District of Columbia whose data were approximately 80 percent or more complete on a place-of-occurrence basis. Data for Georgia, Rhode Island, and South Dakota were excluded because the item was not on their certificates.

Age-specific and age-adjusted death rates by educational attainment are shown in table 27. Age-adjusted death rates by educational attainment were computed based on the age-specific rates and the standard population for ages 25-64 years. Data for age groups 65 years and over are not shown because reporting quality is poorer at older than younger ages (52).

Rates by educational attainment are affected by differences in measurement of education for the numerator and the denominator. The numerator is based on number of years of education completed as reported on the death certificate whereas the denominator is based on highest degree completed as reported on census surveys (53).

Injury at work

Information on deaths attributed to injuries at work is derived from a separate item on the death certificate that asks the medical certifier whether the death resulted from an injury sustained at work. The item is on the death certificate of all States. Number of deaths, age-specific death rates, and age-adjusted death rates for injury at work are shown in tables 28 and 29. Deaths, crude death rates, and age-adjusted death rates for injury at work are shown for ages 15 years and over. Age-adjusted death rates for injury at work were computed using age-specific death rates and the U.S. standard population based on year 2000 standard for ages 15 years and over. See section on

"Computing rates." Figures presented in this report include deaths from the September 11, 2001 terrorist attacks for which death certificates indicated the death occurred at work and were filed as of 10/24/02. For further information on the September 11, 2001 terrorism related deaths, see section entitled "Quality of reporting and processing cause of death."

Infant mortality

Infant mortality rates are the most commonly-used index for measuring the risk of dying during the first year of life. The rates presented in this report are calculated by dividing the number of infant deaths in a calendar year by the number of live births registered for the same period and are presented as rates per 1,000 or per 100,000 live births. For final birth figures used in the denominator for infant mortality rates, see *Births: Final Data for 2001* (54). In contrast to infant mortality rates based on live births, infant death rates are based on the estimated population under 1 year of age. Infant death rates that appear in tabulations of age-specific death rates in this report are calculated by dividing the number of infant deaths by the July 1, 2001 population estimate of persons under 1 year of age, based on 2000 Census populations. These rates are presented as rates per 100,000 population in this age group. Because of differences in the denominators, infant death rates may differ from infant mortality rates.

Maternal mortality

Maternal mortality rates are also computed on the basis of the number of live

births. The maternal mortality rate indicates the likelihood of a pregnant woman dying of maternal causes. They are calculated by dividing the number of maternal deaths in a calendar year by the number of live births registered for the same period and are presented as rates per 100,000 live births. The number of live births used in the denominator is an approximation of the population of pregnant women who are at risk of a maternal death.

"Maternal deaths" are defined by the World Health Organization as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes" (7). Included in these deaths are ICD-10 codes A34, O00-O95, and O98-O99.

Some State death certificates include a separate question regarding pregnancy status. A positive response to the question is interpreted as if "pregnant" was reported in Part II of the cause-of-death section of the death certificate. If a specified length of time is not provided by the medical certifier, it is assumed that the pregnancy terminated 42 days or less prior to death. Further, if only indirect maternal causes of death (i.e., a previously existing disease or a disease that developed during pregnancy which was not due to direct obstetric causes but was aggravated by physiologic effects of pregnancy) are reported in Part I and pregnancy is reported in either Part I or Part II, the death is classified as a maternal death.

Quality of reporting and processing cause of death

One index of the quality of reporting causes of death is the proportion of death certificates coded to Chapter XVIII; Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (ICD-10 codes R00-R99). Although deaths occur for which the underlying causes are impossible to determine, this proportion indicates the care and consideration given to the cause-of-death statement by the medical certifier. This proportion also may be used as a rough measure of the specificity of the medical diagnoses made by the certifier in various areas. The percent of all reported deaths in the United States assigned to Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified, was 1.34 percent, about the same as in 2000 (1.33 percent), but considerably higher than in 1999 (1.12 percent). From 1990 through 1999, the percent of deaths from this cause for all ages combined generally was fairly stable, between 1.08 and 1.18 percent.

The large decrease in Influenza (ICD-10 codes J10-J11) deaths from 2000 to 2001 is largely due to a change in the coding rules, which resulted in deaths that would have previously been assigned to Influenza, instead were assigned to Pneumonia in 2001.

Terrorism related deaths referred to in this report do not represent a final count of deaths resulting from the terrorist attacks on September 11, 2001, as this figure has not yet been determined. To date, an estimated 3,028 deaths resulted from the September 11, 2001 terrorist attacks that occurred in New York City, Pennsylvania, and Virginia

(table D). Of these, an estimated 2,792 deaths occurred in New York City, 189 in Virginia, and 44 in Pennsylvania. Three deaths occurred in other States, one each in Massachusetts, Missouri, and New Jersey, to persons who were injured on September 11 but died as the result of their injuries at a later date. The New Jersey death occurred in 2002.

As of October 24, 2002, death certificates were issued for 2,957 of the estimated 3,028 individuals believed to have died as a result of the September 11 attacks (table D). Of these, four were issued for terrorists and are classified as suicides. The criteria for issuing a death certificate for those believed to have died in the attacks differed by State, reflecting differences in State laws regarding death certification. Pennsylvania issued a death certificate for every individual, including the terrorists. Death certificates were not issued for any of the terrorists in Virginia or New York City. Virginia issued a death certificate only for those victims whose remains were identified. New York City issued a death certificate for those whose remains were identified or, if remains were not recovered, for those whose families applied for a death certificate. For more detailed information regarding New York City's processing of these deaths, see *Deaths in World Trade Center Terrorist Attacks---New York City, 2001* at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm51SPa6.htm.

Data in this report include deaths to residents of the United States. Tables in this report, other than table D, include only the September 11 related deaths that occurred to residents of the United States in 2001 for which a certificate was issued as of October 24, 2002. Of these deaths, 2,922 are classified as homicides and 4 as suicides.

Rare causes of death

Selected causes of death considered to be of public health concern are routinely confirmed by the States according to agreed upon procedures between the State vital statistics programs and the National Center for Health Statistics. These causes, termed "Infrequent and rare causes of death," are listed in the NCHS instruction manuals Parts 2a, 11, and 20 (33,55,56).

For data year 2001, complete confirmation of deaths from infrequent and rare causes were not provided by the District of Columbia and the following States: California, Illinois, Indiana, Kansas, Kentucky, Maine, Minnesota, Montana, New Jersey, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, and Rhode Island.

Population bases for computing rates

Populations used for computing death rates and life tables shown in this report represent the population residing in the United States, enumerated as of April 1 for census years and estimated as of July 1 for all other years. Death rates for the United States for 2001 are computed using postcensal estimates published in 2001 based on the 2000 census estimated as of July 1, 2001. These populations are shown by race for 10-year age groups in table I and are available by 5-year age groups on the mortality Web site at http://www.cdc.gov/nchs/datawh/statab/unpubd/mortabs.htm (57). Population estimates for all origins, Hispanic, non-Hispanic, non-Hispanic white, and non-Hispanic black for 2001 are shown in table II.

Death rates, shown in this report, for 1991-2000 have been recomputed, based on revised populations that are consistent with the 2000 census levels (58-67). These estimates were produced under a collaborative arrangement with the U.S. Census Bureau and are based on the 2000 census counts by age, race, and sex, modified to be consistent with U.S. Office of Management and Budget racial categories as of 1977 and historical categories for death data (9). The modification procedures are described in detail elsewhere (11,12). Death rates previously published in annual reports of final data for 1991 to 2000 (21,23,68-75) were based on postcensal population estimates derived from the 1990 census.

Population estimates in table II for Mexicans, Puerto Ricans, Cubans, and Other Hispanics, and population estimates by marital status in tables III and IV, are based on the Current Population Survey adjusted to resident population control totals for the United States (76) and, as such, are subject to sampling variation (see “Random variation”). The control totals used are 2000-based population estimates for the United States for July 1, 2001 (57).

Population estimates by educational attainment, shown in table V, are also based on the Current Population Survey (76) adjusted to resident population control totals, and are also subject to sampling variation (see “Random variation”). The control totals used are 2000-based population estimates for 47 States and the District of Columbia for July 1, 2001 (57).

Population estimates for each State, shown in table VI, were estimated from

State-level postcensal population estimates based on the 2000 census, estimated as of July 1, 2001 (77). State population estimates, produced in 2002 (2002 "vintage" series), incorporate information not included in the national population estimates, produced in 2001 (2001 "vintage" series); thereby, State population estimates are not consistent with national population estimates used in this report. Population estimates for Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas, also shown in table VI, are based on the 2000 census, estimated as of July 1, 2001 and produced in 2002 (2002 "vintage" series) (78). Population estimates for each State and territory are based on demographic analysis and, therefore, are not subject to sampling variation.

Computing rates

Except for infant and maternal mortality rates, rates are on an annual basis per 100,000 estimated population residing in the specified area. Infant and maternal mortality rates are per 1,000 or per 100,000 live births. Comparisons made in the text among rates, unless otherwise specified, are statistically significant at the 0.05 level of significance. Lack of comment in the text about any two rates does not mean that the difference was tested and found not to be significant at this level.

Age-adjusted rates (R') are used to compare relative mortality risks among groups and over time. However, they should be viewed as relative indexes rather than as actual measures of mortality risk. They were computed by the direct method, that is, by applying age-specific death rates (R_i) to the U.S. standard population (w_i) (table VII).

$$R' = \sum_i w_i R_i$$

Beginning with the 1999 data year, a new population standard was adopted by NCHS for use in age-adjusting death rates. Based on the projected year 2000 population of the United States, the new standard replaces the 1940 standard population that had been used for over 50 years. The new population standard affects levels of mortality and to some extent trends and group comparisons. Of particular note are the effects on race comparison of mortality. For detailed discussion see *Age Standardization of Death Rates: Implementation of the Year 2000 Standard* (79).

All age-adjusted rates shown in this report are based on the year 2000 standard population. The year 2000 standard population and corresponding weights used for computing age-adjusted rates and standard errors, excluding those by marital status, education, injury at work, and the U.S. territories, are shown in table VII.

Table VII. United States standard population: Numbers and proportions (weights)

Age	Number	Weights (w_i)
All ages	1,000,000	1.000000
Under 1 year	13,818	0.013818
1-4 years	55,317	0.055317
5-14 years	145,565	0.145565
15-24 years	138,646	0.138646
25-34 years	135,573	0.135573
35-44 years	162,613	0.162613
45-54 years	134,834	0.134834
55-64 years	87,247	0.087247
65-74 years	66,037	0.066037
75-84 years	44,842	0.044842
85 years and over	15,508	0.015508

Age-adjusted rates by marital status were computed by applying the age-specific death rates to the U.S. standard population for ages 25 years and over. Although age-specific death rates by marital status are shown for the age group 15-24 years, they are not included in the calculation of age-adjusted rates because of their high variability, particularly for the widowed population. Also, the age groups 75-84 and 85 years and over are combined because of high variability in death rates in the 85 years and over age group, particularly for the never married population. The year 2000 standard population and corresponding weights used for computing age-adjusted rates and standard errors by marital status are shown in table VIII.

Table VIII. United States standard population for ages 25 years and over: Numbers and proportions (weights)

Age	Number	Weights (w_i)
25 years and over.....	646,654	1.000000
25-34 years.....	135,573	0.209653
35-44 years.....	162,613	0.251468
45-54 years.....	134,834	0.208510
55-64 years.....	87,247	0.134921
65-74 years.....	66,037	0.102121
75 years and over.....	60,350	0.093327

Age-adjusted rates by educational attainment were computed by applying the age-specific death rates to the U.S. standard population for ages 25-64 years. Data for age groups 65 years and over are not shown because reporting quality is poorer for older than for younger ages (52). The year 2000 standard population and corresponding

weights used for computing age-adjusted rates and standard errors by education are shown in table IX.

Table IX. United States standard population for ages 25-64 years: Numbers and proportions (weights)

Age	Number	Weights (w_i)
25-64 years.....	520,267	1.000000
25-34 years.....	135,573	0.260584
35-44 years.....	162,613	0.312557
45-54 years.....	134,834	0.259163
55-64 years.....	87,247	0.167697

Age-adjusted rates for injury at work were computed by applying the age-specific death rates to the U.S. standard population for ages 15 years and over. The year 2000 standard population and corresponding weights used for computing age-adjusted rates and standard errors for injury at work are shown in table X.

Table X. United States standard population for ages 15 years and over: Numbers and proportions (weights)

Age	Number	Weights (w_i)
15 years and over.....	785,300	1.000000
15-24 years.....	138,646	0.176552
25-34 years.....	135,573	0.172638
35-44 years.....	162,613	0.207071
45-54 years.....	134,834	0.171697
55-64 years.....	87,247	0.111100
65 years and over.....	126,387	0.160941

Age-adjusted rates for Puerto Rico, Virgin Islands, Guam, American Samoa, and Northern Marianas were computed by applying the age-specific death rates to the U.S. standard population. Age groups for 75 years and over were combined because population counts were unavailable by age group for ages over 75 years. The year 2000 standard population and corresponding weights used for computing age-adjusted rates and standard errors for the territories are shown in table XI.

Table XI. United States standard population: Numbers and proportions (weights)

Age	Number	Weights (w_i)
All ages	1,000,000	1.000000
Under 1 year	13,818	0.013818
1-4 years	55,317	0.055317
5-14 years	145,565	0.145565
15-24 years	138,646	0.138646
25-34 years	135,573	0.135573
35-44 years	162,613	0.162613
45-54 years	134,834	0.134834
55-64 years	87,247	0.087247
65-74 years	66,037	0.066037
75 years and over	60,350	0.060350

Using the same standard population, death rates for the total population and for each race-sex group were adjusted separately. The age-adjusted rates were based on 10-year age groups. It is important not to compare age-adjusted death rates with crude rates.

Death rates for the Hispanic population are based only on events to persons reported as Hispanic. Rates for non-Hispanic white persons are based on the sum of all

events to white decedents reported as non-Hispanic and white decedents with origin not stated. Hispanic origin is not imputed if it is not reported.

Random variation

The mortality data presented in this report, with the exception of data for 1972, are not subject to sampling error. In 1972 mortality data were based on a 50-percent sample of deaths because of resource constraints. Mortality data, even based on complete counts, may be affected by random variation. That is, the number of deaths that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances (80,81). When the number of deaths is small (perhaps less than 100), random variation tends to be relatively large. Therefore, considerable caution must be observed in interpreting statistics based on small numbers of deaths.

Measuring random variability—To quantify the random variation associated with mortality statistics, one must make an assumption regarding the appropriate underlying distribution. Deaths, as infrequent events, can be viewed as deriving from a Poisson probability distribution. The Poisson distribution is simple conceptually and computationally, and provides reasonable, conservative variance estimates for mortality statistics when the probability of dying is relatively low (81). Using the properties of the Poisson distribution, the standard error (SE) associated with the number of deaths (D) is

1. $$SE(D) = \sqrt{\text{var}(D)} = \sqrt{D}$$

where var(D) denotes the variance of D.

The standard error associated with crude and age-specific death rates (*R*) assumes that the population denominator (*P*) is a constant and is

2. $$SE(R) = \sqrt{\text{var}\left(\frac{D}{P}\right)} = \sqrt{\frac{1}{P^2}\text{var}(D)} = \sqrt{\frac{D}{P^2}} = \frac{R}{\sqrt{D}}$$

The coefficient of variation or relative standard error (RSE) is a useful measure of relative variation. The RSE is calculated by dividing the statistic (e.g., number of deaths, death rate) into its standard error and multiplying by 100. For the number of deaths

$$RSE(D) = 100\frac{SE(D)}{D} = 100\frac{\sqrt{D}}{D} = 100\sqrt{\frac{1}{D}}$$

For crude and age-specific death rates

$$RSE(R) = 100\frac{SE(R)}{R} = 100\frac{R/\sqrt{D}}{R} = 100\sqrt{\frac{1}{D}}$$

Thus,

3. $$RSE(D) = RSE(R) = 100\sqrt{\frac{1}{D}}$$

The standard error of the age-adjusted death rate (R') is

4. $$SE(R') = \sqrt{\sum_i w_i^2 \text{ var}(R_i)} = \sqrt{\sum_i \left\{ w_i^2 \left(\frac{R_i^2}{D_i} \right) \right\}}$$

where

R_i = age-specific rate for the *i*th age group

w_i = age-specific standard weight for the *i*th age group from the U.S. standard population such that $\sum w_i$ =1.0 (see table VII and age-adjusted death rate under "Definition of terms")

D_i = number of deaths for the *i*th age group

The RSE for the age-adjusted rate, $RSE(R')$, can easily be calculated by dividing $SE(R')$ from formula 4 by the age-adjusted death rate, R', and multiplying by 100.

$$RSE(R') = 100\frac{SE(R')}{R'}$$

For tables showing infant and maternal mortality rates based on live births (*B*) in the denominator, calculation of the standard error assumes random variability in both the numerator and denominator. The standard error for the infant mortality rate (*IMR*) is

5. $$SE(IMR) = \sqrt{\frac{\text{var}(D) + IMR \cdot \text{var}(B)}{E(B)^2}} = \sqrt{\frac{D}{B^2} + \frac{D^2}{B^3}}$$

where the number of births, B, is also assumed to be distributed according to a Poisson distribution and *E(B)* is the expectation of *B*.

The RSE for the IMR is

6. $$RSE(IMR) = 100\frac{SE(IMR)}{IMR} = 100\sqrt{\frac{1}{D} + \frac{1}{B}}$$

For maternal mortality rates, formulas 5 and 6 may be used substituting the maternal mortality rate for the IMR.

Formulas 1-6 may be used for all tables presented in this report except for death rates and age-adjusted death rates shown in tables 5, 25, 26, and 27 which are calculated using population figures that are subject to sampling error (see the following

subsection).

Tables 5, 25, 26, and 27—Death rates for Mexicans, Puerto Ricans, Cubans, and Other Hispanics in table 5, rates by marital status in tables 25 and 26, and rates by educational attainment in table 27 are based on population estimates derived from the U.S. Bureau of the Census' Current Population Survey (CPS) for 2001 and adjusted to resident population control totals. As a result, the rates are subject to sampling variability in the denominator as well as random variability in the numerator.

For crude and age-specific death rates (R) the standard error is calculated as

7. $$SE(R) = R\sqrt{\frac{1}{D} + 0.67\left(a + \frac{b}{P}\right)}$$

For age-adjusted death rates (R')

8. $$SE(R') = \sqrt{\sum_i \left\{ w_i^2 R_i^2 \left[\frac{1}{D_i} + 0.67\left(a + \frac{b}{P_i}\right)\right]\right\}}$$

where *a* and *b* in formulas 7 and 8 represent parameters presented in table XII, which are derived from the CPS data for 2001 and vary depending on the subgroup of interest (82).

Suppression of unreliable rates—Beginning with 1989 data, an asterisk is shown in place of a crude or age-specific death rate based on fewer than 20 deaths, the equivalent of an RSE of 23 percent or more. The limit of 20 deaths is a convenient, if somewhat arbitrary, benchmark, below which rates are considered to be too statistically unreliable for presentation. For infant and maternal mortality rates, the same criterion

(less than 20 deaths) is used to determine whether an asterisk is presented in place of the rate. For age-adjusted death rates the suppression criterion is based on the sum of the age-specific deaths; i.e., if the sum of the age-specific deaths is less than 20, an asterisk is presented in place of the rate. These procedures are used throughout this report except for death rates shown in tables 5, 25, 26, and 27.

For death rates shown in tables 5, 25, 26, and 27, sampling variability in the population denominator has a substantial impact on the overall variability in the rate. Therefore, the number of deaths in the numerator is not used as the sole suppression factor. RSEs for rates shown in tables 5, 25, 26, and 27 are derived from formulas 7 and 8 by dividing the results of formulas 7 and 8, by the crude/age-specific rate and age-adjusted rate, respectively, and multiplying by 100. Rates are replaced by asterisks if the calculated RSE is 23 percent or more. In some cases, for smaller population subgroups, the estimated sample population from the CPS may be zero, even though deaths are presented for these same subgroups. In these cases, the death rate is incalculable and is automatically replaced with an asterisk.

Confidence intervals and statistical tests based on 100 deaths or more—When the number of deaths is large, a normal approximation may be used in the calculation of confidence intervals and statistical tests. How large is to some extent a subjective judgment. In general, for crude and age-specific death rates and for infant and maternal mortality rates, the normal approximation performs quite well when the number of deaths is 100 or greater,. For age-adjusted rates, the criterion for use of the normal

approximation is somewhat more complicated (6,79,83). Formula 9 is used to calculate 95-percent confidence limits for the death rate when the normal approximation is appropriate.

9. $$L(R) = R - 1.96(SE(R)) \text{ and } U(R) = R + 1.96(SE(R))$$

where *L(R)* and *U(R)* are the lower and upper limits of the confidence interval, respectively. The resulting 95-percent confidence interval can be interpreted to mean that the chances are 95 in 100 that the "true" death rate falls between *L(R)* and *U(R)*. For example, suppose that the crude death rate for Malignant neoplasms is 194.4 per 100,000 population based on 553,768 deaths. Lower and upper 95-percent confidence limits using formula 9 are calculated as

$$L(194.4) = 194.4 - 1.96(.26) = 193.9 \text{ and } U(194.4) = 194.4 + 1.96(.26) = 194.9$$

Thus, the chances are 95 in 100 that the true death rate for Malignant neoplasms is between 193.9 and 194.9. Formula 9 can also be used to calculate 95-percent confidence intervals for the number of deaths, age-adjusted death rates, infant mortality rates, and other mortality statistics when the normal approximation is appropriate by replacing *R* with *D*, R', *IMR*, etc.

When testing the difference between two rates, R_1 and R_2 (each based on 100 or more deaths), the normal approximation may be used to calculate a test statistic, z, such that

10. $$z = \frac{R_1 - R_2}{\sqrt{SE(R_1)^2 + SE(R_2)^2}}$$

If $|z| \geq 1.96$ then the difference between the rates is statistically significant at the 0.05-level. If $|z| < 1.96$ then the difference is not statistically significant. Formula 10 can also be used to perform tests for other mortality statistics when the normal approximation is appropriate (when both statistics being compared meet the normal criteria) by replacing R_1 and R_2 with D_1 and D_2, R_1' and R_2', etc. Suppose that the female age-adjusted death rate for lung cancer is 41.3 per 100,000 U.S. standard population in 2000 (R_1) and 41.0 per 100,000 U.S. standard population in 2001 (R_2). The standard error for each of these figures, SE(R_1) and SE(R_2), is calculated using formula 4. Using formula 10, one can test if the decrease in the age-adjusted rate is statistically significant.

$$z = \frac{41.3 - 41.0}{\sqrt{(0.163)^2 + (0.161)^2}} = 1.31$$

Because z=1.31<1.96, the decrease from 2000 to 2001 in the female age-adjusted death rate for lung cancer is not statistically significant.

Confidence intervals and statistical tests based on less than 100 deaths—When the number of deaths is not large (less than 100), the Poisson distribution cannot be approximated by the normal distribution. The normal distribution is a symmetric . to + distribution with a range from - As a result, confidence intervals based on the normal distribution also have this range. The number of deaths or the death rate, however, cannot be less than zero. When the number of deaths is very small, approximating confidence intervals for deaths and death rates using the normal distribution will sometimes produce lower confidence limits that are negative. The Poisson distribution, in contrast, is an asymmetric distribution with zero as a lower bound. Thus, confidence

limits based on this distribution will never be less than zero. A simple method based on the more general family of gamma distributions, of which the Poisson is a member, can be used to approximate confidence intervals for deaths and death rates when the number of deaths is small (79,83). For more information regarding how the gamma method is derived, see *Derivation of the gamma method* at the end of this section.

Calculations using the gamma method can be made using commonly available spreadsheet programs or statistical software (e.g., Excel, SAS) that include an inverse gamma function. In Excel, the function "gammainv(probability, alpha, beta)" returns values associated with the inverse gamma function for a given probability between 0 and 1. For 95 percent confidence limits, the probability associated with the lower limit is .05/2=.025 and the probability associated with the upper limit is 1-(.05/2)=.975. Alpha and beta are parameters associated with the gamma distribution. For the number of deaths and crude and age-specific death rates, alpha=*D* (the number of deaths) and beta=1. In Excel, the following formulas can be used to calculate lower and upper 95 percent confidence limits for the number of deaths and crude and age-specific death rates

L(D)=GAMMAINV(.025, *D*, 1) and *U(D)*= GAMMAINV(.975, *D*+1, 1)

Confidence limits for the death rate are then calculated by dividing *L(D)* and *U(D)* by the population (*P*) at risk of dying (see formula 17).

Alternatively, 95 percent confidence limits can be estimated using the lower and upper confidence limit factors shown in table XIII. For the number of deaths, *D*, and the death rate, *R*,

11. $L(D) = L \times D$ and $U(D) = U \times D$

12. $L(R) = L \times R$ and $U(R) = U \times R$

where *L* and *U* in formulas 11 and 12 are the lower and upper confidence limit factors

which correspond to the appropriate number of deaths, *D*, in table XIII. For example, suppose that the death rate for American Indian females aged 10-14 is 24.0 per 100,000 and based on 30 deaths. Applying formula 12, values for L and U from table XIII for 30 deaths are multiplied by the death rate, 24.0, such that

$L(R) = L(24.0) = 0.674696 \times 24.0 = 16.2$ and $U(R) = U(24.0) = 1.427562 \times 24.0 = 34.3$

These confidence limits indicate that the chances are 95 out of 100 that the actual death rate for American Indian females aged 10-14 is between 16.2 and 34.3 per 100,000.

Although the calculations are similar, confidence intervals based on small numbers for age-adjusted death rates, infant and maternal mortality rates, and rates that are subject to sampling variability in the denominator are somewhat more complicated (6,79). Refer to the most recent version of the Mortality Technical Appendix for more details (http://www.cdc.gov/nchs/datawh/statab/pubd/ta.htm).

When comparing the difference between two rates, R_1 and R_2 where one or both of the rates are based on fewer than 100 deaths, a comparison of 95 percent confidence intervals may be used as a statistical test. If the 95 percent confidence intervals do not overlap, then the difference can be said to be statistically significant at the 0.05-level. A simple rule of thumb is: if $R_1 > R_2$ then test if $L(R_1) > U(R_2)$ or if $R_2 > R_1$ then test if $L(R_2) > U(R_1)$. Positive tests denote statistical significance at the 0.05-level. For example, suppose that American Indian females aged 10-14 have a death rate (R_1) of 24.0 based on 30 deaths and Asian and Pacific Islander (API) females aged 10-14 have a death rate (R_2) of 12.4 per 100,000 based on 55 deaths. The 95 percent confidence limits for R_1 and R_2 calculated using formula 12 would be

$L(R_1) = L(24.0) = 0.674696 \times 24.0 = 16.2$ and $U(R_1) = U(24.0) = 1.427562 \times 24.0 = 34.3$

$L(R_2) = L(12.4) = 0.753337 \times 12.4 = 9.3$ and $U(R_2) = U(12.4) = 1.301637 \times 12.4 = 16.1$

Because $R_1 > R_2$ and $L(R_1) > U(R_2)$, it can be concluded that the difference between the

death rates for American Indian females 10-14 and API females of the same age is statistically significant at the .05-level. That is, taking into account random variability, API females 10-14 have a death rate that is significantly lower than that for American Indian females of the same age.

This test may also be used to perform tests for other statistics when the normal approximation is not appropriate for one or both of the statistics being compared by replacing R_1 and R_2 with D_1 and D_2, R_1' and R_2', etc.

Users of the method of comparing confidence intervals should be aware that this method is a conservative test for statistical significance. That is, the difference between two rates may, in fact, be statistically significant even though confidence intervals for the two rates overlap (84). Thus, caution should be observed when interpreting a non-significant difference between two rates, especially when the lower and upper limits being compared overlap only slightly.

Derivation of the gamma method—For a random variable X that follows a gamma distribution $\Gamma(y,z)$, where *y* and *z* are the parameters that determine the shape of the distribution, $E(X)=yz$ and $Var(X)=yz^2$ (85). For the number of deaths, *D*, *E(D)=D* and *Var(D)=D* . It follows that *y=D* and *z*=1 and thus,

13. $$D \sim \Gamma(D,1)$$

From equation 13, it is clear that the shape of the distribution of deaths depends only on the number of deaths.

For the death rate, *R*, *E(R)=R* and $Var(R)=\frac{D}{P^2}$. It follows, in this case, that *y=D*

and $z = P^{-1}$ and thus,

14. $$R \sim \Gamma(D, P^{-1}) .$$

A useful property of the gamma distribution is that for $X \sim \Gamma(y, z)$, one can divide *X* by *z* such that $\frac{X}{z} \sim \Gamma(y,1)$. This converts the gamma distribution into a simplified, standard form dependent only on parameter *y*. Expressing equation 14 in its simplified form gives

15. $$\frac{R}{P^{-1}} = D \sim \Gamma(D,1)$$

From equation 15, it is clear that the shape of the distribution of the death rate is also dependent solely on the number of deaths.

Using the results of equations 13 and 15, one can use the inverse gamma distribution to calculate upper and lower confidence limits. Lower and upper 100(1-*α*) percent confidence limits for the number of deaths, *L(D)* and *U(D)*, are estimated as

16. $$L(D) = \Gamma^{-1}{}_{(D,1)}(\alpha/2) \quad \text{and} \quad U(D) = \Gamma^{-1}{}_{(D+1,1)}(1-\alpha/2)$$

where Γ^{-1} represents the inverse of the gamma distribution and D+1 in the formula for *U(D)* reflects a continuity correction made necessary by the fact that *D* is a discrete random variable and the gamma distribution is a continuous distribution. For a 95 percent confidence interval, *α*=.05. For the death rate, it can be shown that

17. $$L(R) = \frac{L(D)}{P} \quad \text{and} \quad U(R) = \frac{U(D)}{P}$$

For more detail regarding the derivation of the gamma method and its application to age-adjusted death rates and other mortality statistics, see references 6,79,83.

Availability of mortality data

Mortality data are available in publications, unpublished tables, and electronic products as described on the mortality web site at the following address: http://www.cdc.gov/nchs/about/major/dvs/mortdata.htm. More detailed analysis than provided in this report is possible by using the Mortality public-use data set issued each data year. Since 1991, the data set is available through NCHS in CD-ROM format. Data are also available in the *Vital Statistics of the United States*, Mortality, and *Vital and Health Statistics*, Series 20 reports, and the *National Vital Statistics Reports* through NCHS.

Definitions of terms

Infant deaths —Deaths of infants aged under 1 year.

Neonatal deaths—Deaths of infants aged 0–27 days.

Postneonatal deaths—Deaths of infants aged 28 days–1 year.

Crude death rate—Total deaths per 100,000 population for a specified period. The crude death rate represents the average chance of dying during a specified period for persons in the entire population.

Age-specific death rate—Deaths per 100,000 population in a specified age group, such as 1–4 years or 5–9 years for a specified period.

Age-adjusted death rate—The death rate used to make comparisons of relative mortality risks across groups and over time. This rate should be viewed as a construct

or an index rather than as direct or actual measure of mortality risk. Statistically, it is a weighted average of the age-specific death rates, where the weights represent the fixed population proportions by age (86).

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