

SOURCES OF DATA

Death and fetal-death statistics

Mortality statistics for 1987 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 Trust Territory of the Pacific Islands. 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 Trust Territory of the Pacific Islands.

The Virgin Islands was admitted to the "registration area" for deaths in 1924; Puerto Rico, in 1932; and Guam, in 1970. 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 through 1969, 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 with computer tapes of data coded according to NCHS specifications and provided to NCHS through the Vital Statistics Cooperative Program. The year in which State-coded demographic data were first transmitted on computer tape 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 non-medical data on tape.

1971	1977
Florida	Alaska
	Idaho
1972	Massachusetts
Maine	New York City
Missouri	Ohio
New Hampshire	Puerto Rico
Rhode Island	
Vermont	1978
1973	Indiana
Colorado	Utah
Michigan	Washington
New York (except New York City)	1979
1974	Connecticut
Illinois	Hawaii
Iowa	Mississippi
Kansas	New Jersey
Montana	Pennsylvania
Nebraska	Wyoming
Oregon	
South Carolina	1980
1975	Arkansas
Louisiana	New Mexico
Maryland	South Dakota
North Carolina	
Oklahoma	1982
Tennessee	North Dakota
Virginia	
Wisconsin	
1976	1985
Alabama	Arizona
Kentucky	California
Minnesota	Delaware
Nevada	Georgia
Texas	District of Columbia
West Virginia	

For the Virgin Islands and Guam mortality statistics for 1987 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 on computer tapes according to NCHS specifications. The year in which State-coded medical data were first transmitted to NCHS is shown below for the 22 States now furnishing such data.

1974	1981
Iowa	Maine
Michigan	
	1983
1975	Minnesota
Louisiana	
Nebraska	1984
North Carolina	Maryland
Virginia	New York State (except
Wisconsin	New York City)
	Vermont
1980	
Colorado	1986
Kansas	California
Massachusetts	Florida
Mississippi	Texas
New Hampshire	
Pennsylvania	
South Carolina	

For 1987 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, it was necessary to change these procedures because of a backlog in coding and processing that resulted 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 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 the section "Estimates of errors arising from 50-percent sample for 1972."

Fetal-death data are obtained directly from copies of original reports of fetal deaths received by NCHS, except New York State (excluding New York City), which submitted State-coded data in 1987. Fetal-death data are not published by NCHS for the Virgin Islands and Guam.

Standard certificates and reports

The U.S. Standard Certificate of Death and the U.S. Standard Report of Fetal Death, issued by the Public Health Service, have served for many years as the principal means of attaining uniformity in the content of documents used to collect 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 assured 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 have been dropped when their usefulness appeared to be limited.

New revisions of the U.S. Standard Certificate of Death and the U.S. Standard Report of Fetal Death were recommended for State use beginning January 1, 1978. 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. The certificate of death shown in figure 7-A is for use by a physician, a medical examiner, or a coroner. Two other forms of the U.S. Standard Certificate of Death are available; they are similar to the one shown except that the section on certification is designed for the physician's signature on one, and for the medical examiner's or coroner's signature on the other.

Among the changes in the new revision were the additions of (1) an item asking "If Hosp. or Inst., Indicate DOA, OP/Emer. Rm., Inpatient" and (2) an item asking "Was Decedent Ever in U.S. Armed Forces?" The latter item was previously on the certificate but was deleted from 1968 through 1977. An item on whether autopsy findings were considered for determining cause of death was dropped.

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 consisting of two States (Massachusetts and New Jersey), the District of Columbia, and several large cities having efficient systems for death registrations, the death-registration area continued to expand until 1933, when it included the entire United States for the first time. Tables that show data for death-registration States include the District of Columbia for all years; registration cities in nonregis-

FIGURE 7-A.

PHYSICIAN, MEDICAL EXAMINER OR CORONER
U.S. STANDARD
CERTIFICATE OF DEATH

Form Approved
OMB No. 58R-1901

LOCAL FILE NUMBER

TYPE OR PRINT IN PERMANENT INK FOR INSTRUCTIONS SEE HANDBOOK	DECEDENT - NAME		SEX	STATE	DATE OF DEATH
	FIRST	MIDDLE	LAST		
DECEDENT	1	RACE (e.g. White, Black, American Indian, etc.) (Specify)		AGE - Last Birthday (Years)	DATE OF BIRTH (Mo., Day, Year)
	4	5a	5b	5c	6
	CITY, TOWN OR LOCATION OF DEATH		HOSPITAL OR OTHER INSTITUTION - Name (If applicable) and street number		WAS DECEASED ARMED FOR DEATH?
	7a	7b	7c	7d	7e
IF DEATH OCCURRED IN INSTITUTION SEE HANDBOOK REGARDING COMPLETION OF RESIDENCE ITEMS	STATE OF BIRTH (If not in U.S. name country)		CITIZEN OF WHAT COUNTRY	MARRIED NEVER MARRIED	SURVIVING SPOUSE (If living, give name)
	8		9	10	11
	SOCIAL SECURITY NUMBER		USUAL OCCUPATION (Give kind of work done during period preceding the month of death)		KIND OF BUSINESS OR INDUSTRY
	13	14a	14b	14c	14d
PARENTS	RESIDENCE - STATE		COUNTY	CITY, TOWN OR LOCATION	STREET AND NUMBER
	15a	15b	15c	15d	15e
	FATHER - NAME		MOTHER - MAIDEN NAME		
	FIRST	MIDDLE	LAST	FIRST	MIDDLE
DISPOSITION	16		17		
	INFORMANT - NAME (Type or Print)		MAILING ADDRESS		CITY OR TOWN
	18a		18b		18c
	BURIAL, CREMATION, REMOVAL, OTHER (Specify)		CEMETERY OR CREMATORY NAME		LOCATION
CERTIFIER	19a		19b		19c
	FUNERAL SERVICE LICENSEE Or Person Acting As Such (Signature)		NAME OF FACILITY		ADDRESS OF FACILITY
	20a		20b		20c
	21a		21c		21d
CAUSE OF DEATH	21a		21c		21d
	DATE SIGNED (Mo., Day, Year)		HOUR OF DEATH		
	21b		21c		21d
	NAME OF ATTENDING PHYSICIAN IF OTHER THAN CERTIFIER (Type or Print)		Pronounced Dead (Mo., Day, Year)		Pronounced Dead (Hour)
CAUSE OF DEATH	21d		22a		22b
	NAME AND ADDRESS OF CERTIFIER (Physician, Medical Examiner or Coroner) (Type or Print)		22a		22b
	23		24a		24b
	REGISTRAR		DATE RECEIVED BY REGISTRAR		
CAUSE OF DEATH	24a (Signature)		24b		
	25 IMMEDIATE CAUSE (ENTER ONLY ONE CAUSE PER LINE FOR Iai, Ibi, AND Ici)				
	PART I		Iai		Ibi
	DUE TO, OR AS A CONSEQUENCE OF		DUE TO, OR AS A CONSEQUENCE OF		
CAUSE OF DEATH	PART II		OTHER SIGNIFICANT CONDITIONS - Conditions contributing to death but not related to cause given in PART I (a)		
	26		27		
	AUTOPSY (Specify Yes or No)		WAS CASE REFERRED TO EXAMINER FOR DEATH?		
	28a		28b		28c
ACCIDENT, SUICIDE, HOMICIDE OR PENDING INVESTIGATION (Specify)		DATE OF INJURY (Mo., Day, Year)		HOUR OF INJURY	
28a		28b		28c	
INJURY AT WORK (Specify Yes or No)		PLACE OF INJURY (At home, farm, street, factory, office, building, etc.)		LOCATION	
28a		28b		28c	

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE - PUBLIC HEALTH SERVICE - NATIONAL CENTER FOR VITAL STATISTICS - 1978 REVISION

HRA-162-1
Rev. 1/78

tration States are not included. For more details on the history of the death-registration area, see the Technical Appendix in *Vital Statistics of the United States, 1979*, Volume II, Mortality, Part A, Section 7, pages 3-4, and the section "History and Organization of the Vital Statistics System," chapter 1, *Vital Statistics of the United States, 1950*, Volume I, 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

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 1957 are set forth in two NCHS instruction manuals (1,2).

A discussion of the classification of certain important items is presented below.

SECTION 7 — TECHNICAL APPENDIX — PAGE 4

FIGURE 7-B.

Form Approved
OMB No. 68R 1901

U S STANDARD
REPORT OF FETAL DEATH

STATE FILE NUMBER

TYPE TO PRINT
PERMANENT INK
SEE HANDBOOK FOR
INSTRUCTIONS

1a HOSPITAL NAME (If not in hospital give street and number)		1b CITY TOWN OR LOCATION OF DELIVERY		1c COUNTY OF DELIVERY	
2a DATE OF DELIVERY (Month Day Year)		2b HOUR OF DELIVERY		3 SEX OF FETUS	
4a MOTHER - MAIDEN NAME		4b AGE at time of the delivery		5a RESIDENCE - STATE	
5b CITY TOWN OR LOCATION		5c STREET AND NUMBER		5d INSIDE CITY LIMITS (Specify zip or zip 4 or 5)	
6a RACE (Is g. Wh. Is Black American Indian, etc.) (Specify)		6b EDUCATION (Specify only highest grade completed) (Elementary or Secondary (10-12) College (11 A or 5+))		6c DATE LAST NORMAL MENSTRUATION BEGAN (Month Day Year)	
7 MONTH OF PREGNANCY PRENATAL CARE BEGAN (First second, etc.) (Specify)		8 PRENATAL VISITS - Total number (If none, no state)		9 THIS BIRTH - Single, twin, triplet, etc. (Specify)	
10a FATHER - NAME		10b AGE at time of the delivery		10c RACE (Is g. Wh. Is Black American Indian, etc.) (Specify)	
11a LIVE BIRTHS (Specify sex of fetus)		11b OTHER TERMINATIONS (Specify sex of fetus)		11c DATE OF LAST LIVE BIRTH (Month Year)	
12a FATHER - NAME		12b AGE at time of the delivery		12c RACE (Is g. Wh. Is Black American Indian, etc.) (Specify)	
13a FATHER - NAME		13b AGE at time of the delivery		13c RACE (Is g. Wh. Is Black American Indian, etc.) (Specify)	

MOTHER

FATHER

CAUSE OF FETAL DEATH

15 PART I IMMEDIATE CAUSE (ENTER ONLY ONE CAUSE PER LINE FOR (a), (b), AND (c))		Specify Fetal or Maternal	
(a) Fetal or maternal condition directly causing fetal death		Specify Fetal or Maternal	
(b) Fetal and/or maternal conditions, if any giving rise to the immediate cause (a), listing the underlying cause last		Specify Fetal or Maternal	
(c) DUE TO, OR AS A CONSEQUENCE OF		Specify Fetal or Maternal	
16 PART II OTHER SIGNIFICANT CONDITIONS OF FETUS OR MOTHER (Conditions contributing to fetal death but not related to cause given in (a))		17 FETUS DIED BEFORE LABOR DURING LABOR OR DELIVERY, UNKNOWN (Specify)	
18 PHYSICIAN'S ESTIMATE OF GESTATION (Weeks)		19 AUTOPSY (Specify yes or no)	
20 COMPLICATIONS OF PREGNANCY (Describe on other page)		21 COMPLICATIONS OF LABOR AND OR DELIVERY (Describe on other page)	
22 CONCURRENT ILLNESSES OR CONDITIONS AFFECTING THE PREGNANCY (Describe on other page)		23 CONGENITAL MALFORMATIONS OR ANOMALIES OF FETUS (Describe on other page)	
24 NAME OF PHYSICIAN OR ATTENDANT (Type or print)		25 NAME OF PERSON COMPLETING REPORT (Type or print)	
26 TITLE		27 TITLE	

HRA-163
Rev. 1/78

Classification by occurrence and residence

Tabulations for the United States and specified geographic areas in this volume are 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 United States, with deaths of "nonresidents of the United States" assigned to place of death. "Deaths of nonresidents of the United States" refers to deaths that occur in the United States of nonresident aliens, nationals residing abroad, and residents of Puerto Rico, the Virgin Islands, Guam, and other territories of the United States. Beginning with 1970, deaths of nonresidents of the United States 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 1987 this difference amounted to 3,019 deaths. Mortality statistics by place of occurrence are shown in tables 1-11, 1-19, 1-20, 1-29, 1-30, 3-1, 3-8, 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 (3).

A comparison of the results of this study of deaths with those for a previous matched record study of births (4) showed that the quality of residence data had considerably improved 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 if 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.

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 (1,2).

The geographic codes assigned by the National Center for Health Statistics during data reduction of source information on birth, death, and fetal-death records are given in another instruction manual (5). 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.

Standard metropolitan statistical areas—The standard metropolitan statistical areas (SMSA's) used in this volume are those established by the U.S. Office of Management and Budget (6) from final 1980 census population counts and used by the U.S. Bureau of the Census, except in the New England States.

Except in the New England States, an SMSA is a county or a group of contiguous counties containing a city of 50,000 inhabitants or more or an urbanized area of 50,000 with a total metropolitan population of at least 100,000. In addition to the county or counties containing such a city or urbanized area, contiguous counties are included in an SMSA if, according to specified criteria, they are essentially metropolitan in character and are socially and economically integrated with the central city or urbanized area (7).

In the New England States the U.S. Office of Management and Budget uses towns and cities rather than counties as geographic components of SMSA's. The National Center for Health Statistics cannot, however, use the SMSA classification for these States because its data are not coded to identify all towns. Instead, NCHS uses New England County Metropolitan Areas (NECMA's). Made up of county units, these areas are established by the U.S. Office of Management and Budget (7,8).

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

Population-size groups—Vital statistics data for cities and certain other urban places in 1987 are 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, as a result of changes in the enumerated population between 1970 and 1980, some urban places identified in previous reports are no longer included, and a number of other urban places have been added.

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 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 10,000 or more population, as 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 1–33) 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 country of birth was unknown, not stated, or not classifiable accounted for a small proportion of all deaths in 1987, 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. With respect to the computation of death rates,

the age classification used by the U.S. Bureau of the Census is also based on the age of the person in completed years.

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 1987, deaths are classified by race—White, Black, American Indian, Chinese, Hawaiian, Japanese, Filipino, Other Asian or Pacific Islander, and Other. 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 as 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 is given as a mixture of white and any other race, the entry is coded to the appropriate other 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 in use 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. In about half of all the tables the divisions are white, all other (including black), and black separately. In other tables by race, where the main purpose is to isolate the major groups, the classifications are simply white and all other.

Race not stated—For 1987 the number of death records for which race was unknown, not stated, or not classifiable was 5,650, or 0.3 percent of the total deaths. Death records with race entry not stated are assigned to a racial designation as follows: If the preceding record is coded white, the code assignment is made to white; if the code is other than white, the assignment is 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.

New Jersey, 1962–64—New Jersey omitted the race item from its certificates of live birth, death, and fetal death in use 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 in use for residents of New Jersey did not contain the race item.

Adjustments made in vital statistics to take into account the omission of the race item in New Jersey for part of the certificates filed during 1962 through 1964 are described in the Technical Appendix of *Vital Statistics of the United States* for each of those data years.

Hispanic origin

Mortality statistics for the Hispanic-origin population were published in 1984 for the first time. They 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 were obtained from the District of Columbia and the following 22 States: Arizona, Arkansas, California, Colorado, Georgia, Hawaii, Illinois, Indiana, Kansas, Maine, Mississippi, Nebraska, Nevada, New Jersey, New Mexico, New York (including New York City), North Dakota, Ohio, Tennessee, Texas, Utah, and Wyoming. Generally, the reporting States used items similar to one of two basic formats recommended by NCHS. The first format is open-ended to obtain the specific origin or descent of the decedent (for example, Italian, Mexican, Puerto Rican, English, and Cuban). The second format is directed specifically toward the Hispanic population and asks whether the decedent is of Spanish origin. If so, the specific origin—for example, Mexican, Puerto Rican, or Cuban—is to be indicated.

For 1987, mortality data in tables 1–34 and 2–18 are based on deaths to residents of all 22 reporting States and the District of Columbia. In tables 1–35, 1–41, 1–42, 2–19, 2–20, 2–21, and 2–22 mortality data for the Hispanic-origin population are based on deaths to residents of 18 reporting States and the District of Columbia whose data were at least 90 percent complete on a place-of-occurrence basis and considered to be sufficiently comparable to be used for analysis. The 18 States are as follows: Arizona, Arkansas, California, Colorado, Georgia, Hawaii, Illinois, Indiana, Kansas, Mississippi, Nebraska, New Jersey, New York (including New York City), North Dakota, Ohio, Texas, Utah, and Wyoming. Excluded from these tables are data for New Mexico because the format for the Hispanic item on the New Mexico death certificate departs sufficiently from that of other areas to result in noncomparable data. In addition, in tables 1–34 and 2–18 for New Mexico, no deaths are shown for the category “not stated” origin. Because of the way in which the item on the death certificate for New Mexico is worded, it was not possible to determine whether a blank entry represented a response of “non-Hispanic origin” or of “unknown origin.” Accordingly, blank entries were coded to “non-Hispanic.” Data for three other States—Maine, Nevada, and Tennessee—are excluded from tables 1–35, 1–41, 1–42, 2–19, 2–20, 2–21, and 2–22 because of the large proportion of deaths (in excess of 10 percent) occurring in these States for which Hispanic origin was not stated or was unknown.

In 1980, the 18 reporting States and the District of Columbia accounted for about 80 percent of the Hispanic population in the United States, including about 89 percent of the Mexican population, 78 percent of the Puerto Rican population, 34 percent of the Cuban population, and 68 percent of the “Other Hispanic” population (9). Accordingly, caution should be exercised in generalizing mortality patterns from the reporting area to the Hispanic-origin population (especially Cubans) of the entire United States. For qualifica-

SECTION 7 — TECHNICAL APPENDIX — PAGE 7

tions regarding infant mortality of the Hispanic-origin population, see "Infant deaths."

Marital Status

Mortality statistics by marital status (table 1-32) were published in 1979 for the first time since 1961. (Previously they had been published in the annual volumes for the years 1949-51 and 1959-61.) Several reports analyzing mortality by marital status have been published, including the special study based on 1959-61 data (10). 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 in 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 2,068,117 resident deaths 15 years of age and over in 1987, 10,596 certificates (0.5 percent) had marital status not stated.

Place of death and status of decedent

Mortality statistics by place of death were published in 1979 for the first time since 1958 (tables 1-29 and 1-30). In addition, mortality data were also available for the first time in 1979 for the status of decedent when death occurred in a hospital or medical center (table 1-29). These data were obtained from the following two items that appear on the U.S. Standard Certificate of Death:

- Item 7c. Hospital or Other Institution—Name (If not in either, give street and number)
- Item 7d. If Hosp. or Inst. Indicate DOA, OP/Emer. Rm., Inpatient (Specify)

All of the States and the District of Columbia have item 7c (or its equivalent) on the death certificate. For all States and the District of Columbia in the Vital Statistics Cooperative Program, NCHS accepts the State definition, classification, or codes for hospitals, medical centers, or other institutions.

Table 1-29 shows mortality data for the total of the following 43 States (including New York City) that have item 7d or its equivalent on their death certificates:

Alaska	Indiana
Arizona	Iowa
Arkansas	Kansas
Colorado	Kentucky
Connecticut	Louisiana
Florida	Maine
Georgia	Michigan
Hawaii	Minnesota
Idaho	Mississippi
Illinois	Missouri

Montana	Rhode Island
Nebraska	South Carolina
Nevada	South Dakota
New Hampshire	Tennessee
New Jersey	Utah
New Mexico	Vermont
New York	Virginia
North Carolina	Washington
North Dakota	West Virginia
Ohio	Wisconsin
Oregon	Wyoming
Pennsylvania	

Effective with data for 1980, the coding of place of death and status of decedent was changed. A new coding category was added: "Dead on arrival—hospital, clinic, medical center name not given." Deaths coded to this category are tabulated in table 1-29 as "Dead on arrival" and in table 1-30 as "Not in hospital or medical center." Had the 1979 coding categories been used, these deaths would have been tabulated as "Place unknown."

Mortality by month and date of death

Deaths by month have been regularly tabulated and published in the annual volume for each year beginning with data year 1900. For 1987, deaths by month are shown in tables 1-20, 1-21, 1-24, 1-31, 2-12, 2-13, 2-14, and 3-9.

Date of death was first published 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 in this volume are shown in table 1-31 for the total number of deaths and for the number 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 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 autopsies were performed. For 1987, autopsies were reported on 253,023 death certificates, 11.9 percent of the total (table 1-28).

Information as to whether the autopsy findings were used in determining the cause of death was tabulated for 1972-73 for all but nine registration areas and from 1974-77 for all but eight registration areas. The item "autopsy findings used" was deleted from the 1978 U.S. Standard Certificate of Death.

For eight of the cause-of-death categories shown in table 1-28, autopsies were reported as performed for 50 percent or more of all deaths (Meningococcal infection; Measles; Pregnancy with abortive outcome; Other complications of pregnancy, childbirth, and the puerperium; Motor vehicle accidents; Suicide; Homicide and legal intervention; and All other external causes). There were four other categories for which 40 percent or more of the death certificates reported autopsies. Autopsies were reported for only 7.6 percent of the Major cardiovascular diseases.

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” (11).

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 causes of death in a sequential order. These conditions are 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 or more conditions on the certificate into a single classification category.

As a statistical datum, the 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 start of the chain of events leading to death. The rules for selecting the underlying cause of death are included with the 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 the National Center for Health Statistics have been classified according to the Ninth Revision of the *International Classification of Diseases (ICD-9)* (11). In addition to specifying that the classification be used, WHO also recommends how the data should be tabulated in order to promote international comparability. The recommended system for tabulating data in the Ninth Revision allows countries to construct their own mortality and morbidity tabulation lists from the rubrics of the WHO Basic Tabulation List as long as 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 Basic Tabulation List (BTL) recommended under the Ninth Revision consists of 57 two-digit rubrics that add to the “all causes” total. Within each two-digit rubric, up to 9 three-digit rubrics numbered from 0 to 8 are identified, but these do not add to the total of the two-digit rubric. The two-digit rubrics of the BTL 01 through 46 provide for the tabulation of nonviolent deaths to ICD categories 001-799. Rubrics relating to chapter 17 (nature-of-injury causes 47 through 56) are not used by NCHS for selecting underlying cause of death; rather, preference is given to rubrics E47 through 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 for the tabulation of mortality data. The WHO Mortality List, a subset of the titles contained in the BTL, consists of 50 rubrics which are a minimum 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 more recently in use 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, which identify persons injured, are shown in the accident tables of this report (section 5). Special fifth-digit subcategories are also 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 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 standard 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.

SECTION 7 — TECHNICAL APPENDIX — PAGE 9

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 category numbers *042-*044 for Human immunodeficiency virus infection. The following new categories have been incorporated into the Each-Cause List:

- Human immunodeficiency virus infection . . *042-*044
- Human immunodeficiency virus infection with specified conditions *042
 - With specified infections *042.0
 - Causing other specified infections *042.1
 - With specified malignant neoplasms *042.2
 - Acquired immunodeficiency syndrome, unspecified- *042.9
- Human immunodeficiency virus infection causing other specified conditions *043
 - Causing lymphadenopathy *043.0
 - Causing specified diseases of the central nervous system *043.1
 - Causing other disorders involving the immune mechanism *043.2
 - Causing other specified conditions *043.3
 - Acquired immunodeficiency syndrome-related complex, unspecified *043.9
- Other human immunodeficiency virus infection *044
 - Causing specified acute infections *044.0
 - Human immunodeficiency virus infection, unspecified *044.9

The following changes have been made in the List of 282 Selected Causes of Death:

- from
 - Viral diseases 045-079
 - Other viral diseases 046-049, 051-054, 057-061, 065-066, 071-079
- to
 - Viral diseases *042-*044, 045-079
 - Other viral diseases *042-*044, 046-049, 051-054, 057-061, 065-066, 071-079

The following change has been made in the List of 72 Selected Causes of Death:

- from
 - All other infectious and parasitic diseases 001-003, 005, 020-032, 037, 039-041, 046-054, 56-066, 071-088, 098-139
- to
 - All other infectious and parasitic diseases 001-003, 005, 020-032, 037, 039-041, *042-*044, 046-054, 056-066, 071-088, 098-139

The following change has been made in the List of 61 Selected Causes of Infant Death:

- from
 - Remainder of infectious and parasitic diseases 001-007, 010-032, 034-035, 037, 039-041, 080-088, 091-139
- to
 - Remainder of infectious and parasitic diseases 001-007, 010-032, 034-035, 037, 039-041, *042-*044, 080-088, 091-139

The following change has been made in the List of 34 Selected Causes of Death:

- from
 - Residual of infectious and parasitic diseases 001-009, 020-038, 098-139
- to
 - Residual of infectious and parasitic diseases 001-009, 020-041, *042-*044, 045-088, 098-139

Effect of list revisions—The International Lists or adaptations of them, in use in this country since 1900, have been revised approximately every 10 years so that the disease classification 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 the ICD-9 (11). For a discussion of each of the classifications used with death statistics since 1900, see Technical Appendix in *Vital Statistics of the United States, 1979*, Volume II, Mortality, Part A, Section 7, pages 9-14.

A dual coding study was undertaken between the Ninth and the Eighth Revisions to measure the extent of discontinuity in cause-of-death statistics resulting from introducing the new Revision. An initial study for the List of 72 Selected Causes of Death and the List of 10 Selected Causes of Infant Death has been published (12). 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, Seventh and Sixth, and Sixth and Fifth Revisions. For additional information about these studies, again see the 1979 Technical Appendix.

Significant coding changes during 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 will be discussed below. In early 1983, a change was made in the coding of Acquired immunodeficiency syndrome (AIDS) and Human immunodeficiency virus (HIV) infection, which affected data from 1981 to 1986. Also effective with data year 1981 was a coding change for poliomyelitis. For data year 1982, a change was made in the definition of child (which affects the classification of deaths to a number of

categories, including Child battering and other maltreatment), and in guidelines for coding deaths to the category Child battering and other maltreatment (ICD No. E967). During the calendar year 1985 detailed instructions for coding motor vehicle accidents involving all-terrain vehicles (ATV's) 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 previously been classified to Neoplasms of unspecified nature (ICD-9 No. 239). Detailed discussion of these changes may be found in the Technical Appendix for previous volumes.

Coding in 1987—The rules and instructions used in coding the 1987 mortality medical data remained essentially the same as those used for the 1986 data except for notable changes described below. Beginning with data for 1987, NCHS introduced new category numbers *042–*044 for classifying and coding Human immunodeficiency virus (HIV) infection, formerly referred to as human T-cell lymphotropic virus-III/lymphadenopathy associated virus (HTLV-III/LAV) infection. The asterisk before the category numbers indicates that these codes are not part of the Ninth Revision of the *International Classification of Diseases* (ICD-9). Deaths classified to these categories for 1987 are shown in Tables 1-36, 1-37, 1-38, 1-39, 1-40, 1-41, 1-42, 2-22, and 2-23, and are also shown in the Each Cause List in Table 1-23. Deaths classified to category numbers *042–*044 are not shown separately in the other tables showing cause-of-death data. In the List of 282 Selected Causes of Death, deaths classified to category numbers *042–*044 are included in the category Other viral diseases; in the List of 72 Selected Causes of Death they are included in All other infectious and parasitic diseases; in the List of 61 Selected Causes of Infant Death they are included in Remainder of infectious and parasitic diseases; and, in the List of 34 Selected Causes of Death they are included in Residual of infectious and parasitic diseases.

For data years 1983–86, human immunodeficiency virus (HIV) infection, when reported on the death certificate, was assigned to the category Deficiency of cell-mediated immunity (ICD No. 279.1). Because the selection rules for underlying cause of death were developed prior to the identification of AIDS, other conditions mentioned on the death certificate and not in the category No. 279.1 were often selected as the underlying cause of death during this period. The underlying cause of death for these certificates involving HIV infection was therefore classified to a number of different categories including Deficiency of cell-mediated immunity (ICD No. 279.1), Pneumocystosis (ICD-9 No. 136.3, and Site unspecified (ICD-9 No. 173.9), under Other malignant neoplasm of skin (ICD-9 No. 173). As a consequence, cause-of-death statistics for 1987 are not strictly comparable with data for previous years. Also, the category No. 279.1 was not uniquely specific for HIV conditions. There were 1,141 death certificates which had mention of conditions coded to ICD No. 279.1 in 1983, 2,943 in 1984, 6,040 in 1985, and 10,900 in 1986. It is believed that HIV infection was involved in most of these deaths.

Also, coding rules for the conditions "dehydration" and "disseminated intravascular coagulopathy" were changed. Beginning with data year 1987, "dehydration" was considered to be a "direct sequel of" any malignant neoplasm; previously, for data years 1981–86, dehydration was considered to be a "direct sequel of" only certain specified malignant neoplasms. In addition, effective with data year 1985 for NCHS and with data year 1986 for those States that provide coded medical data to NCHS, "disseminated intravascular coagulopathy" was changed to be considered a "direct sequel of" surgery. As a result, trends in deaths due to Volume depletion (ICD-9 No. 276.5) and Defibrination syndrome (ICD-9 No. 286.6), respectively, are affected.

Medical certification—The use of a standard classification list, although essential for State, regional, and international comparison, does not assure strict comparability of the tabulated figures. A high degree of comparability between 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 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 (13), covering 128 references over a period of 23 years, indicates that 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 there are deaths for which it is not possible to determine the cause, this proportion indicates the care and consideration given to the certification by the medical certifier. It may also be used as a rough measure of the specificity of the medical diagnoses made by the certifier in various areas. In 1987, 1.5 percent of all reported deaths in the United States were assigned to ill-defined or unknown causes, about the same as in 1986. However, in 1987 this percentage varied among the States, from 0.5 percent to 4.4 percent. While the percent for the United States for all ages combined has generally remained stable since 1979, declines have occurred for persons in age groups 55–64 years and 65–74 years, while increases have occurred for persons in age groups 25–34 years and 35–44 years. There has been no clear pattern of change in the percent of deaths assigned to Symptoms, signs, and ill-defined conditions for the other age groups for the United States as a whole.

Automated selection of underlying cause of death—Beginning with data year 1968, NCHS began using a computer system for assigning the underlying cause of death. It has been used every year since to select the underlying cause of death. The system is called "Automated Classification of Medical Entities" (ACME).

The ACME system applies the same rules for selecting the underlying cause as 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 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 between 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 are periodically updated to reflect additional new information on the relationship among medical conditions. For 1987, these tables were amended to incorporate the new categories for Human immunodeficiency virus infection (*042-*044) and to reflect the relationships between HIV infection and other diseases. They were also amended to incorporate the relationship that dehydration is considered as a "direct sequel of" malignant neoplasms. 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 (14,15,16).

Cause-of-death ranking—Cause-of-death ranking (except for infants) is based on the List of 72 Selected Causes of Death and the category Human immunodeficiency virus infection (HIV 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 are not ranked from the List of 72 Selected Causes of Death; and Certain conditions originating in the perinatal period and Symptoms, signs, and ill-defined conditions are not ranked from the List of 61 Selected Causes of Infant Death. In addition, category titles that begin with the words "Other" or "All other" are not ranked to determine the leading causes of death. When one of the titles that represents 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, the World Health Organization (1977, p. 764) 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.

Under the Eighth Revision, maternal deaths were assigned to category title "Complications of pregnancy, childbirth, and the puerperium" (ICDA-8 Nos. 630-678). Although WHO did not define maternal mortality, there was an NCHS classification rule that limited a maternal death to a death 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 of time for the condition was given. If no duration was specified and the underlying cause of death was a maternal condition, then 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 on 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 have been expanded to include Indirect obstetric causes (ICD-9 Nos. 647-648). These causes include Infective and parasitic conditions as well as other current conditions in the mother that are classifiable elsewhere but which complicate pregnancy, childbirth, and the puerperium, such as Syphilis, Tuberculosis, 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 that a pregnant woman will die from 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.

Infant deaths

Age—An infant death is defined as a death under 1 year of age. The term excludes fetal deaths. Infant deaths are usually divided into two categories according to age: neonatal and postneonatal. Neonatal deaths are those that occur during the first 27 days of life, and postneonatal deaths are those that occur between 28 days and 1 year of age. It has generally 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; and environmental factors, such as nutrition, hygiene, and accidents, were considered more important in the post-neonatal 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 section 2 and section 8 are the most commonly used index 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 of the risk of dying in infancy because some of the live births will not have been exposed to a full year's risk of dying and some of the infants that die during a year will have been born in the previous year. The error introduced into the infant mortality rate by this inexactness is usually small, especially when the birth rate is relatively constant from year to year (17,18). 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 (19,20).

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 period. 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 through June, the denominator for the infant mortality rate is a count of births occurring during the 12 months of January through December. The difference in the time reference period can result in different trends between the two indices during periods when birth rates are markedly moving up or down.

In addition, the infant death rate is also subject to greater imprecision than is the infant mortality rate because of problems of enumerating and estimating the population under 1 year of age (20).

Race—Infant mortality rates for specified races other than white or black may be underestimated, based on results of studies in which race on the birth and death certificates for the same infant were compared (21). The figures should be interpreted with caution because of possible inconsistencies in reporting of race between the numerator and denominator of the rates. This reflects differences in the nature of reporting and processing race on these two vital records. On the birth certificate, race of parents is reported by the mother at the time of delivery. On the death certificate,

race of the deceased infant is reported by the funeral director based on observation or on information supplied by an informant, such as a parent. With respect to processing, race of infant at birth is coded using coding rules that take account of the race of each parent (see the Technical Appendix in *Vital Statistics of the United States, 1987*, Volume I, Natality, section entitled "Race or national origin"). For infant deaths, the race of child is coded directly from the race reported on the death certificate.

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 section "Hispanic origin") and numbers of resident live births by Hispanic origin of mother for the 18 reporting States and the District of Columbia. In computing infant mortality rates, deaths and live births of unknown origin are not distributed among the specified Hispanic and non-Hispanic groups. Because for 1987 the percent of infant deaths of unknown origin was 8.0 percent and the percent of live births of unknown origin was 2.9 percent, infant mortality rates by specified Hispanic origin and race for non-Hispanic origin may be somewhat underestimated.

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

Fetal deaths

In May 1950 the World Health Organization 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 (22).

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

Shortly thereafter, this definition of fetal death was adopted by the National Center for Health Statistics as the nationally recommended standard. Currently all registration areas except Puerto Rico have definitions similar to the standard definition (23). Puerto Rico has no formal definition.

As another step toward increasing the comparability of data on fetal deaths for different countries, the World Health Organization 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 (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

Note that in table 3-13, group IV consists of fetal deaths with gestation not stated but presumed to be 20 weeks or more gestation.

Until 1939 the nationally recommended procedure for registration of a fetal death required the filing of both a live-birth 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, 1955, 1956, and 1968. In 1978 the Standard Certificate of Fetal Death was replaced by the Standard Report of Fetal Death (figure 7-B).

The 1977 revision of the *Model State Vital Statistics Act and Model State Vital Statistics Regulations* (24) recommended that spontaneous fetal deaths of 20 weeks or more gestation, or a weight of 350 grams or more, and all induced terminations of pregnancy regardless of gestational age be reported and further that they be reported on separate forms. These forms are to be considered legally required statistical reports rather than legal documents.

Beginning with 1970 fetal deaths, 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 are different for spontaneous fetal deaths and induced terminations of pregnancy. These procedures are still in use.

Comparability and completeness of data—Registration area requirements for reporting fetal deaths vary. Most of these areas require reporting fetal deaths of gestations of 20 weeks or more. Table A shows the minimum period of gestation required by each State for fetal-death reporting. There is substantial evidence that not all fetal deaths for which reporting is required are reported (25).

Underreporting of fetal deaths is more likely to occur in the earlier part of the required reporting period for each State. Thus, for States requiring reporting of all periods of gestation, fetal deaths occurring at younger gestational ages are less completely reported. The reporting of fetal deaths of 20-23 weeks of gestation may be more complete for those States that report fetal deaths of all periods of gestation.

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 of not-stated gestation for

those States requiring reporting at 20 weeks 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 birth weight of 500 grams or more. In 1987 this rule was applied to the following States: Colorado, Georgia, Hawaii, New York (including New York City), Rhode Island, and Virginia. Each year there are some exceptions to this procedure.

The data in table 3-3 include only fetal deaths to residents of selected areas in the United States that reported all periods of gestation. The areas are Colorado, Georgia, Hawaii, New York (including New York City), Rhode Island, and Virginia; excluded are fetal deaths to residents of Maine.

Arkansas—Since 1971, Arkansas has been using two reporting forms for fetal deaths: A confidential Spontaneous Abortion form that is not sent to the National Center for Health Statistics and a Fetal Death Certificate that is. During the period 1971 through 1980, it is believed that most spontaneous fetal deaths of less than 20 weeks' gestation were reported on the confidential form and, therefore, were not reported to NCHS. During the period 1981 through 1983, Arkansas specified that fetal deaths of less than 28 weeks' gestation or weighing less than 1,000 grams could be reported on the confidential form; beginning with 1984 data, the State specified that fetal deaths of 20 weeks' gestation or weighing 500 grams be reported on the Fetal Death Certificate. Because of these changes, the comparability of counts of early fetal deaths may be affected. In particular, counts of fetal deaths aged 20 to 27 weeks during 1981-83 were not comparable between Arkansas and other reporting areas nor with data for 1984-87. It is believed that reporting has improved but is still not comparable with data for 1980 and earlier years.

Maine—Maine uses two reporting forms for fetal deaths: A Report of Abortion (Spontaneous and Induced) and a Report of Fetal Death. Most spontaneous fetal deaths of less than 20 weeks' gestation are reported on the Report of Abortion, and, therefore, are excluded from fetal death counts in this volume.

Missouri—Beginning in 1984, Missouri changed its reporting requirements for spontaneous fetal deaths from "after 20 weeks" to "after 20 weeks or a weight of 350 grams or more."

Wisconsin—Beginning in 1986, Wisconsin changed its reporting requirements for spontaneous fetal deaths from "20 weeks" to "20 weeks or 350 grams."

Period of gestation—The period of gestation is the number of completed weeks elapsed between the first day of the last normal menstrual period and the date of delivery. The first day of the last normal menstrual period (LMP) is used as the initial date because it can 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 the calculated gestation falls beyond a duration considered biologically plausible, "gestation in weeks" or "Physician's estimate of gestation" is used. When

SECTION 7 — TECHNICAL APPENDIX — PAGE 14

Table A. Period of gestation at which fetal-death reporting is required: Each reporting area, 1987

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	X								
California			X						
Colorado	X								
Connecticut			X						
Delaware			X						
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			² X						
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			³ X						
Pennsylvania		X							
Rhode Island	X								
South Carolina				X					
South Dakota									X
Tennessee									² X
Texas			X						
Utah			X						
Vermont			⁵ X						
Virginia	X								
Washington			X						
West Virginia			X						
Wisconsin				X					
Wyoming			X						

¹If gestational age is unknown, weight of 350 grams or more

²If gestational age is unknown, weight of 500 grams or more

³If gestational age is unknown, weight of 400 grams or more, or crown-heel length of 28 centimeters or more

⁴If weight is unknown, 22 completed weeks' gestation or more

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

SECTION 7 — TECHNICAL APPENDIX — PAGE 15

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
- 10 months and over to 43 weeks and over

All areas reported LMP in 1987 except Delaware, New Mexico, Puerto Rico, and South Dakota.

Birth weight—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 birth weight data, the metric system (grams) has been used to facilitate comparison with other data published in the United States and internationally. Birth weight 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

With the introduction of the Ninth Revision, International Classification of Diseases, the birth-weight 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; etc.

Race—The race of the fetus is ordinarily classified based on the race of the parents. If the parents are of different races, the following rules apply. (1) When only one parent is white, the fetus is assigned the other parent's race. (2) When neither parent is white, the fetus is assigned the father's race with one exception: If the mother is Hawaiian or Part-Hawaiian, the fetus is classified as Hawaiian.

When the race of one parent is missing or ill defined, the race of the other determines that of the fetus. When race of both parents is missing, the race of the fetus is allocated to the specific race of the fetus on the preceding record.

Total-birth order—Total-birth order refers to the sum of the live births and other terminations (including both spontaneous fetal deaths and induced terminations of pregnancy) that a woman has had including the fetal death being recorded. For example, if a woman has previously 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.

In the 1978 revision of the Standard Report of Fetal Death, total-birth order is calculated from four items on pregnancy history: Number of previous live births, now living; number of previous live births, now dead; number of other terminations before 20 weeks; and number of other terminations after 20 weeks.

All registration areas use the two standard items pertaining to the number of previous live births. Most areas use the two standard items pertaining to the number of "other terminations" before and after 20 weeks' gestation, but some areas use other criteria. 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.

Marital status—Table 3–4 shows fetal deaths and fetal-death ratios by mother's marital status. States excluded from this table are as follows: California, Connecticut, Maryland, Michigan, Montana, New York (including New York City), Ohio, Texas, and Vermont. Because live births comprise the denominator of the ratio, marital status must also be reported for mothers of live births. Marital status of the mother of the live birth is inferred for States that did not report it on the birth certificate.

There are no quantitative data on the characteristics of unmarried women who may misreport their marital status or who fail to register fetal deaths. Underreporting may be greater for the unmarried group than for the married group.

Age of mother—The fetal-death report asks for the mother's "age (at time of delivery)," and the ages are edited in NCHS for upper and lower limits. When mothers are reported to be under 10 years of age or 50 years and over, the age of the mother is considered not stated and is assigned as follows: Age on all fetal-death records with age of mother not stated is allocated 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).

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. The World Health Organization in the Ninth Revision of the International Classification of Diseases (ICD–9) recommended that "national perinatal statistics should include all fetuses and infants delivered weighing at least 500 grams (or when birth weight is unavailable, the corresponding gestational age (22 weeks) or body length (25 cm crown–heel)), whether alive or dead...." It was further recommended that "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 birth weight is unavailable, the corresponding gestational age (28 weeks)

or body length (35 cm crown–heel)).” Because birth weight and gestational age are not reported on the death certificate in the United States, NCHS was unable to recommend adopting these definitions. Three definitions of perinatal mortality are currently used by NCHS: Perinatal Definition I, generally used for international comparisons, which includes fetal deaths of 28 weeks or more gestation and infant deaths of less than 7 days; Perinatal Definition II, which includes fetal deaths of 20 weeks or more gestation and infant deaths of less than 28 days; and Perinatal Definition III, which includes fetal deaths of 20 weeks or more gestation and infant deaths of less than 7 days.

Variations in fetal death reporting requirements and practices have implications for comparing perinatal rates among States. Because reporting is generally poorer 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 of 20 weeks or more than are other States. The larger number of fetal deaths reported by these “all periods” States may result in higher perinatal rates compared with 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 of 20–27 weeks.

Not stated—Fetal deaths with gestational age not stated are presumed to be of 20 weeks’ gestation or more if (1) the State requires reporting of all fetal deaths of gestational age 20 weeks or more or (2) 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 with gestation not stated but presumed to be 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 with presumed gestation of 20 weeks or more are included with those of stated gestation of 20 weeks or more.

For all three definitions, following the distribution of gestation not stated described above, fetal deaths with not-stated sex are allocated within gestational age groups on the basis of the distribution of stated cases. The allocation of not-stated gestational age and sex for fetal deaths is made individually for each State, for metropolitan and nonmetropolitan areas, and separately for the United States as a whole. 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.

QUALITY OF DATA

Completeness of registration

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

Reporting requirements for fetal deaths vary somewhat from State to State (see “Comparability and completeness of data”). Overall reporting completeness is not as good for fetal deaths as for births and deaths, but it is believed to be relatively complete for fetal deaths of 28 weeks’ gestation or more. National statistical data on fetal deaths include only those fetal deaths with stated or presumed gestation of 20 weeks or more.

Massachusetts data

The 1964 statistics for deaths exclude approximately 6,000 events 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 also somewhat affected.

Quality control procedures

Demographic items on the death certificate—As previously indicated, for 1987 the mortality data for these items were obtained from two sources: (1) Microfilm images of the original certificates furnished by the Virgin Islands and photocopies from Guam; and (2) records on data tape 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.

As part of the quality control procedures for mortality data, each registration area has to go through a calibration period during which it must achieve the specified error tolerance level of 2 percent per item for 3 consecutive months, based on NCHS independent verification of a 50-percent sample of that area’s records. Once the area has achieved the required error tolerance level, a sample of 70–80 records per month is used to monitor quality of coding. All areas providing data on computer tapes prior to 1987 have achieved the specified error tolerance; accordingly, the demographic items on about 70–80 records per area per month were independently verified by NCHS. The estimated average error rate for all demographic items in 1987 was 0.25 percent.

These verification procedures involve controlling two types of error (coding and entering into the data record tape) at the same time, and the error rates are a combined measure of both types. It may be assumed that the entering errors are randomly distributed across all items on the record, but this assumption cannot be made as readily for coding errors. Although systematic errors in coding infrequent events may escape detection during sample verification, it is probable that some of these errors were detected during the initial period when 50 percent of the file was being verified, thus providing an opportunity to retrain the coders.

Medical items on the death certificate—As for demographic data, mortality medical data are also subject to quality control procedures which control for errors of both coding

and data entry. Each of the 22 registration areas in 1987 that furnished NCHS with coded medical information according to NCHS specifications first had to qualify for sample verification. During an initial calibration period, the area had to demonstrate that its staff could achieve a specified error tolerance level of less than 5 percent for coding all medical items. After the area has achieved the required error tolerance level, a sample of 70–80 records per month is used to monitor quality of medical coding. For these 22 States, the average coding error rate in 1987 was estimated at just over 4 percent.

For the remaining 33 registration areas—28 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 independently coded for quality control purposes. The estimated average error rate for these areas was about 3 percent.

The ACME system for selecting the underlying cause of death through computer application contributes to the quality control of medical items on the death certificate. (See section “Automated selection of underlying cause of death.”)

Demographic items on the report of fetal death—For 1987, all data on fetal deaths, except for New York State (excluding New York City), were coded under contract by the U.S. Bureau of the Census. Coding and entering information on data tapes were verified on a 100-percent basis because of the relatively small number of records involved.

Other control procedures—After coding and entering on data tape 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, where there is 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 (26). Further, conditions specified on a list of infrequent or rare causes of death need to be confirmed by the certifier or State Health Officer. For 1985 records, cryptosporidiosis was no longer confirmed by NCHS although this condition was still on the list of infrequent or rare causes of death through 1987. Because cryptosporidiosis has increased in frequency due to its association with human immunodeficiency virus (HIV) infection, it is no longer considered infrequent. 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 of *Vital Statistics of the United States, 1972*, Volume II, Mortality, Part A.

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, and 1980 are based on the population enumerated as of April 1 in the censuses of those years. Rates for all other years use the estimated midyear (July 1) population. Death rates for the United States, individual States, and SMSA's 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 1900–87 are shown in table 7–1. In addition, the population including Armed Forces abroad is shown for the United States. Table B lists the sources for these populations.

Population estimates for 1987—The population of the United States estimated by age, race, and sex for 1987 is shown in table 7–2, and the population for each State by broad age groups follows in table 7–3. Population estimates for 1984–87 incorporate new estimation procedures for net migration and net undocumented immigration. The 1987 estimates are comparable with those for 1984–86 but are not strictly comparable with the postcensal estimates for 1981–83 shown in tables 7–2 and 7–3 of *Vital Statistics of the United States*, Volume II, for those years. Although the death rates and estimates of life expectancy for 1984–1987 are not strictly comparable with those for previous years, the trends for the total population and most age-race-sex groups are not substantially affected. For additional details, see the Technical Appendix in *Vital Statistics of the United States, 1984*, Volume II, and the report of the U.S. Bureau of the Census (27). Population data by race are consistent with the modified (see below) 1980 population by race.

Population for 1980—The population of the United States by age, race, and sex and the population for each State by age are shown in tables 7–2 and 7–3, respectively, of *Vital Statistics of the United States, 1980*, Volume II. The figures by race have been modified as described below.

The racial counts in the 1980 census are affected by changes in reporting practices, particularly of the Hispanic population, and in coding and classifying. One particular change created a major inconsistency between the 1980 census data and historical data series, including censuses and vital statistics. About 40 percent of the Hispanic population counted in 1980, over 5.8 million persons, did not mark one of the specified races listed on the census questionnaire but instead marked the “Other” category.

In the 1980 census, coding procedures were modified for persons who marked “Other” race and wrote in a national

SECTION 7 — TECHNICAL APPENDIX — PAGE 18

Table B. Sources for resident population and population including Armed Forces abroad: Birth- and death-registration States, 1900–1932, and United States, 1900–1987

Year	Source
1986–87	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 1022, Mar. 1988.
1985	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 1000, Feb. 1987.
1984	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 985, Apr. 1986.
1983	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 965, Mar. 1985.
1982	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 949, May 1984.
1981	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 929, May 1983.
1980	U.S. Bureau of the Census, <i>U.S. Census of Population: 1980, Number of Inhabitants</i> , PC80-1A1, United States Summary, 1983.
1971–79	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 917, July 1982.
1970	U.S. Bureau of the Census, <i>U.S. Census of Population: 1970, Number of Inhabitants</i> , Final Report PC (1)-A1, United States Summary, 1971.
1961–69	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 519, April 1974.
1960	U.S. Bureau of the Census, <i>U.S. Census of Population: 1960, Number of Inhabitants</i> , PC (1)-A1, United States Summary, 1964.
1951–59	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 310, June 30, 1965.
1940–50	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 499, May 1973.
1930–39	U.S. Bureau of the Census, <i>Current Population Reports</i> , Series P-25, No. 499, May 1973, and National Office of Vital Statistics, <i>Vital Statistics Rates in the United States, 1900–1940</i> , 1943.
1920–29	National Office of Vital Statistics, <i>Vital Statistics Rates in the United States, 1900–1940</i> , 1943.
1917–19	Same as for 1930–39.
1900–1916	Same as for 1920–29.

origin designation of a Latin American country or a specific Hispanic-origin group in response to the racial question. These persons remained in the "Other" racial category in 1980 census data; in previous censuses and in vital statistics such responses had almost always been coded into the "White" category.

In order to maintain comparability, the "Other" racial category in the 1980 census was reallocated to be consistent with previous procedures. Persons who marked the "Other" racial category and reported any Spanish origin on the Spanish origin question (5,840,648 persons) were distributed to white and black races in proportion to the distribution of persons of Hispanic origin who actually reported their race as "White" or "Black." This was done for each age-sex group.

As a result of this procedure, 5,705,155 persons (98 percent) were added to the white population and 135,493 persons (2 percent) to the black population. Persons who marked the "Other" racial category and reported that they were not of Spanish origin (916,338 persons) were distributed as follows: 20 percent in each age-sex group were added to the "Asian and Pacific Islander" category (183,268 persons), and 80 percent were added to the "White" category (733,070 persons). The count of American Indians, Eskimos, and Aleuts was not affected by these procedures. Unpublished tabulations of these modified census counts were obtained from the U.S. Bureau of the Census and used to compute the rates for this volume.

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 previously been estimated for April 1, 1980 (28). 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 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 in the period 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-25, 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 the National Center for Health Statistics estimated a population by age, race, and sex excluding 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

Just as the underenumeration of deaths and the misreporting of demographic characteristics on the death certificate can introduce error into the annual rates, so can 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

(27). Net census undercount is the result of miscounting and misreporting of demographic characteristics such as age. Age-specific death rates are affected by both the net census undercount and the misreporting of age on the death certificate (29). 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.

Although death rates based on a population adjusted for net census undercount may be more accurate than rates based on an unadjusted population, rates in this volume are not adjusted; rather, they are computed using population estimates that preserve the age pattern of the net census undercount across the postcensal interval. Thus, it is important to consider the possible impact of net census undercount on death rates.

The U.S. Bureau of the Census has conducted extensive research on completeness of coverage of the U.S. population (including underenumeration and misstatement of age, race, and sex) in the last four decennial censuses—1950, 1960, 1970, and 1980. From this work have come estimates of the national population that was not counted by age, race, and sex (30.31). The reports for 1980 include estimates of net census undercount using alternative methodological assumptions for age, race, and sex subgroups of the national population (32). These studies indicate that, although coverage was improved over previous censuses, there was differential coverage in the 1980 census among the population subgroups; that is, some age, race, and sex groups were more completely counted than others.

Net census undercounts can affect (1) levels of the observed vital rates, (2) differences among groups, and (3) levels and group differences shown by summary measures such as age-adjusted death rates and life expectancy.

Levels and differentials—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 1980 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, results in a corresponding decrease in the death rate. A ratio greater than 1.0—indicating a net census overcount—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 than the population of all other races in the 1980 Census of Population. The black population was undercounted relative to the total population of all other races.

For the total population, underenumeration varied by age group, with the greatest differences found for persons aged 80-84 and 85 years and over. All other age groups were overcounted or undercounted by less than 3 percent.

Among the age-sex-race groups, coverage was lowest for black males aged 40-44 and 45-49 years. Underenumeration for these groups was 19 percent. In contrast, white

females in these age groups were essentially completely enumerated. For black females and white males in these same age groups, the undercount ranged from 3 to 6 percent. For the under-1-year age group the white population was overenumerated by 2 percent, whereas infants of other races were underenumerated by 9 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. As a consequence, the ratio of mortality between the rates for males and females, and between the rates for the white population and the population of other races, or 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, for the age group 35-39 years in 1980, the ratio of the death rate for Homicide and legal intervention for black males to that for white males is 7.3, whereas the ratio of the death rates adjusted for net census undercount in 1980 is 6.2. For Ischemic heart disease for males aged 40-44 years, the ratio of the death rate for the population of all other races to that for the white population is 1.2 using the unadjusted rates, but it is 1.1 when adjusted for estimated underenumeration.

Summary measures—The effect of net census undercount on age-adjusted death rates depends on the underenumeration of each age group and on the distribution of deaths by age. Thus, the age-adjusted death rate in 1980 for All causes would decrease from 585.8 to 579.3 per 100,000 population if the age-specific death rates were corrected for net census undercount.

For Diseases of heart, the age-adjusted death rate for white males would decrease from 277.5 to 273.0 per 100,000 population, a decline of 1.3 percent. For black males the change, from an unadjusted rate of 327.3 to an adjusted rate of 308.3, would amount to 5.8 percent.

If death rates by age were adjusted, then the corresponding life expectancy at birth computed from these rates would change. The importance of adjustments varies by age: that is, 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. Differential underenumeration among race-sex groups would lead to greater changes in life expectancy for some groups than for others. For white females who were completely enumerated in 1980, revised estimates of life expectancy would remain roughly constant; those for black males would show the greatest increase.

Age-adjusted death rates

Age-adjusted death rates shown in this volume are computed by using the distribution in 10-year age intervals of the enumerated population of the United States in 1940

as the standard population. Each figure represents the rate that would have existed if the age-specific rates of the particular year prevailed in a population whose age distribution was the same as that of the United States in 1940. The rates for the total population and for each race-sex group were adjusted using the same standard population. It is important not to compare age-adjusted death rates with crude rates. The standard 1940 population, on the basis of one million total 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	139,257
45-54 years	117,811
55-64 years	80,294
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 (33). Life tables for the decennial period 1979-81 are used as the standard life tables in constructing the 1980-87 abridged life tables. With the availability of the 1979-81 standard life tables, revised life table values were computed for 1980-82; these appeared for the first time in *Vital Statistics of the United States, 1983*.

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.

The change in the population estimation methodology (see above section "Population bases") results in life expectancies at certain 5-year age intervals for 1984-87 that are lower than those that would have occurred had they been based on the same methodology used to compute 1983 life expectancies. For additional details, see Technical Appendix for *Vital Statistics of the United States, 1984*, Volume II.

There has been an increasing interest in data on average length of life (e_0) for single calendar years before the initiation of the annual abridged life table series for selected race-sex groups in 1945. The figures in table 6-5 for the race and sex groups for the following years were estimated to meet these needs (34).

Years	Race and sex groups
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 1900-1902 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. Decennial life table values for the 3-year period 1959-61 were derived from data that include both 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 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 time 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 (35). 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 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.

SECTION 7 — TECHNICAL APPENDIX — PAGE 21

If N is the number of registered deaths in the population and R is the corresponding rate, the chances are 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.

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 .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 Community A were 10.0 per 1,000 population and if this rate were based on 20 recorded deaths, then the chances are 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 Community A of 10.0 per 1,000 population were being compared with a rate of 20.0 per 1,000 population for Community

B, which is based on 10 recorded deaths, then the difference between the rates for the two communities is 10.0. This difference is less than twice the standard error of the difference

$$2\sqrt{\frac{(10.0)^2}{20} + \frac{(20.0)^2}{10}}$$

of the two rates, which is computed to be 13.4. From this, it is concluded that the difference between the rates for the two communities is not statistically significant at the .05 level of significance.

SYMBOLS USED IN TABLES

Data not available	—
Category not applicable	...
Quantity zero	-
Quantity more than zero but less than 0.05	0.0
Quantity more than zero but less than 500 where numbers are rounded to thousands	Z
Figure does not meet standards of reliability or precision	.

REFERENCES

1. National Center for Health Statistics. Vital statistics, classification and coding instructions for fetal death records. NCHS Instruction Manual; part 3b. Hyattsville, Maryland: Public Health Service. Published annually.
2. National Center for Health Statistics. Vital statistics, demographic classification and coding instructions for death records, 1987. NCHS Instruction Manual; part 4. Hyattsville, Maryland: Public Health Service. Published annually.
3. McCarthy MA. Comparison of the classification of place of residence on death certificates and matching census records: United States, May–August 1960. National Center for Health Statistics. Vital Health Stat 2(30).
4. National Vital Statistics Division. Matched record comparison of birth certificate and census information, United States, 1950. Vital Statistics—Special Reports; vol 47 no 12. Washington, D.C.: Public Health Service. 1962.
5. National Center for Health Statistics. Vital statistics, vital records geographic classification, 1982: NCHS Instruction Manual; part 8. Hyattsville, Maryland: Public Health Service. 1985.
6. U.S. Office of Management and Budget. Standard metropolitan statistical areas and standard consolidated areas: Statistical Reporter. Washington: U.S. Government Printing Office, 1981. pp. 1–20.
7. U.S. Office of Management and Budget. 36 new standard metropolitan statistical areas: Statistical Reporter. Washington: U.S. Government Printing Office. 420. 1981.
8. U.S. Office of Management and Budget. Standard Metropolitan Statistical Areas, rev. ed. Washington: U.S. Government Printing Office, 89–90. 1975.
9. U.S. Bureau of the Census. 1980 Census of Population. Persons of Spanish Origin by State, 1980 Supplementary Report, PC80–51–7. Washington: U.S. Department of Commerce. 1982.
10. Klebba AJ. Mortality from selected causes by marital status: United States, Parts A & B. National Center for Health Statistics. Vital Health Stat Series 20(8a), Series 20(8b).
11. World Health Organization. Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, based on the recommendations of the Ninth Revision Conference, 1975. Geneva: World Health Organization. 1977.
12. National Center for Health Statistics. Estimates of selected comparability ratios based on dual coding of 1976 death certificates by the Eighth and Ninth Revisions of the International Classification of Diseases. Monthly Vital Statistics Report; vol 28 no 11 Suppl 30–1120. Hyattsville, Maryland: Public Health Service. 1980.
13. Gittelsohn A, Royston PN. Annotated bibliography of cause-of-death validation studies, 1958–80. National Center for Health Statistics. Vital Health Stat 2(89).
14. National Center for Health Statistics. Instructions for classifying multiple causes of death, 1987. NCHS Instruction Manual; part 2b. Hyattsville, Maryland: Public Health Service. Published annually.
15. National Center for Health Statistics. Non-indexed terms, standard abbreviations, and State geographic codes used in mortality data classification, 1987. NCHS Instruction Manual; part 2c. Hyattsville, Maryland: Public Health Service. Published annually.
16. National Center for Health Statistics. Vital statistics. ICD–9 ACME decision tables for classifying underlying causes of death, 1987. NCHS Instruction Manual; part 2c. Hyattsville, Maryland: Public Health Service. Published annually.
17. Guralnick L, Winter ED. A note on cohort infant mortality rates. Public Health Rep 80:692–694; 1965.
18. Grove RD, Hetzel AM. Vital Statistics Rates in the United States, 1940–1960. Public Health Service. Washington: National Center for Health Statistics. 1968.

SECTION 7 — TECHNICAL APPENDIX — PAGE 22

19. McCarthy B, Terry J, Rochat R et al. The underregistration of neonatal deaths: Georgia 1974-77. *Am J Public Health* 70:977-982. 1980.
20. Linder FE, Grove RD. *Vital Statistics Rates in the United States, 1900-1940*. Washington: National Office of Vital Statistics. 1947.
21. Frost F, Shy KK. Racial differences between linked birth and infant death records in Washington State. *Am J Public Health* 70:974-976. 1980.
22. National Office of Vital Statistics. *International Recommendations on Definitions of Live Birth and Fetal Death*. PHS Pub. No. 39. Public Health Service. Washington: U.S. Government Printing Office. 1950.
23. National Center for Health Statistics. *State Definitions and Reporting Requirements for Live Births, Fetal Deaths, and Induced Terminations of Pregnancy*. DHHS Pub. No. (PHS) 81-1119. Washington: Public Health Service. 1981.
24. National Center for Health Statistics. *Model State Vital Statistics Act and Model State Vital Statistics Regulations*, DHEW Pub. No. (PHS) 78-1115. Washington: Public Health Service. 1978.
25. Gred AE, Pauli RM, Kirby RS. Accuracy of fetal death reports: Comparison with data from an independent stillbirth assessment program. *Am J Public Health* 77:1202-1206. 1987.
26. National Center for Health Statistics. *Vital statistics, computer edits for mortality data, effective 1979*. NCHS Instruction Manual; part 11. Hyattsville, Maryland: Public Health Service. 1979.
27. U.S. Bureau of the Census. *United States population estimates, by age, sex, and race: 1980 to 1987*. Current Population Reports; series P-25, no. 1022. Washington: U.S. Government Printing Office. 1988.
28. U.S. Bureau of the Census. *Coverage of the national population in the 1980 census by age, sex, and race. Preliminary estimates by demographic analysis*. Current Population Reports; series P-25, no. 115. Washington: U.S. Department of Commerce. 1982.
29. National Center for Health Statistics, Hambright TZ. *Comparability of age on the death certificate and matching census records: United States, May-August 1960*. *Vital Health Stat* 2(29). 1968.
30. U.S. Bureau of the Census. *Estimates of coverage of the population by sex, race, and age—demographic analysis: 1970 Census of Population and Housing*. PHC(E)-4. Washington: U.S. Government Printing Office. 1974.
31. U.S. Bureau of the Census. *Developmental estimates of the coverage of the population of States in the 1970 census—demographic analysis*. Current Population Reports; series P-25, no. 65. Washington: U.S. Government Printing Office. 1977.
32. Passel JS, Robinson JG. *Revised Demographic Estimates of the Coverage of the Population by Age, Sex, and Race in the 1980 Census*. Unpublished memorandum, U.S. Bureau of the Census. Washington D.C., Apr. 8, 1985.
33. Sirken MG. *Comparison of two methods of constructing abridged life tables by reference to a "standard" table*. National Center for Health Statistics. *Vital Health Stat* 2(4). 1966.
34. National Office of Vital Statistics, Greville TNE, Carlson GA. *Estimated average length of life in the death-registration States*. *Vital statistics—Special Reports*. Vol. 33, No. 9. Washington, D.C.: Public Health Service. 1951.
35. National Office of Vital Statistics, Chiang CL. *Standard error of the age-adjusted death rate*. *Vital Statistics—Special Reports*. Vol. 47, No. 9. Washington, D.C.: Public Health Service. 1951.