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Sources of data

Death and fetal-death statistics

Mortality statistics for 1993 are, as for all previous years except 1972, based on information from records of all deaths occurring in the United States. Fetal-death statistics for every year are based on all reports of fetal death received by the National Center for Health Statistics (NCHS).

The death-registration system and the fetal-death reporting system of the United States encompass the 50 States, the District of Columbia, New York City (which is independent of New York State for the purpose of death registration), Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Marianas. In the statistical tabulations of this publication, United States refers only to the aggregate of the 50 States (including New York City) and the District of Columbia. Tabulations for Guam, Puerto Rico, and the Virgin Islands are shown separately in this volume. No data have ever been included for American Samoa or the Commonwealth of the Northern Marianas.

The Virgin Islands were admitted to the registration area for deaths in 1924; Puerto Rico, in 1932; and Guam, in 1970.

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Tabulations of death statistics for Puerto Rico and the Virgin Islands were regularly shown in the annual volumes of *Vital Statistics of the United States* from the year of their admission through 1971 except for the years 1967-69, and tabulations for Guam were included for 1970 and 1971. Death statistics for Puerto Rico, the Virgin Islands, and Guam were not included in the 1972 volume but have been included in section 8 of the volumes for each of the years 1973-78 and in section 9 beginning with 1979. Information for 1972 for these three areas was published in the respective annual vital statistics reports of the Department of Health of the Commonwealth of Puerto Rico, the Department of Health of the Virgin Islands, and the Department of Public Health and Social Services of the Government of Guam.

Procedures used by NCHS to collect death statistics have changed over the years. Before 1971 tabulations of deaths and fetal deaths were based solely on information obtained by NCHS from copies of the original certificates. The information from these copies was edited, coded, and tabulated. For 1960-70 all mortality information taken from these records was transferred by NCHS to magnetic tape for computer processing.

Beginning with 1971 an increasing number of States have provided NCHS, via the Vital Statistics Cooperative Program (VSCP), with electronic files of data coded according to NCHS

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specifications. The year in which State-coded demographic data were first transmitted in electronic data files to NCHS is shown below for each of the States, New York City, Puerto Rico, and the District of Columbia, all of which now furnish demographic or nonmedical data on tape.

1971

Florida

1977

Alaska

Idaho

Massachusetts

New York City

Ohio

Puerto Rico

1972

Maine

Missouri

New Hampshire

Rhode Island

Vermont

1978

Indiana

Utah

Washington

1973

Colorado

Michigan

New York (except)

1979

Connecticut

Hawaii

Mississippi

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New York City)

New Jersey.

Pennsylvania

Wyoming

1974

1980

Illinois

Arkansas

Iowa

New Mexico

Kansas

South Dakota

Montana

Nebraska

Oregon

South Carolina

1975

1982

Louisiana

North Dakota

Maryland

North Carolina

Oklahoma

Tennessee

Virginia

Wisconsin

1976

1985

Alabama

Arizona

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Kentucky	California
Minnesota	Delaware
Nevada	Georgia
Texas	District of
West Virginia	Columbia

For the Virgin Islands and Guam, mortality statistics for 1993 are based on information obtained directly by NCHS from copies of the original certificates received from the registration offices.

In 1974 States began coding medical (cause-of-death) data in electronic data files according to NCHS specifications. The year in which State-coded medical data were first transmitted to NCHS is shown below for the 38 States now furnishing such data. In 1993 Maine, Montana, North Dakota, and Wyoming contracted with a private company to provide precoded medical data to NCHS. Kansas provided the medical data for Alaska. Iowa provided precoded medical data for Idaho. The remaining 12 VSCP States, New York City, and the District of Columbia submitted copies of the original certificates from which NCHS coded the medical data.

1974	1986
Iowa	California

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Michigan

Florida

Texas

1975

1988

Louisiana

Alaska

Nebraska

Delaware

North Carolina

Idaho

Virginia

North Dakota

Wisconsin

Wyoming

1980

1989

Colorado

Georgia

Kansas

Indiana

Massachusetts

Washington

Mississippi

New Hampshire

Pennsylvania

South Carolina

1981

1991

Maine

Arkansas

1983

1992

Minnesota

Montana

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1984	1993
Maryland	Alabama
New York (except	Connecticut
New York City)	Hawaii
Vermont	Nevada
	Oregon
	South Dakota

For 1993 and previous years except 1972, NCHS coded the medical information from copies of the original certificates received from the registration offices for all deaths occurring in those States that were not furnishing NCHS with medical data coded according to NCHS specifications. For 1981 and 1982, these procedures were modified because of a coding and processing backlog resulting from personnel and budgetary restrictions. To produce the mortality files on a timely basis with reduced resources, NCHS used State-coded underlying cause-of-death information supplied by 19 States for 50 percent of the records; for the other 50 percent of the records for these States as well as for 100 percent of the records for the remaining 21 registration areas, NCHS coded the medical information. Mortality statistics for 1972 were based on information obtained from a 50-percent sample of death records instead of from all

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records as in other years. The sample resulted from personnel and budgetary restrictions. Sampling variation associated with the 50-percent sample is described below in "Estimates of errors arising from 50-percent sample for 1972."

In 1993, 41 States, New York City, the District of Columbia, and Puerto Rico provided NCHS, via the VSCP, electronic data files of fetal-death data coded according to NCHS specifications. The remaining nine States--Arizona, California, Connecticut, Louisiana, Maryland, Massachusetts, Nevada, New Mexico, and New York (excluding New York City)--submitted photocopies of original reports of fetal deaths. For the registration areas submitting photocopies, the demographic items were coded by NCHS for the majority of the file with the remainder coded under contract by the U.S. Bureau of the Census. Fetal-death data are published by NCHS for Puerto Rico, the Virgin Islands, and Guam in section 9 of *Vital Statistics of the United States*, Volume II, Mortality, Part B.

Standard certificates and reports

For many years, the U.S. Standard Certificate of Death and the U.S. Standard Report of Fetal Death, issued by the Public Health Service, have been used as the principal means to attain uniformity in the contents of documents used to collect

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information on these events. They have been modified in each State to the extent required by the particular needs of the State or by special provisions of the State vital statistics law. However, the certificates or reports of most States conform closely in content and arrangement to the standards.

The first issue of the U.S. Standard Certificate of Death appeared in 1900. Since then, it has been revised periodically by the national vital statistics agency through consultation with State health officers and registrars; Federal agencies concerned with vital statistics; national, State, and county medical societies; and others working in such fields as public health, social welfare, demography, and insurance. This revision procedure has ensured careful evaluation of each item in terms of its current and future usefulness for legal, medical and health, demographic, and research purposes. New items have been added when necessary, and old items have been modified to ensure better reporting; or in some cases, items have been dropped when their usefulness appeared to be limited.

The current versions of the U.S. Standard Certificate of Death and the U.S. Standard Report of Fetal Death were recommended for State use beginning on January 1, 1989. The U.S. Standard Certificate of Death and the U.S. Standard Report of Fetal Death are shown in figures 7-A and 7-B, respectively (1).

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History

The first death statistics published by the Federal Government concerned events in 1850 and were based on statistics collected during the decennial census of that year. In 1880 a national "registration area" was created for deaths. Originally, this area consisted of Massachusetts, New Jersey, the District of Columbia, and several large cities that had efficient systems for death registration. The death-registration area continued to expand until 1933, when it included for the first time the entire United States. Tables showing data for death-registration States include the District of Columbia for all years; registration cities in nonregistration States are not included. For more details on the history of the death-registration area, see the *Vital Statistics of the United States*, 1979, Volume II, Mortality, Part A, section 7, pages 3 and 4 and *Vital Statistics of the United States*, 1950, Volume I, chapter 1, pages 2-19. Statistics on fetal deaths were first published for the birth-registration area in 1918 and then every year beginning with 1922.

Classification of data

The principal value of vital statistics data is realized through the presentation of rates, which are computed by

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relating the vital events of a class to the population of a similarly defined class. Vital statistics and population statistics must therefore be classified according to similarly defined systems and tabulated in comparable groups. Even when the variables common to both, such as geographic area, age, sex, and race, have been similarly classified and tabulated, differences between the enumeration method of obtaining population data and the registration method of obtaining vital statistics data may result in significant discrepancies.

The general rules used in the classification of geographic and personal items for deaths and fetal deaths for 1993 are set forth in two NCHS instruction manuals (2,3). A discussion of the classification of certain important items is presented below.

Classification by occurrence and residence

Tabulations for the United States and specified geographic areas in this volume are classified by place of residence unless stated as by place of occurrence. Before 1970 resident mortality statistics for the United States included all deaths occurring in the States and the District of Columbia, with deaths of nonresidents assigned to place of death. Deaths of nonresidents refers to deaths that occur in the United States of nonresident aliens; nationals residing abroad; and residents of Puerto Rico,

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the Virgin Islands, Guam, and other territories of the United States. Beginning with 1970 deaths of nonresidents are not included in tables by place of residence.

Tables by place of occurrence, on the other hand, include deaths of both residents and nonresidents of the United States. Consequently, for each year beginning with 1970, the total number of deaths in the United States by place of occurrence was somewhat greater than the total by place of residence. For 1993 this difference amounted to 3,394 deaths. Mortality statistics by place of occurrence are shown in tables 1-11, 1-19, 1-20, 1-30, 1-31, 1-32, 3-1, 3-6, 8-1, and 8-7.

Before 1970 except for 1964 and 1965, deaths of nonresidents of the United States occurring in the United States were treated as deaths of residents of the exact place of occurrence, which in most instances was an urban area. In 1964 and 1965, deaths of nonresidents of the United States occurring in the United States were allocated as deaths of residents of the balance of the county in which they occurred.

Residence error--Results of a 1960 study showed that the classification of residence information on the death certificates corresponded closely to the residence classification of the census records for the decedents whose records were matched (4).

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A comparison of the results of this study of deaths with those for a previous matched record study of births (5) showed that the quality of residence data had improved considerably between 1950 and 1960. Both studies found that events in urban areas were overstated by the NCHS classification in comparison with the U.S. Bureau of the Census classification. The magnitude of the difference was substantially less for deaths in 1960 than it was for births in 1950.

The improvement is attributed to an item added in 1956 to the U.S. Standard Certificates of Birth and of Death, asking whether residence was inside or outside city limits. This new item aided in properly allocating the residence of persons living near cities but outside the corporate limits. Although this may have improved the quality of data, accurate determination of place of residence appears to be a continuing problem.

Geographic classification

The rules followed in the classification of geographic areas for deaths and fetal deaths are contained in the two instruction manuals referred to previously (2,3). The geographic codes assigned by NCHS during data reduction of source information on birth, death, and fetal-death records are given in another

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instruction manual (6). Beginning with 1982 data, the geographic codes were modified to reflect results of the 1980 census. For 1970-81 codes are based on results of the 1970 census.

Metropolitan statistical areas--The Metropolitan statistical areas (MSA's) and Primary metropolitan statistical areas (PMSA's) used in this volume are those established by the U.S. Office of Management and Budget as of April 1, 1990, and used by the U.S. Bureau of the Census (7), except in the New England States.

Outside the New England States, an MSA has either a city with a population of at least 50,000 or a U.S. Bureau of the Census urbanized area of at least 50,000 and a total MSA population of at least 100,000. A PMSA consists of a large urbanized county or cluster of counties that demonstrate very strong internal economic and social links and has a population over 1 million. When PMSA's are defined, the larger area of which they are component parts is designated a Consolidated Metropolitan Statistical Area (CMSA) (8).

In the New England States, the U.S. Office of Management and Budget uses towns and cities rather than counties as geographic components of MSA's and PMSA's. However, NCHS cannot use this classification for these States because its data are not coded to identify all towns. Instead, NCHS uses New England County

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Metropolitan Areas (NECMA's). Made up of county units, these areas are established by the U.S. Office of Management and Budget (9).

Metropolitan and nonmetropolitan counties--Independent cities and counties included in MSA's and PMSA's or in NECMA's are included in data for metropolitan counties; all other counties are classified as nonmetropolitan.

Population-size groups--In 1993 vital statistics data for cities and certain other urban places were classified according to the population enumerated in the 1980 Census of Population. Data are available for individual cities and other urban places of 10,000 or more population. Data for the remaining areas not separately identified are shown in the tables under the heading "balance of area" or "balance of county." For the years 1970-81, classification of areas was determined by the population enumerated in the 1970 Census of Population. Beginning with 1982 data, some urban places identified in previous reports were deleted and others were added because of changes occurring in the enumerated population between 1970 and 1980.

Urban places other than incorporated cities for which vital statistics data are shown in this volume include the following:

- Each town in New England, New York, and Wisconsin and each township in Michigan, New Jersey, and Pennsylvania

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that had no incorporated municipality as a subdivision and had either 25,000 inhabitants or more, or a population of 10,000 to 25,000 and a density of 1,000 persons or more per square mile.

- Each county in States other than those indicated above that had no incorporated municipality within its boundary and had a density of 1,000 persons or more per square mile. (Arlington County, Virginia, is the only county classified as urban under this rule.)
- Each place in Hawaii with a population of 10,000 or more. (There are no incorporated cities in the State.)

Before 1964 places were classified as "urban" or "rural." The technical appendixes for earlier years discuss the previous classification system.

State or country of birth

Mortality statistics by State or country of birth (table 1-36) became available beginning with 1979. State or country of birth of a decedent is assigned to 1 of the 50 States or the District of Columbia; or to Puerto Rico, the Virgin Islands, or Guam--if specified on the death certificate. The place of birth is also tabulated for Canada, Cuba, Mexico, and for the remainder of the world. Deaths for which information on State or

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country of birth was unknown, not stated, or not classifiable accounted for a small proportion of all deaths in 1993, about 0.6 percent.

Early mortality reports published by the U.S. Bureau of the Census contained tables showing nativity of parents as well as nativity of decedent. Publication of these tables was discontinued in 1933. Mortality data showing nativity of decedent were again published in annual reports for 1939-41 and for 1950.

Age

The age recorded on the death record is the age at last birthday, the same as the age classification used by the U.S. Bureau of the Census. For 1993 data 507 resident death records (0.02 percent) contained not-stated age. For computation of age-specific and age-adjusted death rates, deaths with age not stated are excluded. For life table computation, deaths with age not stated are distributed proportionately.

Race

For vital statistics in the United States in 1993, deaths are classified by race--white, black, American Indian, Chinese, Hawaiian, Japanese, Filipino, and Other Asian or Pacific

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Islander. Beginning with 1992 data an expanded code structure was used for seven States showing five additional Asian or Pacific Islander groups. These groups are Asian Indian, Korean, Samoan, Vietnamese, and Guamanian. These groups are coded only for deaths occurring in California, Hawaii, Illinois, New Jersey, New York, Texas, and Washington. In 1990, at least two-thirds of the U.S. population of each of these groups lived in this seven-State reporting area: Asian Indian, Korean, and Vietnamese, 63-66 percent; Guamanian, 74 percent; and Samoan, 84 percent (10). This additional race detail is available on the mortality public-use data tapes (11,12), but is not shown separately in this volume. Beginning in 1992 all records coded as "other races" (0.02 percent of the total deaths) were assigned to the specified race of the previous record rather than to a separate category called "other races." Mortality data for Filipino and Other Asian or Pacific Islander were shown for the first time in 1979.

The white category includes, in addition to persons reported as white, those reported in the race item on the death certificate as Hispanic, Mexican, Puerto Rican, Cuban, and all other Caucasians. The American Indian category includes American, Alaskan, Canadian, Eskimo, and Aleut. If the racial entry on the death certificate indicates a mixture of Hawaiian and any other race, the entry is coded to Hawaiian. If the race

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is given as a mixture of white and any other race, the entry is coded to the appropriate nonwhite race. If a mixture of races other than white is given (except Hawaiian), the entry is coded to the first race listed. This procedure for coding the first race listed has been used since 1969. Before 1969 if the entry for race was a mixture of black and any other race except Hawaiian, the entry was coded to black.

Most of the tables in this volume, however, do not show data for this detailed classification by race. Most tables show data for white, all other (including black), and black separately. Information on Hispanic or ethnic origin is obtained from a separate item on the death certificate (see "Hispanic origin").

Race not stated--For 1993 the number of death records for which race was unknown, not stated, or not classifiable was 6,318 or 0.3 percent of the total deaths. Beginning in 1992 death records with race not stated were assigned to the specified race of the previous record with known race. From 1965 to 1991 death records with race entry not stated were assigned to a racial designation as follows: If the preceding record was coded white, the code assignment was made to white; if the code was other than white, the assignment was made to black. Before 1964 all records with race not stated were assigned to white except records of residents of New Jersey for 1962-64.

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New Jersey, 1962-64--New Jersey omitted the race item from its certificates of live birth, death, and fetal death in the beginning of 1962. The item was restored during the latter part of 1962. However, the certificate revision without the race item was used for most of 1962 as well as 1963. Therefore, figures by race for 1962 and 1963 exclude New Jersey. For 1964 6.8 percent of the death records used for residents of New Jersey did not contain the race item.

Adjustments made in vital statistics to account for the omission of the race item in New Jersey for part of the certificates filed during 1962-64 are described in the Technical Appendix of the *Vital Statistics of the United States* for each of those data years.

Quality of race data--A number of studies have been conducted on the reliability of race reported on the death certificate. These studies compare race reported on the death certificate with that reported on another data collection instrument such as the census or a survey. Race information on the death certificate is reported by the funeral director as provided by an informant, often the surviving next of kin, or, in the absence of an informant, on the basis of observation. In contrast, race on the census or the Current Population Survey (CPS) is self-reported and, therefore, may be considered more

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valid. A high level of agreement between the death certificate and the census or survey report is essential to ensure unbiased death rates by race.

In one study a sample of approximately 340,000 death certificates was compared with census records for a 4-month period in 1960 (13). Percent agreement was 99.8 percent for white decedents, and 98.2 percent for black decedents; but less for the smaller minority groups (table A). In another study 29,713 death certificates were compared with responses to the race questions from a total of 12 CPS's conducted by the U.S. Bureau of the Census for the years 1979-85 (14). In this study, entitled the National Longitudinal Mortality Study, agreement for white decedents was 99.2 and for black decedents, 98.2; agreement was less for the smaller race groups. In 1986 the National Mortality Followback Survey, conducted by NCHS, listed a question about the race of decedents 25 years old and over. The total sample was 18,733 decedents (15). The rates of agreement were similar to those observed in the other studies.

All of these studies show that persons self-reported as American Indian or Asian on census and survey records (and by informants in the Followback Survey) were sometimes reported as white on the death certificate. The net effect of misclassification is an underestimation of deaths and death rates for the smaller minority races.

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Hispanic origin

Mortality statistics for the Hispanic-origin population are based on information for those States and the District of Columbia that included items on the death certificate to identify Hispanic or ethnic origin of decedents. Data for 1993 were obtained from the District of Columbia and all States except Oklahoma, which was excluded because its death certificate did not include an item to identify Hispanic or ethnic origin.

Hispanic mortality data were published for the first time in 1984. Generally, the reporting States used items similar to one of two basic formats recommended by NCHS. The first format is directed specifically toward the Hispanic population and appears on the U.S. Standard Certificate of Death as follows:

Was decedent of Hispanic origin?

(Specify No or Yes--If Yes, specify Cuban, Mexican, Puerto Rican, etc.) ____ No ____ Yes Specify:

The second format is a more general ancestry item and appears as follows:

Ancestry--Mexican, Puerto Rican, Cuban, African, English, Irish, German, Hmong, etc., (specify)

The 49 States and the District of Columbia for which general mortality data are shown in this report accounted for about 99.6

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percent of the Hispanic population in the United States in 1990. This included about 99.5 percent of the Mexican population, 99.8 percent of the Puerto Rican population, 99.9 percent of the Cuban population, and 99.7 percent of the "Other Hispanic" population (10). For qualifications regarding infant mortality of the Hispanic-origin population, see "Infant deaths."

*Quality of data on Hispanic origin--*A study (14) examined the reliability of Hispanic origin reported on 43,520 death certificates with that reported on a total of 12 CPS's conducted by the U.S. Bureau of the Census for the years 1979-85. In this study, agreement 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 percent indicating net underreporting of Hispanic origin on death certificates as compared with self-reports on the surveys. The sample was too small to assess the reliability of specified Hispanic groups.

Marital status

Mortality statistics by marital status (tables 1-34 and 1-35) have been published annually since 1979. They were previously published in the annual volumes for 1949-51 and 1959-61. Several reports analyzing mortality by marital status have been published, including the special study based on 1959-61

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data (16). Reference to earlier reports is given in the appendix of part B of the 1959-61 special study.

Mortality statistics by marital status are tabulated separately for never married, married, widowed, and divorced. Certificates on which the marriage is specified as being annulled are classified as never married. Where marital status is specified as separated or common-law marriage, it is classified as married. Of the 2,218,856 resident deaths 15 years of age and over in 1993, 10,006 certificates (0.5 percent) had marital status not stated.

Educational attainment

Beginning with the 1989 data year, mortality data on educational attainment have been tabulated from information reported on the death certificate. As a result of the revisions of the U.S. Standard Certificate of Death (1), this item was added to the certificates of a large number of States:

- Decedent's Education (specify only highest grade completed)
- Elementary/Secondary (0-12) College (1-4 or 5+)

Mortality data on educational attainment for 1993 (table 1-45) are based on deaths to residents of 45 States, New York (excluding New York City), and the District of Columbia. Data for four States--Georgia, Oklahoma, Rhode Island, and South

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Dakota--are excluded from this table because their death certificates did not include an educational attainment item. Data for New York City are excluded because the education item on its death certificate provided only grouped educational attainment data, and did not provide the level of detail of educational attainment in single years of age needed by NCHS.

In tables 1-46 and 1-47, the data are based on deaths to residents of 43 States and the District of Columbia whose data were approximately 80 percent or more complete on a place-of-occurrence basis. In addition to the four States mentioned previously, data from Kentucky and West Virginia were excluded because more than 20 percent of their death certificates were classified to "unknown educational attainment." In addition, data for New York were excluded because data for New York City were considered not comparable to data from the other areas.

Place of death and status of decedent

Mortality statistics by place of death have been published annually since 1979. Before that year they were published in 1958 (tables 1-30--1-32). In addition, mortality data also were available for the first time in 1979 for the status of decedent when death occurred in a hospital or medical center. The 1993

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data were obtained from the following two items appearing on the revised U.S. Standard Certificate of Death (1):

- Item 9a. Place of Death (check only one)
- Hospital: Inpatient
- ER/Outpatient, DOA
- Other: Nursing Home, Residence, Other (specify)
- Item 9b. Facility Name (If not institution, give street and number)

Before the 1989 revision of the Standard Certificate of Death, information on place of death and status of decedent could be determined if hospital or institution indicated Inpatient, Outpatient, ER, or DOA, and if the name of the hospital or institution, which was used to determine the kind of facility, appeared on the certificate. The change to a checkbox format in many States for this item may affect the comparability of data between 1989 and subsequent years and that for years before 1989.

Except for Oklahoma, all of the States (including New York City) and the District of Columbia have item 9 (or its equivalent) on their certificates. For all reporting States and the District of Columbia in the VSCP, NCHS accepts the State definition, classification, or code for hospitals, medical centers, nursing homes, or other institutions.

Effective with data for 1980, the coding of place of death

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and status of decedent was modified. A new coding category was added: "Death on arrival--hospital, clinic, medical center name not given." Deaths coded to this category are tabulated in tables 1-30--1-32. Had the 1979 coding categories been used, these deaths would have been tabulated as "Place unknown."

California--For the first 5 months of data year 1989, California coded "residence" to "other" for "Place of death."

Mortality by month and date of death

Deaths by month have been tabulated regularly and published in the annual volume for each year beginning with data year 1900. For 1993 deaths by month are shown in tables 1-20, 1-21, 1-24, 1-33, 2-16--2-18, and 3-7.

Date of death was published for the first time for data year 1972. In addition, unpublished data for selected causes by date of death for 1962 are available from NCHS.

Numbers of deaths by date of death in this volume are shown in table 1-33 for the total number of deaths and for the numbers of deaths for the following three causes, for which the greatest interest in date of occurrence of death has been expressed: Motor vehicle accidents, Suicide, and Homicide and legal intervention.

These data show the frequency distribution of deaths for the

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selected causes by day of week. They also make it possible to identify holidays with peak numbers of deaths from specified causes.

Report of autopsy

Before 1972 the last year for which autopsy data were tabulated was 1958. Beginning in 1972 all registration areas requested information on the death certificate as to whether an autopsy was performed. For 1993 autopsies were reported on 220,620 death certificates, 9.7 percent of the total (table 1-29).

Cause of death

Cause-of-death classification--Since 1949 cause-of-death statistics have been based on the underlying cause of death, which is defined as "(a) the disease or injury which initiated the train of events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury" (17).

For each death the underlying cause is selected from an array of conditions reported in the medical certification section on the death certificate. This section provides a format for entering the cause of death sequentially. The conditions are

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translated into medical codes through use of the classification structure and the selection and modification rules contained in the applicable revision of the *International Classification of Diseases* (ICD), published by the World Health Organization (WHO). Selection rules provide guidance for systematically identifying the underlying cause of death. Modification rules are intended to improve the usefulness of mortality statistics by giving preference to certain classification categories over others and/or to consolidate two conditions or more on the certificate into one classification category.

As a statistical datum, underlying cause of death is a simple, one-dimensional statistic; it is conceptually easy to understand and a well-accepted measure of mortality. It identifies the initiating cause of death and is therefore most useful to public health officials in developing measures to prevent the onset of the chain of events leading to death. The rules for selecting the underlying cause of death are included in ICD as a means of standardizing classification, which contributes toward comparability and uniformity in mortality medical statistics among countries.

Tabulation lists--Beginning with data year 1979, the cause-of-death statistics published by NCHS have been classified according to the Ninth Revision of the *International*

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Classification of Diseases (ICD-9) (17). In addition to specifying that ICD-9 be used, WHO also recommends how the data should be tabulated to promote international comparability. The recommended system for tabulating data in ICD-9 allows countries to construct their mortality and morbidity tabulation lists from the rubrics of the WHO Basic Tabulation List (BTL) if the rubrics from the WHO mortality and morbidity lists, respectively, are included. This tabulation system for the Ninth Revision is more flexible than that of the Eighth Revision, in which specific lists were recommended for tabulating mortality and morbidity data.

The BTL recommended under the Ninth Revision consists of 57 two-digit rubrics that when added equal the "all causes" total. Identified within each two-digit rubric are up to nine three-digit rubrics that are numbered from zero to eight and whose total does not equal the two-digit rubric. The two-digit BTL rubrics 01-46 are used for the tabulation of nonviolent deaths according to ICD categories 001-799. Rubrics relating to chapter 17 (nature-of-injury causes 47-56) are not used by NCHS for selecting underlying cause of death; rather, preference is given to rubrics E47-E56. The 57th two-digit rubric (VO) is the Supplementary Classification of Factors Influencing Health Status and Contact with Health Services and is not appropriate

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for the tabulation of mortality data. The WHO Mortality List, a subset of the titles contained in the BTL, consists of 50 rubrics that are the minimum necessary for the national display of mortality data.

Five lists of causes have been developed for tabulation and publication of mortality data in this volume--the Each-Cause List, List of 282 Selected Causes of Death, List of 72 Selected Causes of Death, List of 61 Selected Causes of Infant Death, and List of 34 Selected Causes of Death. These lists were designed to be as comparable as possible with the NCHS lists used under the Eighth Revision. However, complete comparability could not always be achieved.

The Each-Cause List is made up of each three-digit category of the WHO Detailed List to which deaths may be validly assigned and most four-digit subcategories. The list is used for tabulation for the entire United States. The published Each-Cause table does not show the four-digit subcategories provided for Motor vehicle accidents (E810-E825); however, these subcategories that identify persons injured are shown in the accident tables of this report (section 5). Special fifth-digit subcategories also are used in the accident tables to identify place of accident when deaths from nontransport accidents are shown. These are not shown in the Each-Cause table.

The List of 282 Selected Causes of Death is constructed from

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BTL rubrics 01-46 and E47-E56. Each of the 56 BTL two-digit titles can be obtained either directly or by combining titles in the List. The three-digit level of the BTL is modified more extensively. Where more detail was desired, categories not shown in the three-digit rubrics were added to the List of 282 Selected Causes of Death. Where less detail was needed, the three-digit rubrics were combined. Moreover, each of the 50 rubrics of the WHO Mortality List can be obtained from the List of 282 Selected Causes of Death.

The List of 72 Selected Causes of Death was constructed by combining titles in the List of 282 Selected Causes of Death. It is used in tables published for the United States and each State and for Metropolitan statistical areas.

The List of 61 Selected Causes of Infant Death shows more detailed titles for Congenital anomalies and Certain conditions originating in the perinatal period than any other list except the Each-Cause List.

The List of 34 Selected Causes of Death was created by combining titles in the List of 72 Selected Causes. A table using this list is published for detailed geographic areas.

Beginning with data for 1987, changes were made in these lists to accommodate the introduction in the United States of new categories *042-*044 for Human immunodeficiency virus (HIV) infection. The changes are described in the Technical Appendix

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from *Vital Statistics for the United States*, 1987.

Effect of list revisions--The International Lists, or adaptations of them, used in the United States since 1900, have been revised approximately every 10 years so the disease classifications may be consistent with advances in medical science and with changes in diagnostic practice. Each revision of the International Lists has produced some break in comparability of cause-of-death statistics. Cause-of-death statistics beginning with 1979 are classified by NCHS according to ICD-9 (17). For a discussion of each of the classifications used with death statistics since 1900, see *Vital Statistics of the United States*, 1979, Volume II, Mortality, Part A, section 7, pages 9-14.

A dual coding study was undertaken in which the Ninth and the Eighth Revisions were compared to measure the extent of discontinuity in cause-of-death statistics resulting from introducing the new revision. A study for the List of 72 Selected Causes of Death and the List of 10 Selected Causes of Infant Death has been published (18). The List of 10 Selected Causes of Infant Death is a basic NCHS tabulation list not used in this volume but used for provisional data in the *Monthly Vital Statistics Report*, another NCHS publication. Comparability studies were also undertaken between the Eighth and Seventh,

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Seventh and Sixth, and Sixth and Fifth Revisions. For additional information about these studies, see the Technical Appendix from *Vital Statistics for the United States, 1979*.

Significant coding changes under the Ninth Revision--Since the implementation of ICD-9 in the United States, effective with mortality data for 1979, several coding changes have been introduced. The more important changes are discussed as follows: In early 1983 a change that affected data from 1981 to 1986 was made in the coding of Acquired immunodeficiency syndrome and HIV infection. Also effective with data year 1981 was a coding change for Poliomyelitis. For data year 1982, the definition of child was changed (which affects the classification of deaths to a number of categories, including Child battering and other maltreatment), and guidelines for coding deaths to the category Child battering and other maltreatment (ICD No. E967) were changed also. During the calendar year 1985, detailed instructions for coding Motor vehicle accidents involving all-terrain vehicles were implemented to ensure consistency in coding these accidents. Effective with data year 1986, "Primary" and "Invasive" tumors, unspecified, were classified as "Malignant"; these neoplasms had been classified to Neoplasms of unspecified nature (ICD-9 No. 239).

Beginning with data for 1987, NCHS introduced new category

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numbers *042-*044 for classifying and coding HIV infection, formerly referred to as Human T-cell lymphotropic virus-III/lymphadenopathy associated virus (HTLV-III/LAV) infection. The asterisks appearing before the categories indicate these codes are not part of ICD-9. Also changed effective with data year 1987 were coding rules for the conditions "Dehydration" and "Disseminated intravascular coagulopathy." Effective with data year 1988, minor content changes were made to the classification for HIV infection. Detailed discussion of these changes may be found in the Technical Appendix for previous volumes.

Coding in 1993--The rules and instructions used in coding 1993 mortality medical data remained essentially the same as those used for the 1992 and 1991 data.

Medical certification--The use of a standard classification list, although essential for State, regional, and international comparison, does not ensure strict comparability of the tabulated figures. A high degree of comparability among areas could be attained only if all records of cause of death were reported with equal accuracy and completeness. The medical certification of cause of death can be made only by a qualified person, usually a physician, a medical examiner, or a coroner. Therefore, the reliability and accuracy of cause-of-death

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statistics are, to a large extent, governed by the ability of the certifier to make the proper diagnosis and by the care with which he or she records this information on the death certificate.

A number of studies have been undertaken on the quality of medical certification on the death certificate. In general, these have been for relatively small samples and for limited geographic areas. A bibliography prepared by NCHS (19), covering 128 references over 23 years, indicates no definitive conclusions have been reached about the quality of medical certification on the death certificate. No country has a well-defined program for systematically assessing the quality of medical certifications reported on death certificates or for measuring the error effects on the levels and trends of cause-of-death statistics.

One index of the quality of reporting causes of death is the proportion of death certificates coded to the Ninth Revision, Chapter XVI, Symptoms, signs, and ill-defined conditions (ICD-9 Nos. 780-799). Although deaths occur for which it is impossible to determine the underlying cause, this proportion indicates the care and consideration given to the certification 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. In 1993, 1.2 percent of all reported

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deaths in the United States were assigned to this category. The percent of deaths assigned to this category remained stable at 1.5 percent from 1981 to 1987, but has declined slightly since then.

Automated selection of underlying cause of death--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) (20), the multiple cause codes serve as inputs to the computer software that employs WHO rules to select the underlying cause. Many States also have implemented ACME and provide multiple cause and underlying cause data to NCHS in electronic form.

The ACME system applies the same rules for selecting the underlying cause as would be applied manually by a nosologist; however, under this system, the computer consistently applies the same criteria, thus eliminating intercoder variation in this step of the process.

The ACME computer program requires the coding of all conditions shown on the medical certification. These codes are

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matched automatically against decision tables that consistently select the underlying cause of death for each record according to the international rules. The decision tables provide the comprehensive relationships among the conditions classified by ICD when applying the rules of selection and modification.

The decision tables were developed by NCHS staff on the basis of their experience in coding underlying causes of death under the earlier manual coding system and as a result of periodic independent validations. These tables periodically are updated to reflect additional new information on the relationship among medical conditions. For data year 1988, these tables were amended to incorporate minor changes to the previously mentioned classification for HIV infection (*042-*044) that originally had been implemented with data year 1987. Coding procedures for selecting the underlying cause of death by using the ACME computer program, as well as by using the ACME decision tables, are documented in NCHS instruction manuals (20,24,25).

Beginning with data year 1990, another computer system was implemented for automating cause-of-death coding. This system, called Mortality Medical Indexing, Classification, and Retrieval (MICAR) (21,22), automates coding multiple causes of death. Because MICAR automates multiple-cause coding rules, errors in recognizing terms, applying coding rules, and using the ICD

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index are eliminated. The use of the MICAR system ensures consistent application of multiple-cause coding rules, which is especially important for rules that are complex and infrequently applied. In addition, MICAR ultimately will provide more detailed information on the conditions reported on death certificates than is available through the ICD category structure (23). In the first year of implementation, only about 5 percent (94,372) of the Nation's death records were coded using MICAR with subsequent processing through ACME. This percentage increased from 26 percent in 1991 to 35 percent in 1992 and 59 percent in 1993. States whose data were coded by MICAR in 1993 included Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Missouri, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, Pennsylvania, South Dakota, Texas, Utah, Vermont, Washington, and Wisconsin. For these States, MICAR processed about 88 percent of the mortality records with an average system error rate of 0.33 on an underlying cause basis, and a rate of 0.58 on a multiple-cause basis. Records that MICAR was unable to process were coded manually and then processed using ACME.

Beginning with data year 1993, another computer system was implemented for automating cause-of-death coding. This system, called SuperMICAR, is an enhancement of the MICAR system, which

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allows for total literal entry of the multiple cause-of-death text as reported by the certifier. This information is automatically coded by the MICAR and ACME computer systems. In the first year of implementation, about 9 percent of the Nation's death records were coded using SuperMICAR with subsequent processing through MICAR and ACME. States using SuperMICAR in 1993 included Colorado, Hawaii, Michigan, Minnesota, Oregon, and South Carolina. In 1993, for these States, SuperMICAR processed about 70 percent of the mortality records with an average system error rate of 0.50 on an underlying cause basis, and a rate of 1.03 on a multiple-cause basis. Records that SuperMICAR was unable to process were coded manually and then processed using ACME.

Cause-of-death ranking--Cause-of-death ranking except for infants is based on numbers of deaths assigned to categories in the List of 72 Selected Causes of Death and the category Human immunodeficiency virus infection (*042-*044); cause-of-death ranking for infants is based on the List of 61 Selected Causes of Infant Death and HIV infection. HIV infection was added to the list of rankable causes effective with data year 1987.

The group titles Major cardiovascular diseases and Symptoms, signs, and ill-defined conditions from the List of 72 Selected Causes of Death are not ranked; Certain conditions originating

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in the perinatal period and Symptoms, signs, and ill-defined conditions from the List of 61 Selected Causes of Infant Death are not ranked. In addition, category titles beginning with the words "Other" or "All other" are not ranked to determine the leading causes of death. When one of the titles representing a subtotal is ranked (such as Tuberculosis), its component parts (in this case, Tuberculosis of respiratory system and Other tuberculosis) are not ranked.

Maternal deaths

Maternal deaths are those for which the certifying physician has designated a maternal condition as the underlying cause of death. Maternal conditions are those assigned to Complications of pregnancy, childbirth, and the puerperium (ICD-9 Nos. 630-676). In the Ninth Revision, WHO for the first time defined a maternal death as follows:

A maternal death is defined 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.

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Under the Eighth Revision, maternal deaths were assigned to the category "Complications of pregnancy, childbirth, and the puerperium" (*Eighth Revision International Classification of Diseases, Adapted for Use in the United States* (ICDA-8) Nos. 630-678). Although WHO did not define maternal mortality, an NCHS classification rule existed that limited the definition of a maternal death to a death that occurred within a year after termination of pregnancy from any "maternal cause," that is, any cause within the range of ICDA-8 Nos. 630-678. This rule applied only if a duration was given for the condition. If no duration was specified and the underlying cause of death was a maternal condition, the duration was assumed to be within a year and the death was coded by NCHS as a maternal death. The change from an under-1-year limitation for duration used in the Eighth Revision to an under-42-days limitation used in the Ninth Revision did not have much effect on the comparability of maternal mortality statistics. However, comparability was affected by the following classification change: Under the Ninth Revision, maternal causes of death have been expanded to include Indirect obstetric causes (ICD-9 Nos. 647-648). These causes include Infective and parasitic conditions as well as other conditions present in the mother and classifiable elsewhere but that complicate pregnancy, childbirth, and the puerperium, such as Syphilis, Tuberculosis,

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Diabetes mellitus, Drug dependence, and Congenital cardiovascular disorders.

Maternal mortality rates are 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. 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.

Race--Beginning with the 1989 data year, NCHS changed the method of tabulating live birth and fetal death data by race from race of child to race of mother. This resulted in a discontinuity in maternal mortality rates by race between 1989-93 and previous years; see "Change in tabulation of race data for live births and fetal deaths," under "Infant deaths" in the Technical Appendix from *Vital Statistics of the United States*, 1990, or the series report, "Effect on Mortality Rates of the 1989 Change in Tabulating Race" (26).

Infant deaths

Age--Infant death is defined as a death under 1 year of age. The term excludes fetal deaths. Infant deaths usually are divided into two categories according to age, neonatal and postneonatal. Neonatal deaths are those that occur during the

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first 27 days of life; postneonatal deaths are those that occur between 28 days and 1 year of age. Generally, it has been believed that different factors influencing the child's survival predominate in these two periods: Factors associated with prenatal development, heredity, and the birth process were considered dominant in the neonatal period; environmental factors, such as nutrition, hygiene, and accidents, were considered more important in the postneonatal period. Recently, however, the distinction between these two periods has blurred due in part to advances in neonatology, which have enabled more very small premature infants to survive the neonatal period.

Rates--Infant mortality rates shown in sections 2 and 8 are the most commonly used indices for measuring the risk of dying during the first year of life; they 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. Infant mortality rates use the number of live births in the denominator to approximate the population at risk of dying before the first birthday. This measure is an approximation because some live births will not have been exposed to a full year's risk of dying and some of the infants who die during a year will have been born in the previous year. The error introduced in the infant

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mortality rate by this inexactness is usually small, especially when the birth rate is relatively constant from year to year (27,28). Other sources of error in the infant mortality rate have been attributed to differences in applying the definitions for infant death and fetal death when registering the event (29,30,31).

In contrast to infant mortality rates based on live births, infant death rates shown in section 1 are based on the estimated population under 1 year of age. Infant death rates, which appear in tabulations of age-specific death rates, are calculated by dividing the number of infant deaths in a calendar year by the estimated midyear population of persons under 1 year of age and are presented as rates per 100,000 population in this age group. Patterns and trends in the infant death rate may differ somewhat from those of the more commonly used "infant mortality rate," mainly because of differences in the nature of the denominator and in the time reference. Whereas the population denominator for the infant death rate is estimated using data on births, infant deaths, and migration for the 12-month period of July-June, the denominator for the infant mortality rate is a count of births occurring during the 12 months of January-December. The difference in the time reference can result in different trends between the two indices during periods when birth rates are moving up or down markedly.

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The infant death rate also is subject to greater imprecision than is the infant mortality rate because of problems of enumerating and estimating the population under 1 year of age (30).

Change in tabulation of race data for live births and fetal deaths--Beginning with the 1989 data year, NCHS changed the method of tabulating live-birth and fetal-death data by race from race of child to race of mother. As in previous years, race for infant and maternal deaths (the numerator of the rate) is tabulated by the race of the decedent. Because live births comprise the denominator of infant and maternal mortality rates, this change resulted in a discontinuity in rates between 1989-93 data, and that for previous years. For fetal and perinatal mortality rates, the numerator and the denominator of the rates are affected, resulting in a slightly smaller discontinuity. For additional information, see the Technical Appendix from *Vital Statistics of the United States*, 1990 or the series report, "Effect on Mortality Rates of the 1989 Change in Tabulating Race" (26).

Comparison of race data from birth and death certificates--Regardless of whether vital events are tabulated by race of mother or by race of child, inconsistencies exist in reporting race for the same infant between birth and death certificates,

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based on results of studies in which race on the birth and death certificates for the same infant were compared (32).

These reporting inconsistencies can result in systematic biases in infant mortality rates by specified race, in particular, underestimates for specified races other than white or black. In the computation of race-specific infant mortality rates published in *Vital Statistics of the United States*, the race item for the numerator comes from the death certificate, and for the denominator, from the birth certificate. Biases in the rates may arise because of possible inconsistencies in reporting race on these two vital records. Race of the mother and father is reported on the birth certificate by the mother at the time of delivery; whereas race of the deceased infant is reported on the death certificate by the funeral director based on observation or on information supplied by an informant, such as a parent. Previous studies have noted the race for an infant who died and was of a smaller minority race group is sometimes reported as white on the death certificate but is reported as the minority race group on the birth certificate, resulting, in the aggregate, in understatement of infant mortality for smaller race groups (32).

Estimates can be made of the degree of bias in race-specific infant mortality rates by comparing rates for birth cohorts

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based on the linked birth and infant death data set (33,34) with period rates based on mortality data published in *Vital Statistics of the United States* for the same year(s). The period rates published in *Vital Statistics of the United States* are unlinked because the infant death certificates have not been linked to the corresponding birth certificates.

The comparison of linked and unlinked rates is somewhat affected by small differences in the events included in the numerators of the two rates. The numerator of the linked rate is comprised of infant deaths to the cohort of infants born in a calendar year, whereas the numerator of the unlinked rate is comprised of infant deaths occurring in the calendar year.

Based on data comparing infant mortality rates from the linked data set for the birth cohorts of 1989-91 with unlinked rates for the period 1989-91, bias in the rates for the two major race groups--white and black--is small (table B). However, linked rates for the smaller race groups are estimated to be higher than unlinked rates by 2 to 56 percent.

The exception to this pattern is for Hawaiians, where linked rates are 17 percent lower than unlinked rates. This may reflect the slightly different race coding rules used for Hawaiians than those used for other races (see "Race" under "Classification of data"). For mortality data, in cases of mixed Hawaiian and other

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race parentage, race is always classified as "Hawaiian." In contrast, the race data from the birth certificate is classified according to the race of the mother. The race data from the birth certificate is used in the denominator of the unlinked infant mortality rates, and in the numerator and denominator of the linked infant mortality rates. This difference leads to slightly fewer infant deaths being classified as Hawaiian in the linked data, compared to the unlinked data. The linked infant mortality rate for Hawaiians is considered to be more accurate, because the numerator and denominator data come from the same data source and are coded in the same manner.

Cohort infant mortality rates from the linked file have not been adjusted to reflect the 2 to 3 percent of infant death records that were not linked to their corresponding birth records. Because of systematic underestimation of infant mortality rates based on unlinked data, the national linked files should be used to measure infant mortality for races other than black and white. For the white and black populations, unlinked data are a close approximation of the rates based on linked files.

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

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origin") and numbers of resident live births by Hispanic origin of mother for the 49 States and the District of Columbia. Data for Oklahoma were excluded, because Oklahoma did not include an item on Hispanic origin on its death certificate. In computing infant mortality rates, deaths and live births of unknown origin are not distributed among the specified Hispanic and non-Hispanic groups. Because the percent of infant deaths of unknown origin for 1993 was 2.1 percent and the percent of live births of unknown origin was 1.3 percent, infant mortality rates by specified Hispanic origin and race for non-Hispanic origin may be slightly underestimated.

Small numbers of infant deaths for specific Hispanic-origin groups can result in infant mortality rates subject to relatively large random variation (see "Random variation in numbers of deaths, death rates, and mortality rates and ratios").

Tabulation list--Causes of death for infants are tabulated according to a list of causes that is different from the list of causes for the population of all ages, except for the Each Cause List. (See "Cause-of-death classification" under "Cause of death.")

Fetal deaths

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In May 1950 WHO recommended the following definition of fetal death be adopted for international use:

Death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation, the fetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles (35).

The term "fetal death" was defined on an all-inclusive basis to end confusion arising from the use of such terms as stillbirth, spontaneous abortion, and miscarriage.

Shortly thereafter, this definition was adopted by NCHS as the nationally recommended standard. All registration areas except Puerto Rico have definitions similar to the standard definition (36). Puerto Rico has no formal definition.

As another step toward increasing comparability of data on fetal deaths for different countries, WHO recommended that for statistical purposes fetal deaths be classified as early, intermediate, and late. These groups are defined as follows:

Less than 20 completed weeks of gestation

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(early fetal deaths).....Group I
20 completed weeks of gestation but less than
28 (intermediate fetal deaths).....Group II
28 completed weeks of gestation and over
(late fetal deaths).....Group III
Gestation period not classifiable in groups I,
II, and III.....Group IV

As shown in table 3-11, group IV consists of fetal deaths with gestation not stated but presumed to be 20 weeks or more.

Until 1939 the nationally recommended procedure for registration of a fetal death required the filing of a live-birth certificate and a death certificate. In 1939 a separate Standard Certificate of Stillbirth (fetal death) was created to replace the former procedure. This was revised in 1949, 1956, 1968, 1978, and 1989. The 1989 U.S. Standard Report of Fetal Death is shown as figure 7-B.

The 1977 revision of the *Model State Vital Statistics Act and Model State Vital Statistics Regulations* (37) recommended spontaneous fetal deaths at a gestation of 20 weeks or more or a weight of 350 grams or more be reported and further be reported on separate forms. These should be considered legally required statistical reports rather than legal documents. The 1992 revision of the *Model State Vital Statistics Act and Regulations*

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(38) recommended all spontaneous fetal deaths weighing 350 grams or more, or if weight is unknown, fetal deaths of 20 completed weeks of gestation be reported.

Beginning with fetal deaths reported in 1970, procedures were implemented that attempted to separate reports of spontaneous fetal deaths from those of induced terminations of pregnancy. These procedures were implemented because the health implications of spontaneous fetal deaths are different from those of induced terminations of pregnancy. These procedures are still used.

Comparability and completeness of data--Registration area requirements for reporting fetal deaths vary. Most of the areas require reporting of fetal death at gestations of 20 weeks or more. Table C shows the minimum period of gestation required by each State to report a fetal death in 1993. Substantial evidence exists that indicates some fetal deaths for which reporting is required are not reported (39,40).

Underreporting of fetal deaths is most likely to occur in the earlier part of the required reporting period for each State (39). Thus, for States requiring reporting of all periods of gestation, fetal deaths occurring under 20 weeks of gestation are less completely reported; for States requiring reporting of fetal deaths of 20 weeks or more, fetal deaths occurring at 20-

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23 weeks are less completely reported. Thus, reporting of fetal deaths at 20-23 weeks of gestation may be more complete for those States that report fetal deaths at all periods of gestation than for others.

To maximize the comparability of data by year and by State, most of the tables in section 3 are based on fetal deaths occurring at gestations of 20 weeks or more. These tables also include fetal deaths for which gestation is not stated for those States requiring reporting at 20 weeks of gestation or more only. Beginning with 1969 fetal deaths of not stated gestation were excluded for States requiring reporting of all products of conception except for those with a stated birthweight of 500 grams or more. In 1993 this rule was applied to the following States: Georgia, Hawaii, New York (including New York City), Rhode Island, and Virginia. Each year there are exceptions to this procedure.

Arkansas--Since 1971 Arkansas has been using two reporting forms for fetal deaths: A confidential Spontaneous Abortion form that is not sent to NCHS and a Fetal Death Certificate that is. State changes concerning fetal death registration in 1981 and 1984 (see Technical Appendix from *Vital Statistics of the United States*, 1990) created comparability problems between the counts of fetal deaths at 20-27 weeks for 1981-83 and those for other

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reporting areas or for contiguous years. It is believed that reporting has improved but is still not comparable with data for 1980 and earlier years.

Delaware--Beginning in July 1992, Delaware changed its reporting requirements for spontaneous fetal deaths from 20 weeks of gestation or more to 350 grams or more (table C). If weight is unknown, all fetal deaths of 20 weeks of gestation or more should be reported.

Montana--Beginning in October 1991, Montana changed its reporting requirements for spontaneous fetal deaths from 20 weeks of gestation or more to 20 weeks of gestation or more or 500 grams (table C).

New York City--As a result of local efforts to improve reporting, a combined total of 10,470 additional 1990 and 1991 fetal death records were sent from New York City hospitals after the data files had been processed and tabulated. Most of these records are for fetal deaths under 20 weeks of gestation or not-stated gestation. The values in the tables showing data for 1991 may exclude the additional deaths.

Revised Report of Fetal Death for 1989--Beginning with data for 1989, new items were added to the U.S. Standard Report of Fetal Death, including Hispanic origin of the mother and father, medical and other risk factors of pregnancy, obstetric

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procedures, and method of delivery. In addition, questions on complications of labor and/or delivery and congenital anomalies of fetus were changed from an open-ended question to a checkbox format to ensure more complete reporting of information.

Interpretation of these data must include evaluation of the item completeness of reporting. The percent "not stated" is one measure of the quality of the data. Completeness of reporting varies among items and States. See table D for the percent of fetal death records on which specified items were not stated.

The tabulation of items in the fetal-death section is limited to those States whose reporting is sufficiently complete. For fetal deaths before data year 1991, data were published when a State had a response for the item on at least 20 percent of the records. Beginning in data year 1991, tabulations of prenatal care and educational attainment include only those States with a response for that specific item on at least 80 percent of the fetal death records. For the other tables in the fetal death section, item completion is high (table D) and no reporting criterion is used to exclude States.

Period of gestation--The period of gestation is the number of completed weeks elapsed between the first day of the last normal menstrual period (LMP) and the date of delivery. The first day of the LMP is used as the initial date because it can

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be more accurately determined than the date of conception, which usually occurs 2 weeks after LMP. Data on period of gestation are computed from information on "date of delivery" and "date last normal menses began." If "date last normal menses began" is not on the record or if the calculated gestation falls beyond a duration considered biologically plausible, the "Physician's estimate of gestation" is used.

To improve data quality, beginning with data for 1989, NCHS instituted a new computer edit to check for consistency between gestation and birthweight (41). Briefly, if LMP gestation is inconsistent with birthweight, and the physician's estimate is consistent, the physician's estimate is used; if both are inconsistent with birthweight but are consistent with each other, LMP gestation is used, and birthweight is assigned to unknown. When the period of gestation is reported in months on the report, it is allocated to gestational intervals in weeks as follows:

- 1-3 months to under 16 weeks
- 4 months to 16-19 weeks
- 5 months to 20-23 weeks
- 6 months to 24-27 weeks
- 7 months to 28-31 weeks
- 8 months to 32-35 weeks
- 9 months to 40 weeks

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10 months and over to 43 weeks and over

All areas reported LMP in 1993, and all areas except California, Louisiana, Maryland, and Oklahoma reported physician's estimate of gestation.

Birthweight--Most of the 55 registration areas do not specify how weight should be given, that is, in pounds and ounces or in grams. In the tabulation and presentation of birthweight data, the metric system (grams) has been used to facilitate comparison with other data published in the United States and internationally. Birthweight specified in pounds and ounces is assigned the equivalent of the gram intervals, as follows:

Less than 350 grams	= 0 lb 12 oz or less
350-499 grams	= 0 lb 13 oz-1 lb 1 oz
500-999 grams	= 1 lb 2 oz-2 lb 3 oz
1,000-1,499 grams	= 2 lb 4 oz-3 lb 4 oz
1,500-1,999 grams	= 3 lb 5 oz-4 lb 6 oz
2,000-2,499 grams	= 4 lb 7 oz-5 lb 8 oz
2,500-2,999 grams	= 5 lb 9 oz-6 lb 9 oz
3,000-3,499 grams	= 6 lb 10 oz-7 lb 11 oz
3,500-3,999 grams	= 7 lb 12 oz-8 lb 13 oz
4,000-4,499 grams	= 8 lb 14 oz-9 lb 14 oz
4,500-4,999 grams	= 9 lb 15 oz-11 lb 0 oz
5,000 grams or more	= 11 lb 1 oz or more

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With the introduction of ICD-9, the birthweight classification intervals for perinatal mortality statistics were shifted downward by 1 gram as shown above. Previously, the intervals were, for example, 1,001-1,500, 1,501-2,000, and so forth. Beginning in 1989 NCHS instituted a consistency check between birthweight and gestation; see previous section on gestation.

Race--Beginning with data for 1989, NCHS changed the method of tabulating fetal death, perinatal, and live birth data by race from race of child to race of mother. When the race of the mother is unknown, the mother is assigned the father's race; when information for both parents is missing, the race of the mother is assigned to the specific race of the mother of the preceding record with known race.

The change in tabulation of race has resulted in a discontinuity in fetal mortality rates by race for data year 1989-93 relative to previous years; see "Change in tabulation of race data for live births and fetal deaths," under "Infant deaths" or the series report, "Effect on Mortality Rates of the 1989 Change in Tabulating Race" (26).

Hispanic origin of mother--Fetal mortality data for the Hispanic-origin population are based on fetal deaths to mothers of Hispanic origin who were residents of those States and the

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District of Columbia that included items on the report of fetal death to identify Hispanic or ethnic origin of mother. Data for 1993 were obtained from 46 States and the District of Columbia; areas not supplying data were Louisiana, Maryland, Massachusetts, and Oklahoma.

For 1993 fetal and perinatal mortality data in tables 3-18 and 4-6 are for 46 States and the District of Columbia and tables 3-19 and 4-7 are for 41 States, New York (excluding New York City) and the District of Columbia that had an item on Hispanic or ethnic origin on the death certificate, birth certificate, and report of fetal death and whose data for all three files were at least 80 percent complete on a place-of-occurrence basis and considered to be sufficiently comparable to be used for analysis. The States included are Alabama, Alaska, Arizona, Arkansas, California, Colorado, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York (excluding New York City), North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

The 41 States, New York (excluding New York City), and the District of Columbia for which fetal and perinatal data by

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Hispanic origin are shown accounted for about 87 percent of the Hispanic population in 1990, including 99 percent of the Mexican population, 51 percent of the Puerto Rican population, 91 percent of the Cuban population, and 76 percent of the "Other Hispanic" population (10). Accordingly, caution should be exercised in generalizing mortality patterns from the reporting area to the Hispanic-origin population (especially Puerto Ricans) of the entire United States. (See also "Hispanic origin" under "Classification of data.")

Total-birth order--Total-birth order refers to the sum of live births and other terminations (including spontaneous fetal deaths and induced terminations of pregnancy) a woman has had, including the fetal death being recorded. For example, if a woman has given birth to two live babies and to one born dead, the next fetal death to occur is counted as number four in total-birth order.

Beginning with implementation of the 1989 revision of the U.S. Standard Report of Fetal Death, total-birth order is calculated from three items on pregnancy history: Number of previous live births now living; number of previous live births now dead; and number of other terminations (spontaneous and induced at anytime after conception). For prior years total-birth order was calculated from four items, see the

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Technical Appendix from *Vital Statistics of the United States*, 1988.

Although all registration areas use the two standard items pertaining to number of previous live births, registration areas phrase the item pertaining to other terminations of pregnancy differently. Total-birth order for all areas is calculated from the sum of available information. Thus, information on total-birth order may not be completely comparable among the registration areas. In addition, there may be substantial underreporting of other terminations of pregnancy on the fetal-death report.

Marital status--Table 3-3 shows fetal deaths and fetal mortality rates by mother's marital status. The following States were excluded from this table because their reports of fetal death did not include an item on marital status: California, Connecticut, Maryland, Michigan, Nevada, New York (including New York City), and Texas. Because live births comprise the denominator of the rate, marital status must be reported for mothers of live births also. Marital status of the mother of the live birth is inferred for States that did not report it on the birth certificate (42).

Beginning with data for 1989, fetal-death reports with marital status not stated are shown as not stated in

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frequencies, but are proportionally distributed for rate computations into either the married or unmarried categories according to the percent of fetal-death reports with stated marital status that fall into each category for the reporting States. Before 1989 fetal-death reports with not-stated marital status were assigned to the married category. Because of this change, fetal-death frequencies and rates by marital status for 1989-93 are not strictly comparable with those for previous years.

No quantitative data exist on the characteristics of unmarried women who do not report, misreport their marital status, or fail to register fetal deaths. Underreporting may be greater for the unmarried group than for the married group.

Age of mother--Beginning with data for 1989, the U.S. Standard Report of Fetal Death asks for the mother's date of birth. Age of mother is computed from the mother's date of birth and the date of the termination of the pregnancy. For those States whose certificates do not contain an item for the mother's date of birth, reported age of the mother (in years) is used. The age of the mother is edited in NCHS for upper and lower limits. When mothers are reported to be under 10 years of age or 50 years of age and over, the age of the mother is considered not stated and is assigned as follows: Age on all

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fetal-death records with age of mother not stated is assigned according to the age appearing on the record previously processed for a mother of identical race and having the same total-birth order (total of live births and other terminations).

Sex of fetus--Beginning with data for 1989, for all fetal deaths of 20 weeks of gestation or more, not-stated sex of fetus is assigned the sex of the fetus from the previous record. Before 1989 no such assignment was made.

Plurality--All registration areas except Louisiana report the plurality of the fetus. Although Louisiana has not reported this item for many years, before 1989, data for Louisiana were erroneously converted to a plurality of 1 (single birth) and included in United States totals. Beginning with 1989 data, Louisiana is excluded from tables reporting plurality of the fetus. For reporting areas, not-stated plurality of the fetus is assigned to single births.

Perinatal mortality

Perinatal definitions--Beginning with data year 1979, perinatal mortality data for the United States and each State have been published in section 4. WHO recommends in ICD-9, "national perinatal statistics should include all fetuses and infants delivered weighing at least 500 grams (or when

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birthweight is unavailable, the corresponding gestational age (22 weeks) or body length (25 cm crown-heel)), whether alive or dead. . . ." It further recommends, "countries should present, solely for international comparisons, 'standard perinatal statistics' in which both the numerator and denominator of all rates are restricted to fetuses and infants weighing 1,000 grams or more (or, where birthweight is unavailable, the corresponding gestational age (28 weeks) or body length (35 cm crown-heel))." Because birthweight and gestational age are not reported on the death certificate in the United States, NCHS was unable to adopt these definitions. Three definitions of perinatal mortality are used by NCHS: Perinatal Definition I, generally used for international comparisons, which includes fetal deaths of 28 weeks of gestation or more and infant deaths under 7 days; Perinatal Definition II, which includes fetal deaths of 20 weeks of gestation or more and infant deaths under 28 days; and Perinatal Definition III, which includes fetal deaths of 20 weeks of gestation or more and infant deaths under 7 days.

Variations in fetal death reporting requirements and practices have implications for comparing perinatal rates among States. Because reporting is generally sporadic near the lower limit of the reporting requirement, States that require reporting of all products of pregnancy, regardless of gestation, are likely to have more complete reporting of fetal deaths at 20

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weeks or more than those States that do not. The larger number of fetal deaths reported for these "all periods" States may result in higher perinatal mortality rates than those rates reported for States whose reporting is less complete.

Accordingly, reporting completeness may account, in part, for differences among the State perinatal rates, particularly differences for Definitions II and III, which use data for fetal deaths at 20-27 weeks.

Not stated--Fetal deaths with gestational age not stated are presumed to be of 20 weeks of gestation or more if the State requires reporting of all fetal deaths at a gestational age of 20 weeks or more or the fetus weighed 500 grams or more in those States requiring reporting of all fetal deaths, regardless of gestational age. For Definition I, fetal deaths at a gestation not stated but presumed to have been of 20 weeks or more are allocated to the category 28 weeks or more, according to the proportion of fetal deaths with stated gestational age that falls into that category. For Definitions II and III, fetal deaths at a presumed gestation of 20 weeks or more are included with those at a stated gestation of 20 weeks or more.

The allocation of not-stated gestational age for fetal deaths is made individually for each State, for metropolitan and nonmetropolitan areas, and separately for the entire United

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States. Accordingly, the sum of perinatal deaths for the areas according to Definition I may not equal the total number of perinatal deaths for the United States.

Race--Beginning with the 1989 data year, NCHS changed the method of tabulating fetal-death and live-birth data by race from race of child to race of mother. This has resulted in a discontinuity in perinatal mortality rates by race between 1989-93 data and those for previous years; see "Change in tabulation of race data for live births and fetal deaths" under "Infant deaths."

Hispanic origin--See "Hispanic origin of mother" under "Fetal deaths."

Quality of data

Completeness of registration

All States have adopted laws requiring the registration of births and deaths and the reporting of fetal deaths. It is believed that more than 99 percent of the births and deaths occurring in this country are registered.

Reporting requirements for fetal deaths vary from State to State (see "Comparability and completeness of data"). Overall reporting is not as complete for fetal deaths as for births and

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deaths, but it is believed to be relatively complete for fetal deaths at a gestation of 28 weeks or more. National statistical data on fetal deaths include only fetal deaths occurring at a stated or presumed gestation of 20 weeks or more.

Massachusetts data--The 1964 statistics for deaths exclude approximately 6,000 deaths registered in Massachusetts, primarily to residents of that State. Microfilm copies of these records were not received by NCHS. Figures for the United States and the New England Division are affected also.

Amended records for Alaska and New Jersey--Numbers of deaths occurring in Alaska and New Jersey for 1993 are in error for all causes of death combined and for selected causes because NCHS did not receive all of the States records and did not receive changes resulting from amended records. An estimate of the effect of these omissions can be derived by comparing NCHS counts of records processed through the VSCP with counts prepared by the respective States as shown in table E. Differences are concentrated among selected causes of death, principally Symptoms, signs, and ill-defined conditions (ICD-9 Nos. 780-799) and external causes.

Quality control procedures

Demographic items on the death certificate--As previously

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indicated, for 1993 the mortality data for these items were obtained from two sources--photocopies of the original certificates furnished by the Virgin Islands and Guam and electronic data records furnished by the 50 States, the District of Columbia, New York City, and Puerto Rico. For the Virgin Islands and Guam, which sent only copies of the original certificates, the demographic items were coded for 100 percent of the death certificates. The demographic coding for 100 percent of the certificates was independently verified.

For areas sending electronic data records, a sample of 70-80 records per month for each registration area is used to monitor quality of coding. Under this procedure, each sample record is independently coded by NCHS staff and compared to the State code assignments. NCHS/State differences are adjudicated to ascertain the source of the error and need for corrective action. The estimated average outgoing error rate for all demographic items in 1993 was 0.25 percent. The error rate is a combined measure of State coding, key entry and processing errors made in the process of preparing the statistical file. It is noted, however, that these types of errors are not necessarily randomly distributed in the file and may therefore escape detection through sample verification. Other NCHS procedures such as detailed computer edits, tabular evaluation, and procedure review are used to reduce some systematic errors.

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Medical items on the death certificate--The same procedures used for demographic data are used for the medical items. For the 38 States sending electronic files, the average outgoing error rate in 1993 was estimated at 2.5 percent for underlying cause data, and 5.0 percent for multiple cause-of-death data.

For the remaining 12 States, the District of Columbia, New York City, Puerto Rico, the Virgin Islands, and Guam, NCHS coded the medical items for 100 percent of the death records. A 1-percent sample of the records was coded independently for quality control purposes. The estimated average error rate for these areas was 4.0 percent.

Demographic items on the report of fetal death---As previously indicated, for 1993 the fetal-death demographic data were obtained from two sources: Coded records in electronic form from 43 registration areas and photocopies of the original certificates furnished by the remaining registration areas. For the 12 registration areas submitting photocopies, a small number of the records were coded under contract by the U.S. Bureau of the Census early in the data year before NCHS assumed responsibility for coding photocopies of records. State-coded records may incorporate corrections made to the records as a result of queries whereas data codes from photocopies would be less likely to incorporate all corrections.

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Beginning with data year 1993, quality control for fetal-death data was limited to computer edit checks, code validations, and comparisons of tabulated data with that for the previous year. Dual-coding of a sample of fetal-death records was not performed because of resource constraints.

In 1993 problems that occurred during the conversion of selected State-coded data to NCHS format were detected for Colorado, New York State, and Washington. The effected items were father's Hispanic origin for Colorado; other terminations, medical risk factors, obstetric procedures and complications of labor and/or delivery for New York State; and congenital anomalies for Washington. Although corrections were not made to the 1993 data, changes were instituted to avoid these processing errors in future data.

Other control procedures--After coding and data entry are completed, record counts are balanced against control totals for each shipment of records from a registration area. Editing procedures ensure that records with inconsistent or impossible codes are modified. Inconsistent codes are those, for example, indicating a contradiction between cause of death and age or sex of the decedent. Records so identified during the computer editing process are either corrected by reference to the source record or adjusted by arbitrary code assignment (43). Further,

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conditions specified on a list of infrequent or rare causes of death are confirmed by the certifier or a State health officer. All subsequent operations in tabulating and in preparing tables are verified during the computer processing or by statistical clerks.

*Estimates of errors arising from 50-percent sample for 1972-*Death statistics for 1972 in this report (excluding fetal-death statistics) are based on a 50-percent sample of all deaths occurring in the 50 States and the District of Columbia. A description of the sample design and a table of the percent errors of the estimated numbers of deaths by size of estimate and total deaths in the area are shown in the Technical Appendix from *Vital Statistics of the United States, 1972*.

Computation of rates and other measures

Population bases

The population bases from which death rates shown in this report are computed are prepared by the U.S. Bureau of the Census. Rates for 1940, 1950, 1960, 1970, 1980, and 1990 are based on the population enumerated as of April 1 in the censuses for those years. Rates for all other years use the estimated midyear (July 1) population. Death rates for the United States,

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individual States, and metropolitan areas are based on the total resident populations of the respective areas. Except as noted, these populations exclude the Armed Forces abroad but include the Armed Forces stationed in each area.

The resident populations of the birth- and death-registration States for 1900-32, and of the United States for 1900-93 are shown in table 7-1. In addition, the population including Armed Forces abroad is shown for the United States. Table F lists the sources for these populations.

*Population for 1993--*The population of the United States estimated by age, race, and sex for 1993 is shown in table 7-2, and the population for each State by broad age groups follows in table 7-3. The 1993 estimates are comparable with those for 1992 and 1991.

*Population for 1990--*In the 1980 and 1990 censuses, a substantial number of persons did not specify a racial group that could be classified as any of the white, black, American Indian, Eskimo, Aleut, Asian, or Pacific Islander categories on the census form (44). In 1980 the number of persons of "Other" race was 6,758,319; in 1990, it was 9,804,847. In both censuses the large majority of these persons were of Hispanic origin (based on response to a separate question on the form), and many wrote in their Hispanic origin, or Hispanic origin type

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(for example, Mexican and Puerto Rican) as their race. In 1980 and 1990 persons of unspecified race were allocated to one of the four tabulated racial groups (white, black, American Indian, Asian or Pacific Islander) based on their response to the Hispanic origin question. These four race categories conform with OMB Directive 15 and are more consistent with the race categories in vital statistics.

In 1980 the allocation of unspecified race was determined using cross-tabulations of age, sex, race, type of Hispanic origin, and county of residence. Persons of Hispanic origin and unspecified race were allocated to either white or black based on their Hispanic origin type. Persons of "Other" race and Mexican origin were categorically assumed to be white, while persons in other Hispanic categories were distributed to white and black pro rata within the county-age-sex group. For "Other race-not-specified" persons who were not Hispanic, race was allocated to white, black, or Asian or Pacific Islander based on proportions gleaned from sample data. The 20-percent sample (respondents who were enumerated on the longer census form) provided a highly detailed coding of race, which allowed identification of otherwise unidentifiable responses with a specified race category. Thus, allocation proportions were established at the State level and were used to distribute the non-Hispanic persons of "Other" race in the 100-percent

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tabulations.

In 1990 the race modification procedure was implemented using individual census records. Persons whose race could not be specified were assigned to a racial category using a pool of "race donors" that consisted of persons of specified race who had the identical responses to the Hispanic origin question and who were within the auspices of the same census district office. As in the 1980 census, it appeared that the underlying assumption made in the 1990 census was that the Hispanic origin response was the major criterion for allocating race. Unlike those responding to the 1980 census who could be assigned only to the racial group white or black, persons of Hispanic origin, including Mexican, responding to the 1990 census could be assigned to any racial group. Also, in the 1990 census, the non-Hispanic component of "Other" race was allocated primarily on the basis of geography (district office), rather than detailed characteristic.

The means by which respondent's age was determined were fundamentally different for the two censuses; therefore, the problems that necessitated the modification were different. In 1980 respondents reported year of birth and quarter of birth (within year) on the census form. When census results were tabulated, persons born in the first quarter of the year (before April 1) had age equal to 1980 minus year of birth, while

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persons born in the last three quarters had age equal to 1979 minus year of birth.

In 1990 quarter year of birth was not reported on the census form, so direct determination of age from year of birth was not possible. In 1990 census publications, age is based on respondents' direct reports of age at last birthday. This definition proved inadequate for postcensal estimates as it was apparent that many respondents had reported their age at time of either completion of the census form or interview by an enumerator that could occur several months after the April 1 reference date. As a result, age was biased upward. For most respondents, modification was based on a respecification of age, by year of birth, with allocation to first quarter (persons aged 1990 minus year of birth) and last three quarters (aged 1989 minus year of birth) based on a historical series of registered births by month. This process partially restored the 1980 logic for assignment of age. It was not considered necessary to correct for age overstatement and heaping in 1990, because the availability of age and year of birth on the census form had provided for the elimination of spurious year-of-birth reports in the census data before modification occurred.

*Population estimates for 1981-89--*Death rates in this volume for 1981-89 are based on revised populations that are consistent

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with the 1990 census level (44). They are, therefore, not comparable with death rates published in *Vital Statistics of the United States* for 1981-89, and in other NCHS publications for those years. The 1990 census counted approximately 1.5 million fewer persons than had been estimated earlier for April 1, 1990.

Populations for 1980--The population of the United States by age, race, and sex, and the population for each State are shown in tables 7-2 and 7-3 of *Vital Statistics of the United States*, 1980. The figures by race have been modified as described.

Population estimates for 1971-79--Death rates in this volume for 1971-79 used revised population estimates that are consistent with the 1980 census levels. The 1980 census enumerated approximately 5.5 million more persons than had been estimated for April 1, 1980 (45). These revised estimates for the United States by age, race, and sex are published by the U.S. Bureau of the Census in *Current Population Reports*, Series P-25, Number 917. Unpublished revised estimates for States were obtained from the U.S. Bureau of the Census. For Puerto Rico, the Virgin Islands, and Guam, revised estimates are published in *Current Population Reports*, Series P-25, Number 919.

Population estimates for 1961-69--Death rates in this volume for 1961-69 are based on revised estimates of the population and thus may differ slightly from rates published before 1976. The

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rates shown in tables 1-1 and 1-2, the life table values in table 6-5, and the population estimates in table 7-1 for each year during 1961-69 have been revised to reflect modified population bases as published in the U.S. Bureau of the Census, *Current Population Reports*, Series P-5, Number 519. The data shown in table 1-10 for 1961-69 have not been revised.

Rates and ratios based on live births--Infant and maternal mortality rates and fetal-death and perinatal mortality ratios are computed on the basis of the number of live births. Fetal-death and perinatal mortality rates are computed on the basis of the number of live births and fetal deaths. Counts of live births are published annually in *Vital Statistics of the United States*, Volume I, Natality.

New Jersey--As previously indicated, data by race are not available for New Jersey for 1962 and 1963. Therefore, for 1962 and 1963, NCHS estimated a population by age, race, and sex that excluded New Jersey for rates shown by race. The methodology used to estimate the revised population excluding New Jersey is discussed in the Technical Appendixes of the 1962 and 1963 volumes.

Net census undercount

Errors can be introduced into the annual rates as a result

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of underenumeration of deaths and the misreporting of demographic characteristics. Errors in rates can also result from enumeration errors in the latest decennial census. This is because annual population estimates for the postcensal interval, which are used in the denominator for calculating death rates, are computed using the decennial census count as a base (44). Net census undercount results from the miscounting and misreporting of demographic characteristics such as age. Age-specific death rates are affected by the net census undercount and the misreporting of age on the death certificate (46). To the extent that the net undercount is substantial and that it varies among subgroups and geographic areas, it may have important consequences for vital statistics measures.

Because death rates based on a population adjusted for net census undercount may be more accurate than rates based on an unadjusted population, the possible impact of net census undercount on death rates must be considered. This can be done on a national basis using results of studies conducted by the U.S. Bureau of the Census on the completeness of coverage of the U.S. population (including underenumeration and misstatement of age, race, and sex). Such studies were conducted in the last five decennial censuses--1950, 1960, 1970, 1980, and 1990. From this work have come estimates of the national population that were not counted by age, race, and sex (47-50). The reports for

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1990 (unpublished data from the U.S. Bureau of the Census) include estimates of net underenumeration and overenumeration for age, sex, and racial subgroups of the national population modified for race consistency with previous population counts as described in the section "Population bases." These studies indicate that, although coverage was improved over previous censuses, there was differential coverage among the population subgroups; that is, some age, race, and sex groups were more completely counted than others.

Because estimates of net census undercount are not available by age, race, and sex for individual States and counties, it is not feasible to adjust for net census undercount when presenting rates in routine tabulations. Nevertheless, it is important to be aware that net census undercounts can affect levels of observed vital rates..

Age, race, and sex--If adjustments were made for net census undercount, the size of denominators of the death rates generally would increase and the rates, therefore, would decrease. The adjusted rates for 1993 can be computed by multiplying the reported rates by ratios of the census-level resident population to the resident population adjusted for the estimated net census undercount (table 7-4). A ratio of less than 1.0 indicates a net census undercount and, when applied,

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results in a corresponding decrease in the death rate. A ratio greater than 1.0--indicating a net census overcount--when multiplied by the reported rate results in an increase in the death rate.

Coverage ratios for all ages show that, in general, females were more completely enumerated than males and the white population more completely enumerated than the black population in the 1990 Census of Population. Underenumeration varied by age group for the total population, with the greatest differences found for persons aged 85 years and over. All other age groups were overcounted or undercounted by less than 4.0 percent. Among the age-sex-race groups, underenumeration was highest (13.3 percent) for black males aged 25-34 years. In contrast, white females in this age group were underenumerated by 2.5 percent.

If vital statistics measures were calculated with adjustments for net census undercounts for each population subgroup, the resulting rates would be differentially reduced from their original levels; that is, rates for those groups with the greatest estimated undercounts would show the greatest relative reductions due to these adjustments. Similar effects would be evident in the opposite direction for groups with overcounts. Consequently, the ratio of mortality between the rates for males and females and between the rates for the white

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population and the black population usually would be reduced.

Similarly, the differences between the death rates among subgroups of the population by cause of death would be affected by adjustments for net census undercounts. For example, in 1990 for the age group 35-39 years, the ratio of the unadjusted death rate for Homicide and legal intervention for black males to that for white males is 7.54, whereas the ratio of the death rates adjusted for net census undercount is 6.92. For Ischemic heart disease for males aged 40-44 years, the ratio of the death rate for the black population to that for the white population is 1.38 using the unadjusted rates, but it is 1.26 when adjusted for estimated underenumeration.

*Summary measures--*The effect of net census undercount on age-adjusted death rates and life table values depends on the underenumeration of each age group and on the distribution of deaths by age. Thus, the age-adjusted death rate in 1990 for All causes would decrease from 520.2 to 512.7 per 100,000 population if the age-specific death rates were corrected for net census undercount (table G). For Diseases of heart, the age-adjusted death rate for white males would decrease from 202.0 to 198.2 per 100,000 population, a decline of 2.0 percent. For black males, the change from an unadjusted rate of 275.9 to an adjusted rate of 256.7 would amount to a decrease of 7.0

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percent. For HIV infection, the rate for black males would decrease from 44.2 to 39.0 and for white males from 15.0 to 14.4.

If death rates by age were adjusted, the corresponding life expectancy at birth computed from these rates would change. When calculating life expectancy, the impact of an undercount or overcount is greatest at the younger ages. In general, the effect of correcting the death rates is to increase the estimate of life expectancy at birth. For example, adjustment for net census undercount would increase life expectancy in 1990 by an estimated 0.2 years, from 75.4 years to 75.6 years for the total U.S. population.

Adjustment for differential underenumeration among race-sex groups would lead to greater changes in life expectancy for some groups than for others. For males and females, increases would be 0.3 and 0.1 years, respectively; for the black population and white population, 0.6 and 0.2 years, respectively. The largest increase would be for black males, 1.2 years, followed by white males (0.3 years), black females (0.2 years), and white females (0.2 years).

Age-adjusted death rates

Age-adjusted death rates are used to compare relative

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mortality risk across groups and over time. However, they should be viewed as constructs or indexes rather than as direct or actual measures of mortality risk. Statistically, they are weighted averages of the age-specific death rates, where the weights represent the fixed population proportions by age (51). The age-adjusted death rates presented in this volume were computed by the direct method, that is, by applying age-specific death rates for a given cause of death to the U.S. standard million population (relative age distribution of 1940 enumerated population of the United States totaling 1,000,000 (28)). By using the same standard population, the rates for the total population and for each race-sex group were adjusted separately. It is important not to compare age-adjusted death rates with crude rates. The U.S. standard million population is as follows:

Age	Number
All ages.....	1,000,000
Under 1 year.....	15,343
1-4 years.....	64,718
5-14 years.....	170,355
15-24 years.....	181,677
25-34 years.....	162,066
35-44 years.....	139,237
45-54 years.....	117,811
55-64 years.....	80,294

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65-74 years.....	48,426
75-84 years.....	17,303
85 years and over.....	2,770

Life tables

U.S. abridged life tables are constructed by reference to a standard table (52). Life tables for the decennial period 1979-81 are used as the standard life tables in constructing the 1980-93 abridged life tables. Life table values for 1981-89 appearing in this volume are based on revised intercensal estimates of the populations for those years. Therefore, these life table values may differ from life table values of those years published in previous volumes.

Life tables for the decennial period 1969-71 are used as the standard life tables in constructing the 1970-79 abridged life tables. Life table values for 1970-73 were first revised in *Vital Statistics of the United States, 1977*; before 1977, life table values for 1970-73 were constructed using the 1959-61 decennial life tables. In addition, life table values for 1951-59, 1961-69, and 1971-79 appearing in this volume are based on revised intercensal estimates of the populations for those years. As such, these life table values may differ from life table values for those years published in previous volumes.

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The annual abridged life table series was initiated for selected race-sex groups in 1945. Because of the increased interest in the average length of life ($^{\circ}e_0$) for years prior to 1945, estimates were prepared by race and sex. The figures in table 6-5 show the estimated average length of life for the following race and sex groups and data years (53).

<i>Years</i>	<i>Race and sex groups</i>
1900-45.....	Total
1900-47.....	Male
1900-47.....	Female
1900-50.....	White
1900-44.....	White, male
1900-44.....	White, female
1900-50.....	All other
1900-44.....	All other, male
1900-44.....	All other, female

The geographic areas covered in life tables before 1929-31 were limited to the death-registration areas. Life tables for 1900-02 and 1909-11 were constructed using mortality data from the 1900 death-registration States--10 States and the District of Columbia, and for 1919-21, from the 1920 death-registration States--34 States and the District of Columbia. The tables for 1929-31 through 1958 cover the conterminous United States.

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Decennial life table values for the 3-year period 1959-61 were derived from data that include Alaska and Hawaii for each year (table 6-4). Data for each year shown in table 6-5 include Alaska beginning in 1959 and Hawaii beginning in 1960. It is believed that the inclusion of these two States does not materially affect life table values.

Random variation in numbers of deaths, death rates, and mortality rates and ratios

Deaths and population-based rates--Except for those reported in 1972, the numbers of deaths reported for a community represent complete counts of such events. As such, they are not subject to sampling error, although they are subject to errors in the registration process. However, when the figures are used for analytical purposes, such as the comparison of rates over a period or for different areas, the number of events that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances (54). The probable range of values may be estimated from the actual figures according to certain statistical assumptions.

In general, distributions of vital events may be assumed to follow the binomial distribution. Estimates of standard error

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and tests of significance under this assumption are described in most standard statistics texts. When the number of events is large, the standard error, expressed as a percent of the number or rate, is usually small.

When the number of events is small (perhaps less than 100) and the probability of such an event is small, considerable caution must be observed in interpreting the conditions described by the figures. This is particularly true for infant mortality rates, cause-specific death rates, and death rates for counties. Events of a rare nature may be assumed to follow a Poisson probability distribution. For this distribution, a simple approximation may be used to estimate a confidence interval, as follows:

If N is the number of registered deaths in the population and R is the corresponding rate, the chance is 19 in 20 that

$$1. N-2\sqrt{N} \text{ and } N+2\sqrt{N}$$

covers the "true" number of events.

$$2. R-2\frac{R}{\sqrt{N}} \text{ and } R+2\frac{R}{\sqrt{N}}$$

covers the "true" rate.

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If the rate R_1 corresponding to N_1 events is compared with the rate R_2 corresponding to N_2 events, the difference between the two rates may be regarded as statistically significant at the 0.05 level of significance, if it exceeds

$$2\sqrt{\frac{R_1^2}{N_1} + \frac{R_2^2}{N_2}}$$

For example, if the observed death rate for a community were 10.0 per 1,000 population and if this rate were based on 20 recorded deaths, the chance is 19 in 20 that the "true" death rate for that community lies between 5.5 and 14.5 per 1,000 population. If the death rate for this community of 10.0 per 1,000 population were being compared with a rate of 15.0 per 1,000 population for a second community, which is based on 25 recorded deaths, the difference between the rates for the two communities is 5.0. This difference is less than twice the standard error of the difference

$$2\sqrt{\frac{(10.0)^2}{20} + \frac{(15.0)^2}{25}}$$

of the two rates, which is computed to be 7.5. From this it is

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concluded that the difference between the rates for the two communities is not statistically significant at the 0.05 level of significance.

Rates, proportions, and ratios--Beginning in 1989 an asterisk is shown in place of a rate based on fewer than 20 deaths. These rates have a relative standard error of 23 percent or more and therefore are considered highly variable. For age-adjusted death rates, this criterion is applied to the sum of the age-specific deaths.

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U.S. STANDARD CERTIFICATE OF DEATH

LOCAL FILE NUMBER

STATE FILE NUMBER

TYPE/PRINT
IN
PERMANENT
BLACK INK
FOR
INSTRUCTIONS
SEE OTHER SIDE
AND HANDBOOK

NAME OF DECEDENT:
For use by physician or institution

DEPARTMENT OF HEALTH AND HUMAN SERVICES - NATIONAL CENTER FOR HEALTH STATISTICS - 1989 REVISION

SEE INSTRUCTIONS
ON OTHER SIDE

SEE DEFINITION
ON OTHER SIDE

CERTIFIER

REGISTRAR

1. DECEDENT'S NAME (First, Middle, Last)		2. SEX	3. DATE OF DEATH (Month, Day, Year)
4. SOCIAL SECURITY NUMBER	5a. AGE—Last Birthday (Years)	5b. UNDER 1 YEAR Months Days	5c. UNDER 1 DAY Hours Minutes
6. DATE OF BIRTH (Month, Day, Year)		7. BIRTHPLACE (City and State or Foreign Country)	
8. WAS DECEDENT EVER IN U.S. ARMED FORCES? (Yes or no)		9a. PLACE OF DEATH (Check only one; see instructions on other side) HOSPITAL: ☐ Inpatient ☐ ER/Outpatient ☐ DOA OTHER: ☐ Nursing Home ☐ Residence ☐ Other (Specify)	
9b. FACILITY NAME (If not institution, give street and number)		9c. CITY, TOWN, OR LOCATION OF DEATH	9d. COUNTY OF DEATH
10. MARITAL STATUS—Married, Never Married, Widowed, Divorced (Specify)	11. SURVIVING SPOUSE (If wife, give maiden name)	12a. DECEDENT'S USUAL OCCUPATION (Give kind of work done during most of working life. Do not use retired.)	12b. KIND OF BUSINESS/INDUSTRY
13a. RESIDENCE—STATE	13b. COUNTY	13c. CITY, TOWN, OR LOCATION	13d. STREET AND NUMBER
13e. INSIDE CITY LIMITS? (Yes or no)	13f. ZIP CODE	14. WAS DECEDENT OF HISPANIC ORIGIN? (Specify No or Yes—If yes, specify Cuban, Mexican, Puerto Rican, etc.) ☐ No ☐ Yes Specify:	15. RACE—American Indian, Black, White, etc. (Specify)
16. DECEDENT'S EDUCATION (Specify only highest grade completed) Elementary/Secondary (0-12) College (1-4 or 5+)			
17. FATHER'S NAME (First, Middle, Last)		18. MOTHER'S NAME (First, Middle, Maiden Surname)	
19a. INFORMANT'S NAME (Type/Print)		19b. MAILING ADDRESS (Street and Number or Rural Route Number, City or Town, State, Zip Code)	
20a. METHOD OF DISPOSITION ☐ Burial ☐ Cremation ☐ Removal from State ☐ Donation ☐ Other (Specify)		20b. PLACE OF DISPOSITION (Name of cemetery, crematory, or other place)	20c. LOCATION—City or Town, State
21a. SIGNATURE OF FUNERAL SERVICE LICENSEE OR PERSON ACTING AS SUCH		21b. LICENSE NUMBER (of Licensee)	22. NAME AND ADDRESS OF FACILITY
23a. To the best of my knowledge, death occurred at the time, date, and place stated. Signature and Title		23b. LICENSE NUMBER	23c. DATE SIGNED (Month, Day, Year)
24. TIME OF DEATH M		25. DATE PRONOUNCED DEAD (Month, Day, Year)	
26. WAS CASE REFERRED TO MEDICAL EXAMINER/CORONER? (Yes or no)			
27. PART I. Enter the diseases, injuries, or complications that caused the death. Do not enter the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure. List only one cause on each line. IMMEDIATE CAUSE (Final disease or condition resulting in death) → a. DUE TO (OR AS A CONSEQUENCE OF): Sequentially list conditions, if any, leading to immediate cause. Enter UNDERLYING CAUSE (Disease or injury that initiated events resulting in death) LAST b. DUE TO (OR AS A CONSEQUENCE OF): c. DUE TO (OR AS A CONSEQUENCE OF): d.			Approximate Interval Between Onset and Death
PART II. Other significant conditions contributing to death but not resulting in the underlying cause given in Part I.			28a. WAS AN AUTOPSY PERFORMED? (Yes or no)
			28b. WERE AUTOPSY FINDINGS AVAILABLE PRIOR TO COMPLETION OF CAUSE OF DEATH? (Yes or no)
29. MANNER OF DEATH ☐ Natural ☐ Pending Investigation ☐ Accident ☐ Could not be Determined ☐ Suicide ☐ Homicide	30a. DATE OF INJURY (Month, Day, Year)	30b. TIME OF INJURY M	30c. INJURY AT WORK? (Yes or no)
30d. DESCRIBE HOW INJURY OCCURRED		30e. PLACE OF INJURY—At home, farm, street, factory, office building, etc. (Specify)	
30f. LOCATION (Street and Number or Rural Route Number, City or Town, State)			
31a. CERTIFIER (Check only one) ☐ CERTIFYING PHYSICIAN (Physician certifying cause of death when another physician has pronounced death and completed item 23) To the best of my knowledge, death occurred due to the cause(s) and manner as stated. ☐ PRONOUNCING AND CERTIFYING PHYSICIAN (Physician both pronouncing death and certifying to cause of death) To the best of my knowledge, death occurred at the time, date, and place, and due to the cause(s) and manner as stated. ☐ MEDICAL EXAMINER/CORONER On the basis of examination and/or investigation, in my opinion, death occurred at the time, date, and place, and due to the cause(s) and manner as stated.			
31b. SIGNATURE AND TITLE OF CERTIFIER		31c. LICENSE NUMBER	31d. DATE SIGNED (Month, Day, Year)
32. NAME AND ADDRESS OF PERSON WHO COMPLETED CAUSE OF DEATH (ITEM 27) (Type/Print)			
33. REGISTRAR'S SIGNATURE			34. DATE FILED (Month, Day, Year)

INSTRUCTIONS FOR SELECTED ITEMS

Item 9— Place of Death

If the death was pronounced in a hospital, check the box indicating the decedent's status at the institution (inpatient, emergency room/outpatient, or dead on arrival (DOA)). If death was pronounced elsewhere, check the box indicating whether pronouncement occurred at a nursing home, residence, or other location. If other is checked, specify where death was legally pronounced, such as a physician's office, the place where the accident occurred, or at work.

Items 13a-f. — Residence of Decedent

Residence of the decedent is the place where he or she actually resided. This is not necessarily the same as "home State," or "legal residence." Never enter a temporary residence such as one used during a visit, business trip, or a vacation. Place of residence during a tour of military duty or during attendance at college is not considered as temporary and should be considered as the place of residence.

If a decedent had been living in a facility where an individual usually resides for a long period of time, such as a group home, mental institution, nursing home, penitentiary, or hospital for the chronically ill, report the location of that facility in items 13a through 13f.

If the decedent was an infant who never resided at home, the place of residence is that of the parent(s) or legal guardian. Do not use an acute care hospital's location as the place of residence for any infant.

Items 23 and 31 — Medical Certification

The PRONOUNCING PHYSICIAN is the person who determines that the decedent is legally dead but who was not in charge of the patient's care for the illness or condition which resulted in death. Items 23a through 23c are to be completed only when the physician responsible for completing the medical certification of cause of death (Item 27) is not available at time of death to certify cause of death. The pronouncing physician is responsible for completing only items 23 through 26.

The CERTIFYING PHYSICIAN is the person who determines the cause of death (Item 27). This box should be checked only in those cases when the person who is completing the medical certification of cause of death is not the person who pronounced death (Item 23). The certifying physician is responsible for completing items 27 through 32.

The PRONOUNCING AND CERTIFYING PHYSICIAN box should be checked when the same person is responsible for completing items 24 through 32, that is, when the same physician has both pronounced death and certified the cause of death. If this box is checked, items 23a through 23c should be left blank.

The MEDICAL EXAMINER/CORONER box should be checked when investigation is required by the Post Mortem Examination Act and the cause of death is completed by a medical examiner or coroner. The Medical Examiner/Coroner is responsible for completing items 24 through 32.

Item 27. — Cause of Death

The cause of death means the disease, abnormality, injury, or poisoning that caused the death, not the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure.

In Part I, the immediate cause of death is reported on line (a). Antecedent conditions, if any, which gave rise to the cause are reported on lines (b), (c), and (d). The underlying cause, should be reported on the last line used in Part I. No entry is necessary on lines (b), (c), and (d) if the immediate cause of death on line (a) describes completely the train of events. ONLY ONE CAUSE SHOULD BE ENTERED ON A LINE. Additional lines may be added if necessary. Provide the best estimate of the interval between the onset of each condition and death. Do not leave the interval blank; if unknown, so specify.

In Part II, enter other important diseases or conditions that may have contributed to death but did not result in the underlying cause of death given in Part I.

See examples below.

SEE INSTRUCTIONS ON OTHER SIDE	27. PART I. Enter the diseases, injuries, or complications that caused the death. Do not enter the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure. List only one cause on each line.					Approximate Interval Between Onset and Death		
	IMMEDIATE CAUSE (Final disease or condition resulting in death) →							
	a. Rupture of myocardium DUE TO IOR AS A CONSEQUENCE OF:					Mins.		
	b. Acute myocardial infarction DUE TO IOR AS A CONSEQUENCE OF:					6 days		
c. Chronic ischemic heart disease DUE TO IOR AS A CONSEQUENCE OF:					5 years			
d.								
PART II. Other significant conditions contributing to death but not resulting in the underlying cause given in Part I. Diabetes, Chronic obstructive pulmonary disease, smoking					28a. WAS AN AUTOPSY PERFORMED? (Yes or no) Yes			
					28b. WERE AUTOPSY FINDINGS AVAILABLE PRIOR TO COMPLETION OF CAUSE OF DEATH? (Yes or no) Yes			
29. MANNER OF DEATH ☒ Natural ☐ Pending Investigation ☐ Accident ☐ Suicide ☐ Homicide ☐ Could not be Determined		30a. DATE OF INJURY (Month, Day, Year)		30b. TIME OF INJURY M	30c. INJURY AT WORK? (Yes or no)		30d. DESCRIBE HOW INJURY OCCURRED	
		30e. PLACE OF INJURY —At home, farm, street, factory, office building, etc. (Specify)		30f. LOCATION (Street and Number or Rural Route Number, City or Town, State)				

SEE INSTRUCTIONS ON OTHER SIDE	27. PART I. Enter the diseases, injuries, or complications that caused the death. Do not enter the mode of dying, such as cardiac or respiratory arrest, shock, or heart failure. List only one cause on each line.					Approximate Interval Between Onset and Death		
	IMMEDIATE CAUSE (Final disease or condition resulting in death) →							
	a. Cerebral laceration DUE TO IOR AS A CONSEQUENCE OF:					10 mins.		
	b. Open skull fracture DUE TO IOR AS A CONSEQUENCE OF:					10 mins.		
c. Automobile accident DUE TO IOR AS A CONSEQUENCE OF:					10 mins.			
d.								
PART II. Other significant conditions contributing to death but not resulting in the underlying cause given in Part I.					28a. WAS AN AUTOPSY PERFORMED? (Yes or no) No			
					28b. WERE AUTOPSY FINDINGS AVAILABLE PRIOR TO COMPLETION OF CAUSE OF DEATH? (Yes or no) No			
29. MANNER OF DEATH ☐ Natural ☐ Pending Investigation ☒ Accident ☐ Suicide ☐ Homicide ☐ Could not be Determined		30a. DATE OF INJURY (Month, Day, Year) 11/15/85		30b. TIME OF INJURY 1 p. M	30c. INJURY AT WORK? (Yes or no) No		30d. DESCRIBE HOW INJURY OCCURRED 2-car collision—driver	
		30e. PLACE OF INJURY —At home, farm, street, factory, office building, etc. (Specify) Street		30f. LOCATION (Street and Number or Rural Route Number, City or Town, State) Route 4, Raleigh, North Carolina				

CAUSE OF
FETAL
DEATH

PHS-T-007
REV. 1/89

Table A. Comparison of percent agreement and ratio of deaths for census or survey record to deaths by race for matching death certificate: 1960 and 1979-85

Race	Census		NLMS1/	
	Percent agreement	Ratio census/ death certificate	Percent agreement	Ratio NLMS/ death certificate
White.....	99.8	1.00	99.2	1.00
Black.....	98.2	1.00	98.2	1.00
American Indian.....	79.2	1.12	73.6	1.22
Asian.....	---	...	82.4	1.12
Japanese.....	97.0	1.04	...	...
Chinese	90.3	1.07	...	...
Filipino	72.6	1.28	...	...

---Data not available.

...Category not applicable.

1/NLMS is defined as National Longitudinal Mortality Study.

SOURCES: Hambright TZ. Comparability of marital status, race, nativity, and country of origin on the death certificate and matching census record: U.S., May-August 1960. National Center for Health Statistics. Vital Health Stat 2(34). 1969; Sorlie PD, Rogot E, Johnson NJ. Validity of demographic characteristics on the death certificate. Epidemiology 3(2):181-4. 1992.

Table B. Infant mortality rates by race of mother from linked and unlinked data, 1989-91; and ratio of linked to unlinked rates: United States

[Rates per 1,000 live births in specified group]

Race	Unlinked period rate 1989-91	Linked birth cohort rate 1989-91	Ratio linked/ unlinked rates
All races.....	9.3	9.0	0.97
White.....	7.6	7.4	0.97
Black.....	18.0	17.1	0.95
American Indian.....	11.2	12.6	1.13
Chinese.....	5.0	5.1	1.02
Japanese.....	4.4	5.3	1.20
Hawaiian.....	10.9	9.0	0.83
Filipino.....	4.1	6.4	1.56
Other Asian or Pacific Islander.....	5.6	7.0	1.25

NOTE: Births for race not stated are not distributed.

Table C. Period of gestation at which fetal-death reporting is required: Each reporting area, 1993

Area	All periods of gestation	16 weeks	20 weeks	20 weeks or 350 grams	20 weeks or 400 grams	20 weeks or 500 grams	5 months	350 grams	500 grams
Alabama			X						
Alaska			X						
Arizona				X					
Arkansas	1X								
California			X						
Colorado	1X								
Connecticut			X						
Delaware								2X	
District of Columbia						X			
Florida			X						
Georgia	X								
Hawaii	X								
Idaho				X					
Illinois			X						
Indiana			X						
Iowa			X						
Kansas								X	
Kentucky				X					
Louisiana				X					
Maine			X						
Maryland			3X						
Massachusetts				X					
Michigan					X				
Minnesota			X						
Mississippi				X					
Missouri				X					
Montana						X			
Nebraska			X						
Nevada			X						
New Hampshire				X					
New Jersey			X						
New Mexico									X
New York									
New York excluding New York City	X								
New York City	X								
North Carolina			X						
North Dakota			X						
Ohio			X						
Oklahoma			X						
Oregon			X						
Pennsylvania		X							
Rhode Island	X								
South Carolina				X					
South Dakota									X
Tennessee									4X
Texas			X						
Utah			X						
Vermont			5X						
Virginia	X								
Washington			X						
West Virginia			X						
Wisconsin				X					
Wyoming			X						
Puerto Rico							X		
Virgin Islands	X								
Guam			X						

1/Although State law requires the reporting of fetal deaths of all periods of gestation, only data for fetal deaths of 20 weeks of gestation or more are provided to NCHS.

2/If weight is unknown, 20 completed weeks of gestation or more.

3/If gestational age is unknown, weight of 500 grams or more.

4/If weight is unknown, 22 completed weeks of gestation or more.

5/If gestational age is unknown, weight of 400 grams or more, 15 ounces or more.

Table D. Percent of fetal death records on which specified items were not stated: Each State, 1993

[By place of occurrence. Records include only those with stated or presumed period of gestation of 20 weeks or more]

Area	Length of gestation 1/	Maternal status	Place of delivery	Birth weight	Month prenatal care began	Number of prenatal visits	Hispanic origin of mother	Mother's educational attainment	Medical risk factors 2/	Tobacco use	Alcohol use	Obstetric procedures	Complications of labor and/or delivery 3/	Congenital anomalies
Alabama	1.9	0.5	-	5.1	7.1	8.0	0.2	4.4	3.2	-	-	2.4	4.2	1.4
Alaska	-	-	-	4.4	-	-	6.7	13.3	-	4.4	4.4	-	-	-
Arizona	1.6	2.0	0.2	6.2	9.1	13.7	3.5	6.7	3.1	8.9	9.1	3.3	3.1	3.8
Arkansas	-	-	-	6.3	11.2	13.4	-	9.7	0.7	2.2	3.0	1.1	1.1	1.9
California	11.1	---	0.1	1.3	6.7	8.5	1.7	7.9	0.9	---	---	0.8	1.0	1.9
Colorado	-	-	-	12.6	15.2	17.8	-	18.1	4.3	21.8	23.0	4.9	4.3	5.5
Connecticut	8.5	---	2.5	13.8	67.8	46.6	39.6	65.4	26.1	34.3	34.6	25.8	33.6	56.9
Delaware	2.1	-	-	6.3	2.1	2.1	-	6.3	-	2.1	2.1	-	-	-
District of Columbia	8.7	17.3	-	16.8	30.1	29.5	5.2	24.3	44.5	64.2	65.9	45.1	44.5	64.2
Florida	4.1	4.1	-	8.5	17.5	17.2	2.1	9.1	3.2	7.5	7.9	4.0	4.4	4.6
Georgia	0.8	0.4	-	14.5	18.4	19.0	8.5	30.1	18.6	4.1	4.3	2.0	2.6	9.9
Hawaii	0.8	-	-	27.7	30.0	30.8	13.8	34.6	---	---	---	---	---	---
Idaho	1.1	-	-	6.4	11.7	12.8	17.0	11.7	2.1	4.3	9.6	4.3	3.2	12.8
Illinois	3.1	5.3	0.1	7.5	12.8	14.6	5.1	9.8	15.6	2.5	1.5	12.6	15.0	20.3
Indiana	0.5	1.2	-	6.8	12.1	14.1	12.3	7.5	5.3	---	9.4	2.8	2.5	3.7
Iowa	2.2	0.4	-	3.4	5.2	6.0	12.5	3.0	1.3	3.0	3.5	0.9	0.4	1.7
Kansas	0.5	-	-	0.5	5.8	5.8	1.4	1.9	9.6	9.6	9.6	7.7	9.6	13.9
Kentucky	0.8	0.5	0.3	2.5	3.8	5.8	1.1	3.3	20.8	19.7	20.5	19.2	20.8	38.4
Louisiana	17.9	0.4	-	2.9	9.0	14.5	---	9.6	---	---	---	---	---	---
Maine	2.5	18.5	-	33.3	22.2	18.5	25.9	27.2	21.0	23.5	24.7	19.8	23.5	29.6
Maryland	46.9	---	0.6	35.5	42.6	---	---	39.7	---	---	---	---	---	---
Massachusetts	-	0.4	-	2.1	1.9	1.9	---	16.3	---	---	---	---	---	---
Michigan	0.4	---	0.3	2.5	12.0	14.7	15.7	16.8	2.5	10.4	11.3	1.4	4.1	4.8
Minnesota	0.3	10.9	0.3	2.4	5.6	6.8	2.6	9.7	8.8	11.8	12.1	6.8	9.7	15.6
Mississippi	-	-	-	4.4	9.8	14.6	0.4	8.6	4.2	7.3	7.7	1.9	3.3	5.6
Missouri	0.8	-	-	2.0	11.4	11.7	0.6	14.9	0.4	2.9	3.3	-	0.4	1.8
Montana	1.3	1.3	2.7	4.0	2.7	5.3	2.7	2.7	2.7	6.7	6.7	2.7	1.3	1.3
Nebraska	-	-	-	3.9	0.6	0.6	4.5	3.9	-	0.6	0.6	-	-	-
Nevada	4.3	---	-	29.0	26.1	29.7	2.2	8.7	26.8	37.0	41.3	23.9	34.1	34.8
New Hampshire	-	-	-	3.4	4.5	9.1	21.6	8.0	-	3.4	2.3	-	-	-
New Jersey	6.5	3.8	-	22.0	22.5	19.9	2.4	20.3	5.8	7.4	8.7	5.2	8.3	8.8
New Mexico	-	0.9	-	6.4	5.5	9.1	-	37.3	0.9	2.7	2.7	-	0.9	---
New York State	2.7	---	2.3	35.5	25.9	23.7	8.4	31.6	-	---	---	-	-	33.3
New York City	2.1	---	0.1	24.6	32.1	27.5	25.7	46.0	4.6	---	---	11.1	8.3	---
North Carolina	0.7	0.6	-	5.0	4.6	3.9	0.4	4.3	1.2	2.6	2.9	1.2	1.4	2.4
North Dakota	1.7	1.7	-	8.3	3.3	8.3	8.3	6.7	5.0	13.3	16.7	5.0	5.0	5.0
Ohio	1.0	35.6	0.1	8.1	8.6	12.7	2.4	10.9	5.4	10.2	12.1	6.3	6.1	8.7
Oklahoma	54.3	30.6	1.7	35.8	49.3	50.1	---	45.2	---	---	---	---	---	---
Oregon	0.5	-	-	5.8	3.9	3.4	1.0	9.2	-	4.8	6.3	-	-	-
Pennsylvania	2.4	2.6	0.1	9.6	8.3	9.6	3.5	16.2	2.7	7.1	9.3	3.4	3.3	7.6
Rhode Island	1.0	77.9	-	22.1	97.1	97.1	98.1	98.1	64.4	81.7	81.7	60.6	65.4	82.7
South Carolina	0.4	0.2	-	1.4	4.6	4.4	1.2	8.9	1.6	3.9	4.1	2.5	1.2	3.6
South Dakota	-	-	2.2	-	-	-	-	-	-	---	---	-	-	-
Tennessee	0.5	-	-	2.4	4.7	7.1	0.7	5.5	0.5	2.4	2.4	0.7	0.5	0.7
Texas	4.2	---	-	10.5	10.5	11.3	0.1	11.6	13.9	12.2	13.9	3.8	6.2	4.9
Utah	-	2.6	-	6.8	9.8	10.7	2.1	9.0	5.1	6.0	6.0	0.9	5.1	19.7
Vermont	-	-	-	9.7	9.7	16.1	3.2	12.9	3.2	3.2	9.7	-	-	16.1
Virginia	0.8	2.9	-	26.4	21.9	26.3	8.2	35.7	25.3	29.0	30.6	25.4	26.6	34.2
Washington	4.2	2.7	0.2	12.2	15.9	24.1	4.5	22.8	-	16.6	29.3	-	-	-
West Virginia	-	-	-	4.1	9.4	10.5	0.6	8.2	-	9.9	10.5	-	0.6	0.6
Wisconsin	-	0.3	-	1.8	0.8	1.0	0.3	1.8	0.8	0.3	0.3	0.8	0.8	2.0
Wyoming	-	-	-	8.6	-	-	-	2.9	-	-	2.9	2.9	-	-

- Quantity zero.

--- Data not available.

1/ California, Louisiana, Maryland, and Oklahoma report date last normal menses began but do not report clinical estimate of gestation.

2/ Kansas and South Dakota do not report Rh sensitization; New York State does not report previous infant 4000+ grams. Texas does not report genital herpes and uterine bleeding.

3/ Texas does not report cephalopelvic disproportion, anesthetic complications, and fetal distress.

Table E. Numbers of deaths and ratios of deaths for selected causes as tabulated by State of occurrence and NCHS, 1993

[Data by place of occurrence include deaths of nonresidents. Numbers after causes of death are category numbers of the Ninth Revision, International Classification of Diseases, 1975]

Causes	Ratio					
	Alaska	NCHS	Alaska/NCHS	Jersey	NCHS	NJ/NCHS
All causes.....	2,395	2,382	1.01	71,198	71,090	1.00
Symptoms, signs, and ill-defined conditions.....780-799	37	62	0.60	320	862	0.37
Accidents and adverse effects.....E800-E949	301	372	0.81	2,084	2,058	1.01
Motor vehicle accidents.....E810-E825	124	120	1.03	814	791	1.03
All other accidents and adverse effects...E800-E807,E826-E949	177	252	0.70	1,270	1,267	1.00
Suicide.....E950-E959	140	98	1.43	607	551	1.10
Homicide and legal intervention.....E960-E978	58	42	1.38	441	417	1.06
All other external causes.....E980-E999	11	2	5.50	185	82	2.26

Table F. Source for resident population and population including Armed Forces abroad:
Birth- and death-registration States, 1900-32, and United States, 1900-93

Year	Source
1993.....	U.S. Bureau of the Census, Electronic Data File, RESP0793, and unpublished data.
1992.....	U.S. Bureau of the Census, Electronic Data File, RESP0792, and unpublished data.
1991.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1095, 1993.
1990.....	U.S. Bureau of the Census, Unpublished data from the 1990 census. 1990 CPH-L-74 and unpublished data consistent with Current Population Reports, Series P-25, No. 1095.
1989.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1057, 1990.
1988.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1045, 1990.
1986-87.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1022, Mar. 1988.
1985.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1000, Feb. 1987.
1984.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 985, Apr. 1986.
1983.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 965, Mar. 1985.
1982.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 949, May 1984.
1981.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 929, May 1983.
1980.....	U.S. Bureau of the Census, U.S. Census of Population: 1980, Number of Inhabitants, PC80-1A1, United States Summary, 1983.
1971-79.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 917, July 1982.
1970.....	U.S. Bureau of Census, U.S. Census of Population: 1970, Number of Inhabitants, Final Report PC(1)-A1, United States Summary, 1971.
1961-69.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 519, April 1974.
1960.....	U.S. Bureau of the Census, U.S. Census of Population: 1960, Number of Inhabitants, PC(1)-A1, United States Summary, 1964.
1951-59.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 310, June 30, 1965.
1940-50.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 499, May 1973.
1930-39.....	U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 499, May 1973, and National Office of Vital Statistics, Vital Statistics Rates in the United States, 1900-1940, 1947.
1920-29.....	National Office of Vital Statistics, Vital Statistics Rates in the United States, 1900-1940, 1947.
1917-19.....	Same as for 1930-39.
1900-16.....	Same as for 1920-29.

Table G. Age-adjusted death rates for selected causes by race and sex, unadjusted and adjusted for estimated net census undercount: United States, 1990

[Based on age-specific death rates per 100,000 population in specified group. Age-adjusted death rates per 100,000 U.S. standard million population. Numbers after causes of deaths are numbers of the Ninth Revision, International Classification of Diseases, 1975. Beginning 1987 includes category numbers *042-*044. See section "Cause of death"]

Race, sex, and adjustment for net census undercount	All causes	Human immunodeficiency virus infection (*042-*044)	Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues (140-208)	Diabetes mellitus (250)	Diseases of heart (390-398, 402, 404-429)	Cerebrovascular diseases (430-438)	Homicide and legal intervention (E960-E978)
All races							
Both sexes:							
Unadjusted.....	520.2	9.8	135.0	11.7	152.0	27.7	10.2
Adjusted.....	512.7	9.6	133.3	11.5	149.9	27.3	10.1
Male:							
Unadjusted.....	680.2	17.7	166.3	12.3	206.7	30.2	16.3
Adjusted.....	664.3	17.0	162.4	12.1	202.1	29.6	15.9
Female:							
Unadjusted.....	390.6	2.1	112.7	11.1	108.9	25.7	4.2
Adjusted.....	387.9	2.1	112.6	11.0	107.9	25.4	4.2
White							
Both sexes:							
Unadjusted.....	492.8	8.0	131.5	10.4	146.9	25.5	5.9
Adjusted.....	485.9	7.8	129.9	10.2	145.0	25.2	5.7
Male:							
Unadjusted.....	644.3	15.0	160.3	11.3	202.0	27.7	8.9
Adjusted.....	631.0	14.4	156.9	11.1	198.2	27.3	8.7
Female:							
Unadjusted.....	369.9	1.1	111.2	9.5	103.1	23.8	2.8
Adjusted.....	367.0	1.0	110.8	9.5	102.2	23.5	2.7
Black							
Both sexes:							
Unadjusted.....	789.2	25.7	182.0	24.8	213.5	48.4	39.5
Adjusted.....	760.0	23.9	177.0	24.1	207.2	46.9	37.4
Male:							
Unadjusted.....	1,061.3	44.2	248.1	23.6	275.9	56.1	68.7
Adjusted.....	980.8	39.0	230.9	21.9	256.7	52.3	62.9
Female:							
Unadjusted.....	581.6	9.9	137.2	25.4	168.1	42.7	13.0
Adjusted.....	579.4	9.7	138.4	25.7	168.2	42.7	12.7