

## Infant Mortality Statistics from the 2001 Period Linked Birth/Infant Death Data Set

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### Abstract

**Objectives**—This report presents 2001 period infant mortality statistics from the linked birth/infant death data set (linked file) by a variety of maternal and infant characteristics.

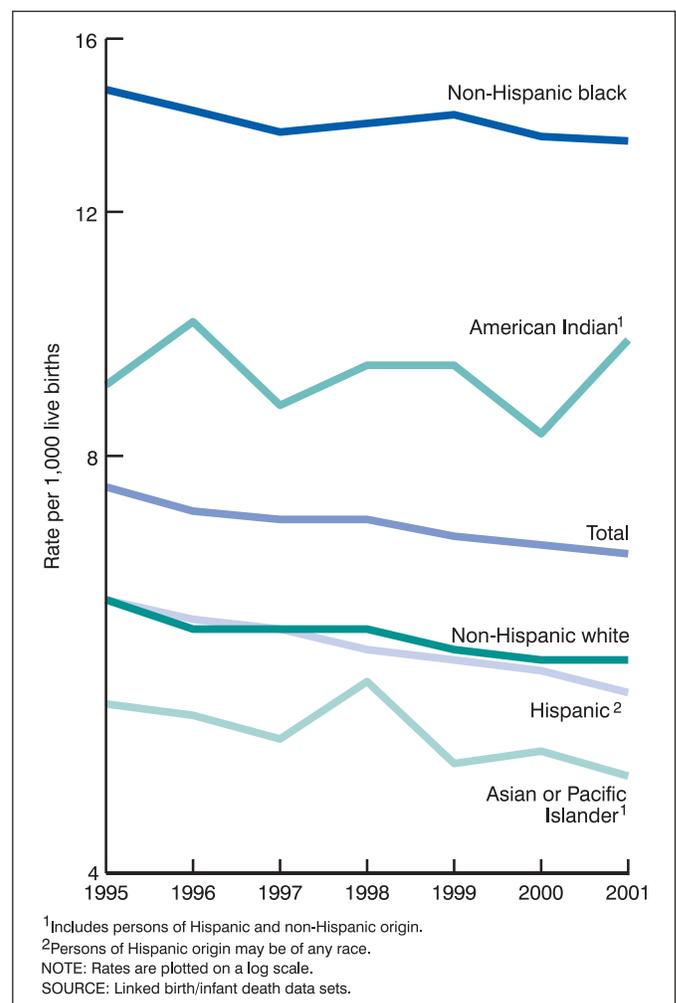
**Methods**—Descriptive tabulations of data are presented and interpreted.

**Results**—Infant mortality rates ranged from 3.2 per 1,000 live births for Chinese mothers to 13.3 for black mothers. Among Hispanics, rates ranged from 4.2 for Cuban mothers to 8.5 for Puerto Rican mothers. Infant mortality rates were higher for those infants whose mothers were born in the 50 States and the District of Columbia, were unmarried, or smoked during pregnancy. Infant mortality was also higher for male infants, multiple births, and infants born preterm or at low birthweight. The three leading causes of infant death—Congenital malformations, low birthweight, and Sudden infant death syndrome (SIDS)—taken together accounted for 44 percent of all infant deaths. Cause-specific mortality rates varied considerably by race and Hispanic origin. For infants of black mothers, the cause-specific infant mortality rate for low birthweight was nearly four times that for infants of white mothers. Between 1995 and 2001, the overall infant mortality rate declined by 10.5 percent; significant declines ranged from 8.2 percent for infants of non-Hispanic black mothers to 14.3 percent for infants of Hispanic mothers. The SIDS rate declined by 11 percent from 2000 to 2001. For infants of black and American Indian mothers, the SIDS rates were 2.2 and 2.8 times that for non-Hispanic white mothers.

**Keywords:** infant mortality • infant health • birthweight • maternal characteristics

### Introduction

This report presents infant mortality data from the 2001 period linked file. In the linked file, the information from the death certificate is linked to information from the birth certificate for each infant under 1 year of age who died in the 50 States, the District of Columbia,



**Figure 1. Infant mortality rates by race and ethnicity of mother, 1995–2001**

Puerto Rico, the Virgin Islands, or Guam during 2001. Linked birth/infant death data are not available for American Samoa and the Commonwealth of the Northern Marianas. The purpose of the linkage is to use the many additional variables available from the birth certificate to conduct more detailed analyses of infant mortality patterns. This report presents infant mortality data by race and Hispanic origin of the mother, birthweight, period of gestation, sex of infant, plurality, trimester of pregnancy prenatal care began, maternal age, maternal educational attainment, live-birth order, mother's marital status, mother's place of birth, maternal smoking during pregnancy, age at death, and underlying cause of death (tables 1–7, A–D, and figure 1). Other variables available in the linked file data set (1), but which are not discussed in this report include: father's age, race, and Hispanic origin; birth attendant; place of delivery; mother's weight gain during pregnancy; and many medical and health measurements. Another report, based on data from the vital statistics

mortality file, provides more detailed information on trends in infant mortality and on causes of infant death (2). Some rates calculated from the mortality file differ from those published using the linked birth/infant death file (see "Technical Notes").

## Methods

Data shown in this report are based on birth and infant death certificates registered in all States, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam. As part of the Vital Statistics Cooperative Program, each State provided to the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) matching birth and death certificate numbers for each infant under 1 year of age who died in the State during 2001. When the birth and death occurred in different States, the State of death was responsible

**Table A. Infant, neonatal, and postneonatal deaths and mortality rates by specified race or national origin of mother: United States, 2001 linked file**

Race of mother	Live births	Number of deaths			Mortality rate per 1,000 live births		
		Infant	Neonatal	Postneonatal	Infant	Neonatal	Postneonatal
All races .....	4,026,036	27,523	18,275	9,248	6.8	4.5	2.3
White .....	3,177,698	18,087	12,078	6,009	5.7	3.8	1.9
Black .....	606,183	8,084	5,396	2,688	13.3	8.9	4.4
American Indian <sup>1</sup> .....	41,872	404	176	228	9.7	4.2	5.4
Asian or Pacific Islander .....	200,283	947	624	323	4.7	3.1	1.6
Chinese .....	31,401	100	60	40	3.2	1.9	1.3
Japanese .....	9,048	36	22	14	4.0	2.5	*
Hawaiian .....	6,411	47	23	24	7.3	3.6	3.7
Filipino .....	32,470	180	131	48	5.5	4.0	1.5
Other Asian or Pacific Islander .....	120,953	584	388	197	4.8	3.2	1.6

\* Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.

<sup>1</sup> Includes Aleuts and Eskimos.

NOTE: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Neonatal is less than 28 days and postneonatal is 28 days to under 1 year.

**Table B. Infant, neonatal, and postneonatal deaths and mortality rates by Hispanic origin of mother and by race of mother for mothers of non-Hispanic origin: United States, 2001 linked file**

Hispanic origin and race of mother	Live births	Number of deaths			Mortality rate per 1,000 live births		
		Infant	Neonatal	Postneonatal	Infant	Neonatal	Postneonatal
All origins <sup>1</sup> .....	4,026,036	27,523	18,275	9,248	6.8	4.5	2.3
Total Hispanic .....	851,867	4,630	3,105	1,526	5.4	3.6	1.8
Mexican .....	611,013	3,187	2,130	1,057	5.2	3.5	1.7
Puerto Rican .....	57,568	491	345	147	8.5	6.0	2.5
Cuban .....	14,017	60	35	24	4.2	2.5	1.7
Central and South American .....	121,366	604	408	196	5.0	3.4	1.6
Other and unknown Hispanic .....	47,903	289	187	102	6.0	3.9	2.1
Non-Hispanic total <sup>2</sup> .....	3,149,626	22,512	14,864	7,648	7.1	4.7	2.4
Non-Hispanic white .....	2,326,606	13,300	8,817	4,483	5.7	3.8	1.9
Non-Hispanic black .....	589,940	7,938	5,293	2,645	13.5	9.0	4.5
Not stated .....	24,543	380	306	74	...	...	...

... Category not applicable.

<sup>1</sup> Origin of mother not stated included in "All origins" but not distributed among origins.

<sup>2</sup> Includes races other than white or black.

NOTE: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Neonatal is less than 28 days and postneonatal is 28 days to under 1 year.

**Table C. Infant, neonatal, and postneonatal deaths and mortality rates by race or national origin of mother: Total of 11 States, 2001 linked file**

Race of mother	Live births	Number of Deaths			Mortality rate per 1,000 live births		
		Infant	Neonatal	Postneonatal	Infant	Neonatal	Postneonatal
All races .....	1,806,096	10,962	7,257	3,705	6.1	4.0	2.1
Total Asian or Pacific Islander .....	141,756	638	401	237	4.5	2.8	1.7
Chinese .....	24,945	71	39	32	2.8	1.5	1.3
Japanese .....	7,139	31	17	14	4.4	*	*
Filipino .....	26,620	153	110	42	5.7	4.1	1.6
Vietnamese .....	15,129	54	29	25	3.6	1.9	1.7
Asian Indian .....	26,786	115	74	41	4.3	2.8	1.5
Korean .....	10,185	29	16	13	2.9	*	*
Hawaiian .....	5,742	39	20	18	6.8	3.5	*
Samoan .....	1,673	15	5	10	*	*	*
Guamanian .....	509	3	2	1	*	*	*
Remaining Asian or Pacific Islander .....	23,028	128	88	39	5.5	3.8	1.7
White .....	1,432,297	7,538	5,047	2,491	5.3	3.5	1.7
Black .....	223,252	2,705	1,774	931	12.1	7.9	4.2
American Indian <sup>1</sup> .....	8,791	80	34	45	9.1	3.9	5.2

\* Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.

<sup>1</sup> Includes Aleuts and Eskimos.

NOTE: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. States included are California, Hawaii, Illinois, Minnesota, Missouri, New Jersey, New York, Texas, Virginia, Washington, and West Virginia. Neonatal is less than 28 days and postneonatal is 28 days to under 1 year.

**Table D. Infant mortality rates, by race and Hispanic origin of mother: United States, 1995–2001 linked files**

Race and Hispanic origin of mother	1995	1996	1997	1998	1999	2000	2001	Percent change 1995 to 2001
All races .....	7.6	7.3	7.2	7.2	7.0	6.9	6.8	-10.5
White .....	6.3	6.1	6.0	6.0	5.8	5.7	5.7	-9.5
Black .....	14.6	14.1	13.7	13.8	14.0	13.5	13.3	-8.9
American Indian <sup>1</sup> .....	9.0	10.0	8.7	9.3	9.3	8.3	9.7	7.8**
Asian or Pacific Islander .....	5.3	5.2	5.0	5.5	4.8	4.9	4.7	-11.3
Chinese .....	3.8	3.2	3.1	4.0	2.9	3.5	3.2	-15.8**
Japanese .....	5.3	4.2	5.3	3.5	3.4	4.5	4.0	-24.5**
Hawaiian .....	6.6	5.6	9.0	10.0	7.1	9.0	7.3	10.6**
Filipino .....	5.6	5.8	5.8	6.2	5.8	5.7	5.5	-1.8**
Hispanic .....	6.3	6.1	6.0	5.8	5.7	5.6	5.4	-14.3
Mexican .....	6.0	5.8	5.8	5.6	5.5	5.4	5.2	-13.3
Puerto Rican .....	8.9	8.6	7.9	7.8	8.3	8.2	8.5	-4.5**
Cuban .....	5.3	5.1	5.5	3.6	4.7	4.6	4.2	-20.8**
Central and South American .....	5.5	5.0	5.5	5.3	4.7	4.6	5.0	-9.1**
Non-Hispanic white .....	6.3	6.0	6.0	6.0	5.8	5.7	5.7	-9.5
Non-Hispanic black .....	14.7	14.2	13.7	13.9	14.1	13.6	13.5	-8.2

\*\* Not significant at  $p < .05$ .

<sup>1</sup> Includes Aleuts and Eskimos.

for contacting the State of birth identified on the death certificate to obtain the original birth certificate number. NCHS used the matching birth and death certificate numbers provided by the States to extract final edited data from the NCHS natality and mortality statistical files. These data were linked to form a single statistical record, thereby establishing a national linked record file.

After the initial linkage, NCHS returned to each State computer lists of unlinked infant death records and records with inconsistent data between the birth and death certificates. State additions and corrections were incorporated, and a final national linked file was produced. In 2001, 98.9 percent of all infant death records were successfully matched to their corresponding birth records. This is higher than in 2000 (98.6 percent). A record weight was added to the linked file in 2001 to

compensate for the 1.1 percent of infant death records that were not linked to their corresponding birth certificates. See the "Technical Notes" for more information on the weighting of the linked file.

Information on births by age, race, or marital status of mother is imputed if it is not reported on the birth certificate. These items were not reported for less than 1 percent of U.S. births in 2001 (3).

Race and Hispanic origin are reported independently on the birth certificate. In tabulations of birth data by race and Hispanic origin, data for Hispanic persons are not further classified by race because the vast majority of women of Hispanic origin are reported as white. Data for American Indian and Asian or Pacific Islander (API) births are not shown separately by Hispanic origin because the vast majority of these populations are non-Hispanic.

Starting with data year 1999 cause-of-death statistics in this and similar publications are classified in accordance with the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10) (4). Previous issues of this report included causes of death classified according to the *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Ninth Revision* (ICD-9) (5).

### Data by maternal and infant characteristics

This report presents descriptive tabulations of infant mortality data by a variety of maternal and infant characteristics. These tabulations are useful for understanding the basic relationships between risk factors and infant mortality, *unadjusted for the possible effects of other variables*. In reality, women with one risk factor often have other risk factors as well. For example, teenage mothers are more likely to also be unmarried and of a low-income status, and mothers who do not receive prenatal care are more likely to be of a low-income status and uninsured. The preferred method for disentangling the multiple interrelationships among risk factors is multivariate analysis; however, an understanding of the basic relationships between risk factors and infant mortality is a necessary precursor to more sophisticated types of analyses, and is the aim of this publication.

*Race and Hispanic origin data*—Infant mortality rates are presented for both detailed race of mother and Hispanic origin of mother. The linked file is particularly useful for computing accurate infant mortality rates for this purpose because the race of the mother from the birth certificate is used in both the numerator and denominator of the infant mortality rate. In contrast, for the vital statistics mortality data—the more “traditional” source of infant mortality data—race information for the denominator is the race of the mother as reported on the birth certificate, whereas the race information for the numerator is the race of the decedent as reported on the death certificate (1,6). Another source of error is misreported race on the death certificate where race of the deceased infant is reported by the funeral director based on information provided by an informant or on observation. These different reporting methods can lead to differences in race-specific infant mortality rates between the two data sources with a larger impact on rates for races other than white and black (6,7).

Rates for API and for Chinese, Japanese, Filipino, and other API mothers are reported for all 50 States and the District of Columbia. In addition, infant mortality rates for five other detailed API groups, including Vietnamese, Asian Indian, Korean, Samoan, and Guamanian mothers, are presented for an 11-State reporting area: California, Hawaii, Illinois, Minnesota, Missouri, New Jersey, New York, Texas, Virginia, Washington, and West Virginia.

Race and Hispanic origin of mother are reported as separate items on the birth certificate; thus, a mother of Hispanic origin may be of any race. Although the overwhelming majority of Hispanic-origin births are to white women (3), there are notable differences in infant mortality trends between Hispanic and non-Hispanic white women. Therefore, race-specific data for non-Hispanic mothers are presented for comparison in tables showing data for Hispanic mothers. Race and ethnic differentials in infant mortality rates may reflect differences in income, educational levels, access to health care, health insurance, and other factors.

*Statistical significance*—Text statements have been tested for statistical significance, and a statement that a given infant mortality rate

is higher or lower than another rate indicates that the rates are significantly different. Information on the methods used to test for statistical significance, as well as information on differences between period and cohort data, the weighting of the linked file, and a comparison of infant mortality data between the linked file and the vital statistics mortality file are presented in the “Technical Notes.” Additional information on maternal age, marital status, period of gestation, birth-weight, and cause-of-death classification is also presented in the “Technical Notes.”

## Results and Discussion

### Trends in Infant mortality, 1995–2001

The infant mortality rate in the United States was 7.6 in 1995 and fell by over 10 percent to 6.8 in 2001. The rate either remained unchanged or dropped slightly each year between 1995 and 2001 (table D, figure 1).

Decreases have been observed for nearly all race and ethnic groups, although only a few had significant declines. Declines were observed for infants of non-Hispanic white (10 percent), black (9 percent), and Mexican mothers (13 percent). The infant mortality rate for infants of American Indian and Hawaiian mothers had non-significant increases from 1995 to 2001.

### Infant mortality by race and Hispanic origin of mother

The overall 2001 infant mortality rate from the linked file was 6.8 infant deaths per 1,000 live births, similar to the rate in 2000 (6.9) and lower than the 1999 level (7.0)(8).

There was wide variation in infant mortality rates by race of mother with the highest rate, 13.3 for infants of black mothers, four times greater than the lowest rate of 3.2 for infants of Chinese mothers. Rates were also high for infants of Hawaiian (7.3) and American Indian (9.7) mothers. Rates were intermediate for infants of non-Hispanic white (5.7) and Filipino mothers (5.5) (tables A and B).

The neonatal mortality rate (less than 28 days) for infants of black mothers (8.9) was significantly higher than for nearly all other racial groups. Infants of black and American Indian mothers had the highest postneonatal rates (28 days to under 1 year) of any group, 4.4 and 5.4, respectively. In general, the neonatal mortality rates were about twice the postneonatal rates for nearly all groups in which both rates could be reliably computed. The exception was infants of American Indian mothers whose neonatal mortality rate was lower than the postneonatal rate (4.2 versus 5.4).

In the 11-State reporting area for the expanded API subgroups, infant mortality rates were 4.3 for Asian Indians, 3.6 for Vietnamese, and 2.9 for infants of Korean mothers (table C).

There was wide variation in infant mortality rates for Hispanic subgroups with the rates high for infants of Puerto Rican mothers (8.5) and low for Cuban mothers (4.2). Rates were intermediate for infants of Mexican and Central and South American mothers (5.2 and 5.0, respectively) (table B). Among Hispanics, only Mexican mothers showed a significant decline from 1995 to 2001 (6.0 in 1995).

## Infant mortality by State

Infant mortality rates for 1999–2001 varied by State and within States by race and Hispanic origin of mother (table 3). Three years of data were combined to obtain statistically reliable rates. Rates were generally highest for States in the South and lowest for States in the West and Northeast. Infant mortality rates ranged from 10.4 for Mississippi to 4.9 for Massachusetts. The highest rate (13.0) was noted for the District of Columbia; however, the rate for the District of Columbia is more appropriately compared with rates for other large U.S. cities, because of the high concentrations of high-risk women in these areas.

Mortality rates for infants of non-Hispanic black mothers ranged from 16.7 in Michigan to 7.5 in Oregon. A recent report described an ongoing multifaceted effort to reduce infant mortality in a Michigan county (9). Again, the highest rate was for the District of Columbia (16.9). Oklahoma had the highest infant mortality rate for infants of non-Hispanic white mothers (7.6) and Massachusetts had the lowest rate (4.1).

Mortality rates for infants of American Indian and API mothers could be reliably computed for only 15 and 24 States, respectively. Mortality rates for infants of American Indian mothers ranged from 17.3 in Nebraska to 7.1 in New Mexico. Overall, infant mortality rates for infants of API mothers were the lowest, ranging from 3.7 in New Jersey and Pennsylvania to 7.4 in Minnesota.

## Sex of infant

In 2001 the overall infant mortality rate for male infants was 7.5 per 1,000, 23 percent higher than the rate for female infants (6.1). Infant mortality rates were higher for male than female infants in each racial and Hispanic origin group (tables 1 and 2). Differences were not statistically significant for infants of American Indian and Cuban mothers.

## Multiple births

For plural births, the infant mortality rate was 32.4, more than five times the rate of 6.0 for single births (table 1). Infant mortality rates that could be reliably calculated for plural births were higher than rates for single births for all race and Hispanic-origin groups.

The risk of infant death increases with the increasing number of infants in the pregnancy (10). In 2001 the infant mortality rates for quadruplets (126.7) and triplets (71.4) were more than four times and two times, respectively, the rate for twin births (29.7). Rates for quadruplets and triplets were more than 21 and 11 times, respectively, the rate for single births (6.0) (tabular data not shown).

## Birthweight and period of gestation

Birthweight and period of gestation are the two most important predictors of an infant's subsequent health and survival. Infants born too small or too soon have a much greater risk of death and both short-term and long-term disability than those born at term (37–41 weeks of gestation) or with birthweights of 2,500 grams or more (11–13). The percent of infants born at low birthweight ranged from 5.3 percent for births to Chinese mothers to 13.0 percent for births to black mothers (tables 4 and 5). The percent of preterm births (those

born before 37 completed weeks of gestation) ranged from 7.7 percent for births to Chinese mothers to 17.5 percent for births to black mothers.

Infant mortality rates were much higher for low-birthweight infants than for infants with birthweights of 2,500 grams or more for all race and ethnic groups studied. Overall, the infant mortality rate for very-low-birthweight infants (those with birthweights of less than 1,500 grams) was 244.4, more than 100 times the rate for infants with birthweights of 2,500 grams or more (2.4) (table 6).

Similarly, the infant mortality rate for very preterm infants (those born at less than 32 weeks of gestation) was 181.0, more than 72 times the rate for infants born at term (2.5) (37–41 weeks of gestation) (tables 1 and 2).

Eighty-six percent of infants with birthweights of less than 500 grams died within the first year of life—81 percent within the first few days of life. An infant's chances of survival increase rapidly with increasing birthweight. At birthweights of 1,250–1,499 grams, about 95 out of 100 infants survive the first year of life. Infant mortality rates are lowest at birthweights of 3,500–4,999 grams.

From 1995 to 2001, infants weighing 3,000 to 3,499 grams had the largest decline, 21 percent, in the infant mortality rate by specified birthweight (from 2.9 to 2.3). The only nonsignificant changes were for infants weighing 4,500–4,999 and 5,000 grams or more. For infants of white mothers, the largest decline was for infants weighing 3,000 to 3,499 grams (22 percent). The largest decline by specified birthweight for infants of black mothers was for those weighing 4,000 to 4,499 grams (37 percent).

## Prenatal care

The level and timing of prenatal care is often used as a proxy for access to care. Prenatal care includes patient education and early recognition of symptoms and risk factors that may require monitoring or intervention. Therefore, increasing early access to prenatal care has frequently been the focus of efforts to reduce infant mortality, especially among women with medical and demographic risk factors for adverse outcomes (14–18).

In 2001 infants of mothers who began prenatal care after the first trimester of pregnancy or not at all had an infant mortality rate of 8.5 per 1,000, which was 37 percent higher than the rate for those whose care began in the first trimester (6.2). Infant mortality rates for each race and Hispanic origin group were higher for mothers who began prenatal care after the first trimester or received no care than for those who received early care (tables 1 and 2). These differences were significant for all but infants of Mexican and Puerto Rican mothers. Because of the small number of total infant deaths for Cuban mothers, the only rate that could be calculated was for first trimester.

Overall, the rate for women who began care in the third trimester (6.0) was lower than that for women who began care in the second trimester (6.9). This is because women who began prenatal care in the third trimester had to have a gestation period of at least 7 months, thus reducing the probability that the infant would be born preterm or of low birthweight (19). The relationship between month of initiation of prenatal care and length of gestation is complex. Therefore, to be able to compare women who receive the timeliest care with all other women, the category “after first trimester or no care” is reported (table 1 and table 2).

A recent report suggests that especially in the presence of certain pregnancy complications (e.g., post-term pregnancy and pregnancy-

induced hypertension), infants of both black and white women who do not obtain prenatal care are at increased risk of postneonatal death (20).

### Maternal age

Infant mortality rates vary by maternal age; they are highest for infants of teenage mothers (10.0) and mothers aged 40 years and over (8.4). Infants of mothers in their late twenties and early thirties have the lowest rates (tables 1 and 2).

In 2001, among teenagers, infants of the youngest teenagers (under 15 years) had the highest rate (16.1). For infants of mothers aged 15–17 years the rate was 10.7; the rate for infants of mothers aged 18–19 years was 9.5 (tabular data not shown). The differences in rates among these three teenage groups were significant.

Generally, infant mortality rates were higher for infants of teenage mothers than for mothers aged 40 years and over. However, among groups for which rates could be reliably computed, for Central and South American mothers rates were higher for infants of the oldest mothers than for teenagers.

Studies suggest that the higher mortality risk for infants of younger mothers may be related to socioeconomic factors; maternal age under 16 might be a marker for poverty (21–23). Among older mothers, especially those of low socioeconomic status, infant mortality rates may be affected by pregnancy complications related to higher maternal age (e.g., gestational diabetes mellitus and hypertensive disorders) (24).

### Maternal education

Infant mortality rates generally decreased with increasing educational level (tables 1 and 2). This pattern may reflect the effects of more education as well as socioeconomic differences; women with more education tend to have higher income levels (25). In addition, most mothers with 0–8 years of education were born outside of the 50 States and the District of Columbia (26).

### Live-birth order

Infant mortality rates were generally higher for first births than for second births, and then increased as birth order increased (tables 1 and 2). Overall, the infant mortality rate for first births (6.8) was 15 percent higher than for second births (5.9). The rate for fifth and higher order births (10.7) was 81 percent higher than the rate for second births. The higher parities and therefore the highest order births (fifth child and above) are more likely to be associated with older maternal age and lower socioeconomic status (27).

In a recent report, live birth order of fourth child and above, which is likely to be associated with household crowding, was associated with an increased risk of bronchiolitis-related infant mortality (28).

### Marital status

Marital status is considered an indicator of the presence or absence of environmental and economic support (29,30). Such support may have a positive effect on fetal growth through fostering healthy maternal behaviors (31). Infants of mothers who are not married have been shown to be at higher risk for poor outcomes (32–34). The infant mortality rate for infants of unmarried mothers was 9.7 per 1,000 in 2001, 80 percent higher than the rate for infants

of married mothers (5.4) (tables 1 and 2). Infants of unmarried mothers had higher rates of mortality in each race and Hispanic origin group (with the exception of infants of Cuban mothers).

### Nativity

In 2001 the infant mortality rate for mothers born in the 50 States and the District of Columbia (7.2) was 41 percent higher than the rate for mothers born outside of the 50 States and the District of Columbia (5.1). All race and Hispanic origin groups had higher infant mortality rates for mothers born in the 50 States and the District of Columbia (tables 1 and 2).

A variety of different hypotheses have been advanced to account for the lower infant mortality rate among infants of mothers born outside the 50 States and the District of Columbia, including possible differences in the level of familial integration and social support for new mothers (35–37). Also, women born outside the 50 States and the District of Columbia have been shown to have different characteristics than their U.S.-born counterparts with regard to socioeconomic and educational status, and risk behaviors such as smoking and alcohol use (37,38).

### Maternal smoking

Tobacco use during pregnancy causes the passage of substances such as nicotine, hydrogen cyanide, and carbon monoxide from the placenta into the fetal blood supply. These substances restrict the growing infant's access to oxygen and can lead to adverse pregnancy and birth outcomes such as low birthweight, preterm delivery, intrauterine growth retardation, and infant mortality (39–42).

The infant mortality rate for infants of smokers was 10.5 in 2001, 62 percent higher than the rate of 6.5 for nonsmokers. For each race and Hispanic-origin group for which these rates could be computed, the infant mortality rate for smokers was higher than for nonsmokers (tables 1 and 2). Infant mortality rates for API, Mexican, and American Indian mothers who smoked during pregnancy were much higher than the rates for nonsmokers (117, 104, and 91 percent higher, respectively).

### Leading causes of infant death

Infant mortality rates for the five leading causes of infant death are presented in table 7 by race and Hispanic origin of mother. The leading cause of infant death in the United States in 2001 was Congenital malformations, deformations and chromosomal abnormalities (congenital malformations), accounting for 20 percent of all infant deaths. Disorders relating to short gestation and low birthweight, not elsewhere classified (low birthweight) was second, accounting for 16 percent of all infant deaths, followed by Sudden infant death syndrome (SIDS), accounting for 8 percent of infant deaths. The fourth and fifth leading causes—Newborn affected by maternal complications of pregnancy (maternal complications), and Respiratory distress of newborn, accounted for 5 and 4 percent, respectively, of all infant deaths in 2001. Together the five leading causes accounted for 53 percent of all infant deaths in the United States in 2001.

The first four leading causes of death were the same in 2001 as in the previous year. However, Respiratory distress of newborn (respiratory distress), long a member of the five leading causes, had dropped to sixth in 2000, replaced by Newborn affected by

complications of placenta, cord and membranes (cord complications). Mortality from respiratory distress declined rapidly during the 1990s. However, between 2000 and 2001, respiratory distress rates did not decline, and in fact increased by 2 percent, although the change was not statistically significant. Due to this lack of decline from 2000 to 2001, respiratory distress returned as the fifth leading cause in 2001 (cord complications was fifth in 2000).

The rank order of leading causes of infant death varied substantially by race and Hispanic origin of mother. Congenital malformations was the leading cause of infant death for all groups except for black and Puerto Rican mothers, for whom low birthweight was the leading cause.

The largest decline in cause-specific infant mortality rates from 2000 to 2001 was for SIDS, which declined by 11 percent, continuing its rapid decline during the 1990s. When examined by race and ethnicity, SIDS declined by 12 percent for white mothers, by 21 percent for the total Hispanic population, and by 27 percent for Mexican mothers. The 7 percent decline in SIDS for black mothers was not statistically significant, nor were declines for other race and ethnic groups. In contrast, the infant mortality rate from maternal complications increased by 9 percent from 2000 to 2001, after being relatively stable since the early 1990s. When examined by race and ethnicity, the increase from 2000 to 2001 was 6 percent for black mothers, and 15 percent for non-Hispanic white mothers. Other changes in cause-specific infant mortality rates by race and ethnicity from 2000 to 2001 were not statistically significant.

In 2001, 97 to 98 percent of infant deaths from maternal complications and respiratory distress occurred to infants born at low birthweight. Thus, the recent increases in the percent of infants born at low birthweight may help to explain the recent increase in mortality from maternal complications, and the lack of decline in mortality from respiratory distress.

When differences between cause-specific infant mortality rates by race and ethnicity were examined, infant mortality rates for congenital malformations were 21 percent higher for black than for white mothers. Rates were 12 percent higher for Mexican mothers and 19 percent higher for Central and South American mothers than for non-Hispanic white mothers. Differences in infant mortality rates for congenital malformations between American Indian and white mothers were not statistically significant. Infant mortality rates from congenital malformations were 14 percent lower for API than for white mothers.

Infants of black mothers had the highest infant mortality rates from low birthweight; the rate for black mothers was 3.8 times the rate for white mothers. The rate for Puerto Rican mothers was more than twice the rate for non-Hispanic white mothers, while rates for Mexican mothers were 11 percent lower than those for non-Hispanic white mothers.

SIDS rates were highest for American Indian mothers—3.2 times those for white mothers. Rates for black mothers were also high—2.5 times those for white mothers. As most SIDS deaths occur during the postneonatal period, the high SIDS rates for infants of black and American Indian mothers account for much of their elevated risk of postneonatal mortality. SIDS rates for API mothers were less than half those for white mothers. For Mexican mothers, the SIDS rate was less than half that for non-Hispanic white mothers, and for Puerto Rican mothers, the SIDS rate was 46 percent higher than the rate for non-Hispanic white mothers.

For maternal complications and respiratory distress, infants of black mothers had the highest mortality rates—2.9 times those for white mothers. Infants of Puerto Rican mothers had respiratory distress mortality rates 2.3 times those for non-Hispanic white mothers. For maternal complications, infant mortality rates for Puerto Rican mothers were one-third higher than for non-Hispanic white mothers, although this difference was not statistically significant. The higher percent of black and Puerto Rican infants born at low birthweight may help to explain their higher infant mortality rates from these causes, which occur predominantly among low-birthweight infants. In contrast, the infant mortality rate from maternal complications was 35 percent lower for API than for white women. Infant mortality rates from maternal complications were 37 and 43 percent lower, respectively, for Mexican and Central and South American women than for non-Hispanic white women.

An examination of cause-specific differences in infant mortality rates between race and Hispanic-origin groups can help the researcher to understand overall differences in infant mortality rates between these groups. For example, 28 percent of the elevated infant mortality rate for black mothers, when compared with white mothers, can be accounted for by their higher infant mortality rate from low birthweight, 9 percent by differences in SIDS, and 7 percent by differences in maternal complications. In other words, if black infant mortality rates for these three causes could be reduced to levels for white infants, the difference in the infant mortality rate between black and white mothers would be reduced by 44 percent.

For American Indian mothers, 25 percent of their elevated infant mortality rate, when compared with white mothers, can be accounted for by their higher SIDS rates. Thus, if American Indian SIDS rates could be reduced to levels for white infants, the difference in the infant mortality rate between American Indian and white mothers would be reduced by 25 percent.

Similarly, 33 percent of the difference between Puerto Rican and non-Hispanic white infant mortality rates can be accounted for by differences in infant mortality rates for low birthweight, 9 percent by differences in respiratory distress, and 8 percent by SIDS. If Puerto Rican infant mortality rates for these three causes could be reduced to levels of non-Hispanic white infants, the difference in the infant mortality rate between Puerto Rican and non-Hispanic white infants would be cut in half. In addition to helping to explain differences in infant mortality rates between various groups, comparisons such as these can be helpful in targeting prevention efforts.

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**Table 1. Infant mortality rates, live births, and infant deaths by selected characteristics and specified race of mother: United States, 2001 linked file**

Characteristics	All races	Race of mother			
		White	Black	American Indian <sup>1</sup>	Asian/ Pacific Islander
Infant mortality rates per 1,000 live births in specified group					
Total .....	6.8	5.7	13.3	9.7	4.7
Age at death:					
Total neonatal .....	4.5	3.8	8.9	4.2	3.1
Early neonatal (< 7 days) .....	3.6	3.0	7.3	3.1	2.5
Late neonatal (7-27 days) .....	0.9	0.8	1.6	1.1	0.6
Postneonatal .....	2.3	1.9	4.4	5.4	1.6
Sex:					
Male .....	7.5	6.2	14.8	10.5	5.2
Female .....	6.1	5.1	11.9	8.8	4.2
Plurality:					
Single births .....	6.0	5.0	11.8	9.3	4.2
Plural births .....	32.4	28.0	55.1	25.3	27.4
Birthweight:					
Less than 2,500 grams .....	58.6	53.5	75.7	61.5	41.3
Less than 1,500 grams .....	244.4	232.9	270.1	225.9	223.0
1,500-2,499 grams .....	15.2	15.2	15.0	27.0	12.2
2,500 grams or more .....	2.4	2.2	3.8	5.4	1.7
Period of gestation:					
Less than 32 weeks .....	181.0	170.5	206.4	137.3	162.1
32-36 weeks .....	8.9	8.5	9.9	16.9	7.9
37-41 weeks .....	2.5	2.3	4.0	5.6	1.8
42 weeks or more .....	3.0	2.6	5.1	*	2.2
Trimester of pregnancy prenatal care began:					
First trimester .....	6.2	5.2	12.4	8.1	4.3
After first trimester or no care .....	8.5	6.9	13.7	12.4	5.6
Second trimester .....	6.9	5.9	10.4	9.7	4.8
Third trimester .....	6.0	5.1	8.1	14.0	5.7
No prenatal care .....	34.8	26.2	52.3	39.2	24.8
Age of mother:					
Under 20 years .....	10.0	8.6	14.2	9.8	8.3
20-24 years .....	7.6	6.2	12.9	11.5	5.7
25-29 years .....	6.1	5.1	13.0	7.1	4.1
30-34 years .....	5.4	4.5	13.2	8.5	4.2
35-39 years .....	6.5	5.7	14.0	11.3	4.5
40-54 years .....	8.4	7.5	14.7	*	8.1
Educational attainment of mother:					
0-8 years .....	6.7	6.2	14.1	11.4	5.9
9-11 years .....	9.2	7.7	14.2	12.1	6.1
12 years .....	7.4	6.1	12.9	9.4	6.0
13-15 years .....	6.1	5.0	12.2	7.6	4.4
16 years and over .....	4.3	3.8	10.7	*	3.4
Live-birth order:					
1 .....	6.8	5.8	13.5	8.4	4.4
2 .....	5.9	5.0	11.6	9.7	4.1
3 .....	6.8	5.6	13.1	10.7	5.5
4 .....	8.1	6.7	13.7	9.6	7.5
5 or more .....	10.7	8.2	18.3	12.4	7.4
Marital status:					
Married .....	5.4	4.9	11.6	7.4	4.2
Unmarried .....	9.7	7.7	14.2	11.2	7.9
Mother's place of birth:					
Born in the 50 States and D.C. ....	7.2	5.8	13.6	9.8	5.7
Born elsewhere .....	5.1	4.8	9.2	*	4.4
Maternal smoking during pregnancy: <sup>2</sup>					
Smoker .....	10.5	9.2	19.3	15.7	10.2
Nonsmoker .....	6.5	5.2	12.7	8.2	4.6

See footnotes at end of table.

**Table 1. Infant mortality rates, live births, and infant deaths by selected characteristics and specified race of mother: United States, 2001 linked file--Con.**

Characteristics	All races	Race of mother				
		White	Black	American Indian <sup>1</sup>	Asian/ Pacific Islander	
			Live births			
Total .....	4,026,036	3,177,698	606,183	41,872	200,283	
Sex: .....						
Male .....	2,057,977	1,625,548	307,851	21,183	103,395	
Female .....	1,968,059	1,552,150	298,332	20,689	96,888	
Plurality: .....						
Single births .....	3,897,299	3,075,741	585,212	40,906	195,440	
Plural births .....	128,737	101,957	20,971	966	4,843	
Birthweight: .....						
Less than 2,500 grams .....	309,760	212,870	78,760	3,072	15,058	
Less than 1,500 grams .....	58,702	37,367	18,726	534	2,075	
1,500-2,499 grams .....	251,058	175,503	60,034	2,538	12,983	
2,500 grams or more .....	3,714,965	2,963,831	527,185	38,773	185,176	
Not stated .....	1,311	997	238	27	49	
Period of gestation: .....						
Less than 32 weeks .....	77,676	49,923	24,184	879	2,690	
32-36 weeks .....	398,623	295,214	81,158	4,606	17,645	
37-41 weeks .....	3,235,790	2,581,838	456,539	32,419	164,994	
42 weeks or more .....	274,065	218,956	39,785	3,596	11,728	
Not stated .....	39,882	31,767	4,517	372	3,226	
Trimester of pregnancy prenatal care began: .....						
First trimester .....	3,276,935	2,648,785	436,513	28,205	163,432	
After first trimester or no care .....	654,069	460,754	149,666	12,476	31,173	
Second trimester .....	506,673	361,530	111,416	9,147	24,580	
Third trimester .....	105,661	72,660	24,927	2,579	5,495	
No prenatal care .....	41,735	26,564	13,323	750	1,098	
Not stated .....	95,032	68,159	20,004	1,191	5,678	
Age of mother: .....						
Under 20 years .....	453,746	322,669	114,308	8,084	8,685	
20-24 years .....	1,021,643	779,543	199,223	14,071	28,806	
25-29 years .....	1,058,291	850,360	137,406	9,878	60,647	
30-34 years .....	942,718	777,309	94,666	6,190	64,553	
35-39 years .....	451,740	368,830	49,068	2,940	30,902	
40-54 years .....	97,898	78,987	11,512	709	6,690	
Educational attainment of mother: .....						
0-8 years .....	239,642	216,276	14,594	1,759	7,013	
9-11 years .....	621,926	463,177	133,654	10,994	14,101	
12 years .....	1,253,047	951,950	237,433	16,372	47,292	
13-15 years .....	856,773	669,254	137,539	8,665	41,315	
16 years and over .....	998,505	836,603	72,316	3,370	86,216	
Not stated .....	56,143	40,438	10,647	712	4,346	
Live-birth order: .....						
1 .....	1,594,981	1,259,716	226,789	14,639	93,837	
2 .....	1,308,765	1,051,430	178,097	11,619	67,619	
3 .....	675,759	535,780	107,913	7,560	24,506	
4 .....	263,248	200,996	50,246	3,989	8,017	
5 or more .....	169,458	118,998	41,001	3,829	5,630	
Not stated .....	13,825	10,778	2,137	236	674	
Marital status: .....						
Married .....	2,676,745	2,297,823	191,635	16,884	170,403	
Unmarried .....	1,349,291	879,875	414,548	24,988	29,880	
Mother's place of birth: .....						
Born in the 50 States and D.C. ....	3,110,736	2,509,383	528,239	39,556	33,558	
Born elsewhere .....	904,579	661,489	75,107	2,210	165,773	
Not stated .....	10,721	6,826	2,837	106	952	
Maternal smoking during pregnancy: <sup>2</sup> .....						
Smoker .....	416,483	353,641	51,396	7,658	3,788	
Nonsmoker .....	3,056,543	2,375,680	517,618	30,826	132,419	
Not stated .....	25,226	20,123	3,389	462	1,252	

See footnotes at end of table.



**Table 1. Infant mortality rates, live births, and infant deaths by selected characteristics and specified race of mother: United States, 2001 linked file--Con.**

Characteristics	All races	Race of mother			
		White	Black	American Indian <sup>1</sup>	Asian/ Pacific Islander
Infant deaths					
Mother's place of birth:					
Born in the 50 States and D.C. ....	22,259	14,498	7,181	388	192
Born elsewhere .....	4,633	3,191	690	14	738
Not stated .....	631	398	213	2	18
Maternal smoking during pregnancy: <sup>2</sup>					
Smoker .....	4,393	3,242	992	120	38
Nonsmoker .....	19,745	12,318	6,569	251	607
Not stated .....	562	376	160	10	15

\* Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.

<sup>1</sup> Includes Aleuts and Eskimos.

<sup>2</sup> Excludes data for California, which does not report tobacco use on the birth certificate.

NOTE: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Not stated responses were included in totals but not distributed among groups for rate computations.

**Table 2. Infant mortality rates, live births, and infant deaths by selected characteristics and Hispanic origin of mother and by race of mother for mothers of non-Hispanic origin: United States, 2001 linked file**

Characteristics	All origins <sup>1</sup>	Hispanic						Non-Hispanic		
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total <sup>2</sup>	White	Black
Infant mortality rates per 1,000 live births in specified group										
Total .....	6.8	5.4	5.2	8.5	4.2	5.0	6.0	7.1	5.7	13.5
Age at death:										
Total neonatal .....	4.5	3.6	3.5	6.0	2.5	3.4	3.9	4.7	3.8	9.0
Early neonatal (< 7 days) .....	3.6	2.9	2.7	5.0	1.9	2.6	3.2	3.8	3.0	7.4
Late neonatal (7-27 days) .....	0.9	0.8	0.8	1.0	*	0.7	0.7	0.9	0.8	1.6
Postneonatal .....	2.3	1.8	1.7	2.5	1.7	1.6	2.1	2.4	1.9	4.5
Sex:										
Male .....	7.5	6.0	5.7	9.5	4.4	5.5	6.4	7.9	6.3	14.9
Female .....	6.1	4.9	4.7	7.5	4.1	4.5	5.6	6.4	5.1	12.0
Plurality:										
Single births .....	6.0	4.9	4.8	7.4	3.3	4.4	5.4	6.2	4.9	11.9
Plural births .....	32.4	30.1	27.9	47.1	*	28.4	31.6	32.5	27.2	55.3
Birthweight:										
Less than 2,500 grams .....	58.6	54.9	55.1	64.8	41.0	52.1	47.8	58.8	52.2	75.7
Less than 1,500 grams .....	244.4	232.6	234.6	265.3	162.9	214.4	217.2	244.4	229.9	269.7
1,500-2,499 grams .....	15.2	16.5	17.3	14.5	*	15.6	14.9	14.8	14.7	15.1
2,500 grams or more .....	2.4	1.9	1.9	2.7	*	1.7	2.3	2.5	2.3	3.8
Period of gestation:										
Less than 32 weeks .....	181.0	152.4	150.9	194.7	110.4	143.8	130.0	185.7	175.0	206.7
32-36 weeks .....	8.9	8.1	8.0	9.6	*	7.0	8.9	9.0	8.7	9.9
37-41 weeks .....	2.5	2.1	2.1	2.9	*	1.9	2.6	2.6	2.3	4.1
42 weeks or more .....	3.0	2.0	2.0	*	*	*	*	3.2	2.8	5.3
Trimester of pregnancy prenatal care began:										
First trimester .....	6.2	5.1	4.9	7.8	3.3	4.5	5.5	6.4	5.2	12.6
After first trimester or no care .....	8.5	5.7	5.3	9.7	*	5.7	5.8	9.7	7.8	13.9
Second trimester .....	6.9	4.6	4.3	8.0	*	4.5	4.8	7.8	6.7	10.5
Third trimester .....	6.0	4.0	3.7	*	*	5.3	*	7.1	6.1	8.3
No prenatal care .....	34.8	22.4	20.2	47.0	*	25.3	*	40.0	29.4	52.4
Age of mother:										
Under 20 years .....	10.0	6.9	6.3	12.0	*	6.8	8.3	11.2	9.6	14.3
20-24 years .....	7.6	5.1	4.9	7.6	*	4.3	5.7	8.3	6.7	13.0
25-29 years .....	6.1	4.9	4.8	7.8	*	4.3	4.7	6.3	5.1	13.2
30-34 years .....	5.4	4.7	4.6	7.2	*	4.4	4.1	5.5	4.4	13.4
35-39 years .....	6.5	6.4	6.2	8.1	9.0	5.7	8.2	6.5	5.5	14.0
40-54 years .....	8.4	9.8	8.4	*	*	12.3	*	8.0	6.8	14.9
Educational attainment of mother:										
0-8 years .....	6.7	5.2	5.0	9.3	*	5.8	7.7	11.1	10.7	14.8
9-11 years .....	9.2	5.8	5.5	9.9	*	4.9	6.1	11.1	9.6	14.3
12 years .....	7.4	5.2	4.8	9.2	*	5.0	5.7	8.0	6.4	13.1
13-15 years .....	6.1	5.0	4.9	6.5	*	4.7	4.4	6.3	5.0	12.3
16 years and over .....	4.3	3.9	4.3	5.1	*	3.4	*	4.3	3.8	10.8
Live-birth order:										
1 .....	6.8	5.7	5.4	9.3	3.7	5.0	6.6	7.0	5.7	13.7
2 .....	5.9	4.8	4.7	7.4	3.9	4.3	4.8	6.2	5.1	11.8
3 .....	6.8	4.9	4.7	6.9	*	4.7	5.6	7.4	5.8	13.2
4 .....	8.1	6.0	5.5	9.1	*	7.2	6.5	8.8	7.0	13.8
5 or more .....	10.7	7.3	6.7	13.8	*	7.0	*	11.9	8.8	18.3
Marital status:										
Married .....	5.4	4.8	4.8	6.9	3.4	4.4	4.7	5.4	4.9	11.7
Unmarried .....	9.7	6.2	5.8	9.7	6.6	5.7	7.7	10.9	8.5	14.3
Mother's place of birth:										
Born in the 50 States and D.C. ....	7.2	6.2	5.9	8.8	4.7	5.3	5.6	7.2	5.7	13.6
Born elsewhere .....	5.1	4.9	4.7	7.8	3.8	4.9	4.7	5.4	4.4	9.6
Maternal smoking during pregnancy: <sup>3</sup>										
Smoker .....	10.5	10.0	10.4	10.1	*	*	8.0	10.5	9.1	19.5
Nonsmoker .....	6.5	5.4	5.1	8.1	3.7	4.9	6.0	6.7	5.1	12.8

See footnotes at end of table.

**Table 2. Infant mortality rates, live births, and infant deaths by selected characteristics and Hispanic origin of mother and by race of mother for mothers of non-Hispanic origin: United States, 2001 linked file--Con.**

Characteristics	All origins <sup>1</sup>	Hispanic						Non-Hispanic			Not stated	
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total <sup>2</sup>	White	Black		
Live births												
Total .....	4,026,036	851,867	611,013	57,568	14,017	121,366	47,903	3,149,626	2,326,606	589,940	24,543	
Sex:												
Male .....	2,057,977	433,874	311,015	29,509	7,119	61,788	24,443	1,611,626	1,192,106	299,582	12,477	
Female .....	1,968,059	417,993	299,998	28,059	6,898	59,578	23,460	1,538,000	1,134,500	290,358	12,066	
Plurality:												
Single births .....	3,897,299	833,897	598,926	55,956	13,610	118,624	46,781	3,039,739	2,242,824	569,431	23,663	
Plural births .....	128,737	17,970	12,087	1,612	407	2,742	1,122	109,887	83,782	20,509	880	
Birthweight:												
Less than 2,500 grams .....	309,760	55,253	37,239	5,392	911	7,888	3,823	252,487	157,715	77,325	2,020	
Less than 1,500 grams .....	58,702	9,815	6,480	1,082	180	1,451	622	48,405	27,508	18,407	482	
1,500-2,499 grams .....	251,058	45,438	30,759	4,310	731	6,437	3,201	204,082	130,207	58,918	1,538	
2,500 grams or more .....	3,714,965	796,501	573,702	52,163	13,103	113,458	44,075	2,896,177	2,168,207	512,404	22,287	
Not stated .....	1,311	113	72	13	3	20	5	962	684	211	236	
Period of gestation:												
Less than 32 weeks .....	77,676	14,092	9,477	1,454	229	2,043	889	63,012	35,887	23,733	572	
32-36 weeks .....	398,623	81,291	57,302	6,392	1,254	11,373	4,970	315,099	214,273	79,518	2,233	
37-41 weeks .....	3,235,790	674,020	481,929	45,277	11,630	97,380	37,804	2,543,057	1,908,845	443,809	18,713	
42 weeks or more .....	274,065	63,839	46,381	4,196	845	8,789	3,628	208,643	155,422	38,585	1,583	
Not stated .....	39,882	18,625	15,924	249	59	1,781	612	19,815	12,179	4,295	1,442	
Trimester of pregnancy prenatal care began:												
First trimester .....	3,276,935	625,821	442,515	43,796	12,736	91,079	35,695	2,632,911	2,022,753	425,092	18,203	
After first trimester or no care .....	654,069	200,672	150,857	11,552	1,141	26,627	10,495	449,547	262,177	145,844	3,850	
Second trimester .....	506,673	152,170	114,292	9,031	956	19,897	7,994	351,758	210,948	108,640	2,745	
Third trimester .....	105,661	35,400	26,275	1,874	121	5,367	1,763	69,576	37,807	24,120	685	
No prenatal care .....	41,735	13,102	10,290	647	64	1,363	738	28,213	13,422	13,084	420	
Not stated .....	95,032	25,374	17,641	2,220	140	3,660	1,713	67,168	41,676	19,004	2,490	
Age of mother:												
Under 20 years .....	453,746	132,566	100,729	11,056	1,049	11,437	8,295	318,644	191,745	111,662	2,536	
20-24 years .....	1,021,643	258,437	192,173	18,669	2,408	30,715	14,472	757,697	523,030	194,393	5,509	
25-29 years .....	1,058,291	227,913	165,179	13,426	4,047	33,622	11,639	824,199	622,367	133,496	6,179	
30-34 years .....	942,718	150,353	101,213	9,275	3,821	27,488	8,556	786,211	625,444	91,714	6,154	
35-39 years .....	451,740	67,954	42,709	4,254	2,253	14,641	4,097	380,520	300,013	47,497	3,266	
40-54 years .....	97,898	14,644	9,010	888	439	3,463	844	82,355	64,007	11,178	899	
Educational attainment of mother:												
0-8 years .....	239,642	179,475	150,309	2,503	165	22,813	3,685	59,536	37,910	13,569	631	
9-11 years .....	621,926	227,531	179,242	15,853	1,488	20,536	10,412	391,848	238,213	130,181	2,547	
12 years .....	1,253,047	250,709	172,024	19,667	4,824	37,342	16,852	996,337	704,412	231,410	6,001	
13-15 years .....	856,773	111,090	65,545	12,484	3,184	20,541	9,336	741,646	559,162	134,234	4,037	
16 years and over .....	998,505	65,828	31,563	6,275	4,290	17,563	6,137	927,595	768,511	70,656	5,082	
Not stated .....	56,143	17,234	12,330	786	66	2,571	1,481	32,664	18,398	9,890	6,245	
Live-birth order:												
1 .....	1,594,981	312,537	216,645	22,391	6,269	48,308	18,924	1,272,922	947,995	220,107	9,522	
2 .....	1,308,765	260,317	183,758	17,916	5,123	38,628	14,892	1,041,236	791,306	173,279	7,212	
3 .....	675,759	160,292	118,715	10,026	1,867	21,202	8,482	511,560	375,813	105,187	3,907	
4 .....	263,248	69,905	53,633	4,184	498	8,163	3,427	191,752	131,311	49,107	1,591	
5 or more .....	169,458	45,018	35,104	2,921	252	4,764	1,977	123,259	74,060	40,285	1,181	
Not stated .....	13,825	3,798	3,158	130	8	301	201	8,897	6,121	1,975	1,130	
Marital status:												
Married .....	2,676,745	490,173	361,936	23,657	10,204	67,640	26,736	2,170,013	1,802,225	185,424	16,559	
Unmarried .....	1,349,291	361,694	249,077	33,911	3,813	53,726	21,167	979,613	524,381	404,516	7,984	
Mother's place of birth:												
Born in the 50 States and D.C. ....	3,110,736	312,787	220,759	37,214	6,304	13,528	34,982	2,778,264	2,190,423	520,946	19,685	
Born elsewhere .....	904,579	537,302	389,345	20,172	7,702	107,678	12,405	363,385	131,735	66,414	3,892	
Not stated .....	10,721	1,778	909	182	11	160	516	7,977	4,448	2,580	966	
Maternal smoking during pregnancy: <sup>3</sup>												
Smoker .....	416,483	18,900	8,975	5,382	391	1,240	2,912	394,667	333,374	50,603	2,916	
Nonsmoker .....	3,056,543	568,227	370,664	49,901	12,833	94,603	40,226	2,471,539	1,810,875	503,584	16,777	
Not stated .....	25,226	3,660	2,718	234	24	388	296	20,091	15,329	3,199	1,475	

See footnotes at end of table.

**Table 2. Infant mortality rates, live births, and infant deaths by selected characteristics and Hispanic origin of mother and by race of mother for mothers of non-Hispanic origin: United States, 2001 linked file--Con.**

Characteristics	All origins <sup>1</sup>	Hispanic						Non-Hispanic			Not stated
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total <sup>2</sup>	White	Black	
Infant deaths											
Total .....	27,523	4,630	3,187	491	60	604	289	22,512	13,300	7,938	380
Age at death:											
Total neonatal .....	18,275	3,105	2,130	345	35	408	187	14,864	8,817	5,293	306
Early neonatal (< 7 days) .....	14,622	2,439	1,653	287	26	317	155	11,903	6,979	4,337	280
Late neonatal (7-27 days) .....	3,653	666	477	57	9	91	32	2,961	1,839	956	26
Postneonatal .....	9,248	1,526	1,057	147	24	196	102	7,648	4,483	2,645	74
Sex:											
Male .....	15,434	2,590	1,785	280	31	338	156	12,659	7,478	4,464	185
Female .....	12,089	2,040	1,402	212	28	266	132	9,853	5,823	3,474	196
Plurality:											
Single births .....	23,358	4,089	2,850	415	45	526	253	18,946	11,018	6,804	322
Plural births .....	4,165	541	338	76	14	78	36	3,566	2,282	1,134	58
Birthweight:											
Less than 2,500 grams .....	18,151	3,034	2,053	350	37	411	183	14,853	8,238	5,855	264
Less than 1,500 grams .....	14,345	2,283	1,520	287	29	311	135	11,830	6,323	4,965	232
1,500-2,499 grams .....	3,806	751	533	62	8	100	48	3,023	1,915	890	31
2,500 grams or more .....	8,989	1,551	1,102	139	19	188	103	7,372	4,906	1,971	67
Not stated .....	383	46	33	3	3	4	3	288	156	111	50
Period of gestation:											
Less than 32 weeks .....	14,060	2,148	1,430	283	25	294	116	11,704	6,279	4,907	208
32-36 weeks .....	3,538	656	461	61	9	80	44	2,844	1,854	787	38
37-41 weeks .....	8,221	1,447	1,013	130	18	189	97	6,725	4,458	1,807	49
42 weeks or more .....	809	126	92	8	-	17	9	678	436	203	5
Not stated .....	894	254	192	9	7	23	23	561	273	234	79
Trimester of pregnancy prenatal care:											
First trimester .....	20,177	3,178	2,186	344	42	410	195	16,830	10,599	5,340	168
After first trimester or no care .....	5,581	1,135	801	112	9	152	60	4,372	2,036	2,027	74
Second trimester .....	3,492	700	497	73	3	89	38	2,751	1,412	1,142	42
Third trimester .....	638	142	96	9	1	28	7	492	231	199	4
No prenatal care .....	1,450	293	208	30	5	34	15	1,129	394	686	28
Not stated .....	1,766	318	200	35	8	41	33	1,310	665	571	138
Age of mother:											
Under 20 years .....	4,547	921	637	132	5	78	69	3,569	1,836	1,601	57
20-24 years .....	7,729	1,318	951	142	8	133	83	6,318	3,497	2,522	94
25-29 years .....	6,411	1,108	791	105	12	145	55	5,210	3,143	1,758	92
30-34 years .....	5,065	705	469	66	12	122	35	4,287	2,752	1,225	73
35-39 years .....	2,945	434	263	34	20	83	33	2,469	1,637	666	42
40-54 years .....	825	144	75	11	2	43	13	659	434	167	22
Educational attainment of mother:											
0-8 years .....	1,609	936	752	23	1	132	28	661	407	200	12
9-11 years .....	5,698	1,319	988	157	9	102	64	4,348	2,279	1,864	31
12 years .....	9,321	1,307	826	181	17	186	96	7,953	4,507	3,035	62
13-15 years .....	5,261	556	319	82	17	97	41	4,676	2,790	1,649	29
16 years and over .....	4,245	257	134	32	12	59	19	3,966	2,891	765	22
Not stated .....	1,387	255	169	15	3	29	40	909	427	425	223
Live-birth order:											
1 .....	10,864	1,778	1,181	209	23	241	125	8,945	5,424	3,015	141
2 .....	7,758	1,256	866	133	20	165	72	6,420	4,008	2,039	82
3 .....	4,615	786	564	69	5	100	48	3,788	2,195	1,389	42
4 .....	2,131	420	293	38	7	59	22	1,690	920	676	21
5 or more .....	1,817	329	235	40	2	33	19	1,472	651	738	15
Not stated .....	338	61	49	1	2	6	3	198	102	81	79
Marital status:											
Married .....	14,392	2,373	1,753	163	34	297	126	11,806	8,833	2,166	213
Unmarried .....	13,131	2,257	1,434	328	25	306	163	10,707	4,468	5,771	167

See footnotes at end of table.

**Table 2. Infant mortality rates, live births, and infant deaths by selected characteristics and Hispanic origin of mother and by race of mother for mothers of non-Hispanic origin: United States, 2001 linked file--Con.**

Characteristics	All origins <sup>1</sup>	Hispanic						Non-Hispanic			Not stated
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total <sup>2</sup>	White	Black	
Infant deaths											
Mother's place of birth:											
Born in the 50 States and D.C. ....	22,259	1,934	1,308	329	29	72	196	20,106	12,474	7,109	219
Born elsewhere .....	4,633	2,620	1,849	157	29	527	58	1,960	586	639	53
Not stated .....	631	77	31	6	1	5	34	446	240	191	108
Maternal smoking during pregnancy: <sup>3</sup>											
Smoker .....	4,393	189	93	54	7	11	23	4,157	3,021	986	47
Nonsmoker .....	19,745	3,052	1,893	405	47	466	241	16,520	9,262	6,455	173
Not stated .....	562	74	54	10	-	2	8	392	223	145	96

\* Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.

- Quantity zero.

<sup>1</sup> Includes origin not stated.

<sup>2</sup> Includes races other than black or white.

<sup>3</sup> Excludes data for California, which does not report tobacco use on the birth certificate.

NOTE: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Not stated responses were included in totals but not distributed among groups for rate computations.

**Table 3. Infant mortality rates by race and Hispanic origin of mother: United States and each State, Puerto Rico, Virgin Islands, and Guam, 1999-2001 linked files**

[By place of residence]

State	Total	Race and Hispanic origin of mother						
		Race				Hispanic origin		
		White	Black	American Indian <sup>1</sup>	Asian/Pacific Islander	Hispanic	Non-Hispanic White	Non-Hispanic Black
Infant mortality rates per 1,000 live births in specified group								
United States <sup>2</sup> .....	6.9	5.7	13.6	9.1	4.8	5.6	5.7	13.7
Alabama .....	9.5	6.8	15.3	*	*	7.0	6.8	15.2
Alaska .....	7.0	5.6	*	11.9	*	*	5.3	*
Arizona .....	6.8	6.3	16.6	9.3	5.2	6.3	6.3	16.5
Arkansas .....	8.2	7.2	12.3	*	*	4.2	7.5	12.2
California .....	5.4	5.0	11.5	7.9	4.5	5.1	4.7	11.6
Colorado .....	6.2	5.8	12.7	*	6.2	6.1	5.7	12.7
Connecticut .....	6.2	5.3	13.1	*	*	7.5	4.7	13.3
Delaware .....	9.2	7.0	16.1	*	*	8.2	6.8	16.3
District of Columbia .....	13.0	5.3	16.9	*	*	8.5	*	16.9
Florida .....	7.1	5.5	12.7	*	4.9	5.0	5.6	12.8
Georgia .....	8.4	5.9	13.4	*	6.2	5.1	6.0	13.5
Hawaii .....	7.1	6.8	*	*	7.2	6.6	6.4	*
Idaho .....	6.9	6.8	*	*	*	8.1	6.6	*
Illinois .....	8.2	6.3	16.4	*	6.7	6.9	6.1	16.4
Indiana .....	7.8	7.0	14.4	*	*	6.8	7.0	14.5
Iowa .....	5.9	5.6	15.8	*	*	6.6	5.5	15.8
Kansas .....	7.1	6.6	14.1	*	*	6.3	6.7	14.1
Kentucky .....	6.8	6.5	10.4	*	*	*	6.5	10.5
Louisiana .....	9.4	6.4	13.7	*	*	5.3	6.5	13.7
Maine .....	5.3	5.3	*	*	*	*	5.3	*
Maryland .....	8.0	5.2	13.6	*	4.8	6.1	5.1	13.6
Massachusetts .....	4.9	4.4	9.9	*	3.8	5.5	4.1	11.1
Michigan .....	8.1	6.2	16.7	*	6.0	6.5	5.9	16.7
Minnesota .....	5.7	5.1	11.7	10.8	7.4	6.8	5.0	11.4
Mississippi .....	10.4	6.9	14.7	*	*	*	6.9	14.6
Missouri .....	7.4	5.9	16.0	*	*	5.7	5.9	16.0
Montana .....	6.6	5.9	*	11.7	*	*	5.9	*
Nebraska .....	6.9	6.3	13.0	17.3	*	7.6	6.1	13.2
Nevada .....	6.2	5.6	11.7	15.8	5.4	5.5	5.2	11.9
New Hampshire .....	5.2	5.1	*	*	*	*	4.5	*
New Jersey .....	6.4	5.0	13.5	*	3.7	6.3	4.4	14.0
New Mexico .....	6.6	6.5	14.6	7.1	*	6.3	6.9	14.7
New York .....	6.2	5.1	10.9	*	3.6	5.8	4.8	11.4
North Carolina .....	8.7	6.6	15.1	11.6	6.9	5.9	6.7	15.1
North Dakota .....	8.0	7.3	*	15.2	*	*	7.0	*
Ohio .....	7.8	6.6	15.1	*	4.2	7.5	6.6	14.9
Oklahoma .....	8.1	7.4	14.3	8.4	*	4.9	7.6	14.3
Oregon .....	5.5	5.5	7.3	9.5	4.0	6.4	5.4	7.5
Pennsylvania .....	7.2	6.0	15.1	*	3.7	9.0	5.7	15.0
Rhode Island .....	6.3	5.5	12.8	*	*	7.9	4.6	13.0
South Carolina .....	9.3	6.2	15.2	*	*	4.4	6.3	15.2
South Dakota .....	7.1	6.2	*	11.7	*	*	6.2	*
Tennessee .....	8.5	6.5	16.0	*	5.8	6.3	6.5	16.0
Texas .....	5.9	5.3	10.9	*	3.9	5.1	5.4	10.9
Utah .....	5.0	5.0	*	*	7.0	5.9	4.8	*
Vermont .....	5.9	5.9	*	*	*	*	5.7	*
Virginia .....	7.2	5.5	13.0	*	4.6	4.9	5.5	13.0
Washington .....	5.3	5.0	10.8	8.9	4.4	4.9	4.9	10.3
West Virginia .....	7.4	7.3	9.9	*	*	*	7.3	10.0
Wisconsin .....	6.8	5.7	16.8	10.1	5.0	6.4	5.7	16.8
Wyoming .....	6.6	6.7	*	*	*	*	6.4	*
Puerto Rico .....	9.7	9.7	10.2	---	---	---	---	---
Virgin Islands .....	9.0	*	9.4	*	*	*	*	8.5
Guam .....	8.2	*	*	*	8.7	*	*	*

\* Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.

--- Data not available.

<sup>1</sup> Includes Aleuts and Eskimos.<sup>2</sup> Excludes data for Puerto Rico, Virgin Islands, and Guam.

**Table 4. Percent of live births with selected maternal and infant characteristics by specified race of mother: United States, 2001 linked file**

Characteristic	All races	White	Black	American Indian <sup>1</sup>	Asian or Pacific Islander					
					Total	Chinese	Japanese	Hawaiian	Filipino	Other
Birthweight:										
Less than 1,500 grams .....	1.5	1.2	3.1	1.3	1.0	0.7	0.7	1.5	1.3	1.1
Less than 2,500 grams .....	7.7	6.7	13.0	7.3	7.5	5.3	7.3	7.9	8.7	7.8
Preterm births <sup>2</sup> .....	11.9	11.0	17.5	13.2	10.3	7.7	8.8	14.2	12.5	10.3
Prenatal care beginning in the first trimester .....	83.4	85.2	74.5	69.3	84.0	87.0	90.1	79.1	85.0	82.7
Births to mothers under 20 years .....	11.3	10.2	18.9	19.3	4.3	1.0	1.7	16.2	5.1	4.6
Fourth and higher order births .....	10.8	10.1	15.1	18.8	6.8	2.2	4.2	15.4	7.5	7.6
Births to unmarried mothers .....	33.5	27.7	68.4	59.7	14.9	8.4	9.2	50.6	20.4	13.7
Mothers completing 12 or more years of school ...	78.3	78.3	75.1	69.0	89.2	88.1	98.2	84.6	94.0	87.8
Mothers born in the 50 States and D.C. ....	77.5	79.1	87.6	94.7	16.8	10.2	40.1	97.6	21.2	11.3
Mother smoked during pregnancy <sup>3</sup> .....	12.0	13.0	9.0	19.9	2.8	0.7	3.8	14.8	3.2	2.3

<sup>1</sup> Includes births to Aleuts and Eskimos.

<sup>2</sup> Born prior to 37 completed weeks of gestation.

<sup>3</sup> Excludes data for California which does not report tobacco use on the birth certificate.

**Table 5. Percent of live births with selected maternal and infant characteristics by Hispanic origin of mother and race of mother for mothers of non-Hispanic origin: United States, 2001 linked file**

Characteristic	All origins <sup>1</sup>	Hispanic						Non-Hispanic		
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total <sup>2</sup>	White	Black
Birthweight:										
Less than 1,500 grams .....	1.5	1.2	1.1	1.9	1.3	1.2	1.3	1.5	1.2	3.1
Less than 2,500 grams .....	7.7	6.5	6.1	9.4	6.5	6.5	8.0	8.0	6.8	13.1
Preterm births <sup>3</sup> .....	11.9	11.4	11.2	13.7	10.6	11.2	12.4	12.1	10.8	17.6
Prenatal care beginning in the first trimester .....	83.4	75.7	74.6	79.1	91.8	77.4	77.3	85.4	88.5	74.5
Births to mothers under 20 years .....	11.3	15.6	16.5	19.2	7.5	9.4	17.3	10.1	8.2	18.9
Fourth and higher order births .....	10.8	13.6	14.6	12.4	5.4	10.7	11.3	10.0	8.9	15.2
Births to unmarried mothers .....	33.5	42.5	40.8	58.9	27.2	44.3	44.2	31.1	22.5	68.6
Mothers completing 12 or more years of school ...	78.3	51.2	45.0	67.7	88.2	63.5	69.6	85.5	88.0	75.2
Mothers born in the 50 States and D.C. ....	77.5	36.8	36.2	64.8	45.0	11.2	73.8	88.4	94.3	88.7
Mother smoked during pregnancy <sup>4</sup> .....	12.0	3.2	2.4	9.7	3.0	1.3	6.8	13.8	15.5	9.1

<sup>1</sup> Includes origin not stated.

<sup>2</sup> Includes races other than black or white.

<sup>3</sup> Born prior to 37 completed weeks of gestation.

<sup>4</sup> Excludes data for California which does not report tobacco use on the birth certificate.

**Table 6. Live births, infant, neonatal, and postneonatal deaths and mortality rates by race of mother and birthweight: United States, 2001 linked file, and percent change in birthweight-specific infant mortality, 1995-2001 linked file**

Race and birthweight	Number in 2001				Mortality rate per 1,000 live births in 2001			Percent change in infant mortality rate 1995-2001
	Live births	Infant deaths	Neonatal deaths	Postneonatal deaths	Infant	Neonatal	Postneonatal	
All races <sup>1</sup>	4,026,036	27,523	18,275	9,248	6.8	4.5	2.3	-10.5
Less than 2,500 grams	309,760	18,151	14,752	3,399	58.6	47.6	11.0	-9.3
Less than 1,500 grams	58,702	14,345	12,548	1,797	244.4	213.8	30.6	-8.9
Less than 500 grams	6,450	5,515	5,406	110	855.0	838.1	17.1	-5.4
500-749 grams	11,081	5,283	4,555	729	476.8	411.1	65.8	-9.7
750-999 grams	11,847	1,826	1,373	454	154.1	115.9	38.3	-15.4
1,000-1,249 grams	13,572	1,001	679	322	73.8	50.0	23.7	-13.7
1,250-1,499 grams	15,752	719	535	183	45.6	34.0	11.6	-16.5
1,500-1,999 grams	60,858	1,658	1,058	600	27.2	17.4	9.9	-18.1
2,000-2,499 grams	190,200	2,148	1,146	1,002	11.3	6.0	5.3	-16.3
2,500 grams or more	3,714,965	8,989	3,164	5,825	2.4	0.9	1.6	-20.0
2,500-2,999 grams	680,813	3,042	1,184	1,858	4.5	1.7	2.7	-16.7
3,000-3,499 grams	1,515,531	3,434	1,167	2,267	2.3	0.8	1.5	-20.7
3,500-3,999 grams	1,139,550	1,902	576	1,326	1.7	0.5	1.2	-15.0
4,000-4,499 grams	322,426	474	160	314	1.5	0.5	1.0	-16.7
4,500-4,999 grams	51,145	102	55	47	2.0	1.1	0.9	-9.1**
5,000 grams or more	5,500	35	22	13	6.4	4.0	*	-23.8**
Not stated	1,311	383	359	24	...	...	...	...
White	3,177,698	18,087	12,078	6,009	5.7	3.8	1.9	-9.5
Less than 2,500 grams	212,870	11,380	9,419	1,961	53.5	44.2	9.2	-10.4
Less than 1,500 grams	37,367	8,705	7,769	936	233.0	207.9	25.0	-10.6
Less than 500 grams	3,724	3,201	3,145	55	859.6	844.5	14.8	-5.7**
500-749 grams	6,376	3,144	2,785	358	493.1	436.8	56.1	-9.7
750-999 grams	7,564	1,175	946	228	155.3	125.1	30.1	-19.5
1,000-1,249 grams	9,006	685	501	183	76.1	55.6	20.3	-16.3
1,250-1,499 grams	10,697	501	390	111	46.8	36.5	10.4	-15.7
1,500-1,999 grams	42,200	1,169	782	386	27.7	18.5	9.1	-16.6
2,000-2,499 grams	133,303	1,506	868	639	11.3	6.5	4.8	-17.5
2,500 grams or more	2,963,831	6,461	2,434	4,027	2.2	0.8	1.4	-18.5
2,500-2,999 grams	487,930	2,106	902	1,204	4.3	1.8	2.5	-18.9
3,000-3,499 grams	1,185,191	2,464	899	1,565	2.1	0.8	1.3	-22.2
3,500-3,999 grams	958,843	1,410	443	968	1.5	0.5	1.0	-16.7
4,000-4,499 grams	282,098	383	137	246	1.4	0.5	0.9	-12.5**
4,500-4,999 grams	45,093	71	37	34	1.6	0.8	0.8	-20.0**
5,000 grams or more	4,676	26	16	10	5.6	*	*	-27.3**
Not stated	997	247	226	21	...	...	...	...
Black	606,183	8,084	5,396	2,688	13.3	8.9	4.4	-8.9
Less than 2,500 grams	78,760	5,960	4,708	1,252	75.7	59.8	15.9	-4.4
Less than 1,500 grams	18,726	5,057	4,282	775	270.1	228.7	41.4	-5.4
Less than 500 grams	2,491	2,111	2,062	49	847.5	827.8	19.7	-5.3**
500-749 grams	4,262	1,933	1,594	339	453.5	374.0	79.5	-9.2
750-999 grams	3,733	561	358	203	150.3	95.9	54.4	-7.8**
1,000-1,249 grams	3,968	271	151	120	68.3	38.1	30.2	-8.3**
1,250-1,499 grams	4,272	181	116	64	42.4	27.2	15.0	-12.8**
1,500-1,999 grams	15,414	398	217	181	25.8	14.1	11.7	-20.4
2,000-2,499 grams	44,620	505	209	296	11.3	4.7	6.6	-16.3
2,500 grams or more	527,185	2,009	574	1,435	3.8	1.1	2.7	-15.6
2,500-2,999 grams	142,307	768	221	547	5.4	1.6	3.8	-12.9
3,000-3,499 grams	231,071	764	210	553	3.3	0.9	2.4	-19.5
3,500-3,999 grams	122,568	375	106	269	3.1	0.9	2.2	-11.4**
4,000-4,499 grams	26,699	73	18	55	2.7	*	2.1	-37.2
4,500-4,999 grams	3,996	21	13	8	5.3	*	*	*
5,000 grams or more	544	7	5	2	*	*	*	*
Not stated	238	115	114	1	...	...	...	...

\* Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.

\*\* Not significant at p&lt;.05.

† Category not applicable.

<sup>1</sup> Includes races other than white or black.

NOTE: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Neonatal is less than 28 days and postneonatal is 28 days to under 1 year.

**Table 7. Infant deaths and mortality rates for the five leading causes of infant death by race and Hispanic origin of mother: United States, 2001 linked file**  
 [Rates per 100,000 live births in specified group]

Cause of death (Based on the Tenth Revision, International Classification of Diseases, 1992)	All races			White <sup>1</sup>			Black			American Indian <sup>2,3</sup>			Asian and Pacific Islander		
	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate
All causes .....	...	27,523	683.6	...	18,087	569.2	...	8,084	1333.6	...	404	964.8	...	947	472.8
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) .....	1	5,538	137.6	1	4,261	134.1	2	982	162.0	1	65	155.2	1	230	114.8
Disorders related to short gestation and low birth weight, not elsewhere classified (P07) .....	2	4,408	109.5	2	2,463	77.5	1	1,779	293.5	4	28	66.9	2	138	68.9
Sudden infant death syndrome (R95) .....	3	2,236	55.5	3	1,449	45.6	3	688	113.5	2	61	145.7	4	37	18.5
Newborn affected by maternal complications of pregnancy (P01) .....	4	1,501	37.3	4	932	29.3	4	517	85.3	6	14	*	*	38	19.0
Respiratory distress of newborn (P22) .....	5	1,019	25.3	7	633	19.9	5	346	57.1	10	9	*	*	31	15.5

Cause of death (Based on the Tenth Revision International Classification of Diseases, 1992)	Total Hispanic			Mexican			Puerto Rican			Central and South American <sup>4</sup>			Non-Hispanic White <sup>5</sup>		
	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate
All causes .....	...	4,630	543.6	...	3,187	521.6	...	491	852.9	...	604	497.7	...	13,300	571.6
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) .....	1	1,246	146.3	1	885	144.8	2	83	144.2	1	187	154.1	1	3,003	129.1
Disorders related to short gestation and low birth weight, not elsewhere classified (P07) .....	2	651	76.4	2	413	67.6	1	97	168.5	2	82	67.6	2	1,760	75.6
Sudden infant death syndrome (R95) .....	3	232	27.1	3	142	23.2	3	44	76.4	7	17	*	3	1,221	52.5
Newborn affected by maternal complications of pregnancy (P01) .....	5	180	21.0	5	122	20.0	5	24	41.7	3	22	18.1	4	734	31.5
Respiratory distress of newborn (P22) .....	4	187	21.8	4	129	21.1	4	25	43.4	4	21	17.3	7	440	18.9

... Category not applicable.  
 1 Figure does not meet standard of reliability or precision; based on fewer than 20 deaths in the numerator.  
 2 For whites; Newborn affected by complications of placenta, cord and membranes was the fifth leading cause of death, with 696 deaths and a rate of 21.9.  
 3 Includes Aleuts and Eskimos.  
 4 For American Indians, Accidents (unintentional injuries) was the third leading cause of death with 37 deaths and a rate of 88.9. Influenza and pneumonia was the fifth leading cause of death; however with only 18 deaths a reliable infant mortality rate could not be computed.  
 5 For Central and South Americans. Infections specific to the perinatal period was the fifth leading cause of death; however with only 19 deaths a reliable infant mortality rate could not be computed.  
 6 For non-Hispanic whites, Newborn affected by complications of placenta, cord and membranes was the fifth leading cause of death with 529 deaths and a rate of 22.7.  
 NOTE: Reliable cause-specific infant mortality rates cannot be computed for Cubans because of the small number of infant deaths (60).

## Technical Notes

### Differences between period and cohort data

From 1983 to 1991, NCHS produced linked files in a birth cohort format (43). Beginning with 1995 data, linked files are produced first using a period format and then subsequently using a birth cohort format (both available on CD ROM). Thus, the 2001 period linked file contains a numerator file that consists of all infant deaths occurring in 2001 that have been linked to their corresponding birth certificates, whether the birth occurred in 2001 or in 2000. In contrast, the 2001 birth cohort linked file will contain a numerator file that consists of all infant deaths to babies born in 2001 whether the death occurred in 2001 or 2002.

For the 2001 file, NCHS accepted birth records that could be linked to infant deaths even if registered after the closure of the 2001 birth file (slightly more than 100 cases). This improved the infant birth/death linkage and made the denominator file distinctly different from the official 2001 birth file.

The release of linked file data in two different formats allows NCHS to meet demands for more timely linked files while still meeting the needs of data users who prefer the birth cohort format. While the birth cohort format has methodological advantages, it creates substantial delays in data availability, since it is necessary to wait until the close of the following data year to include all infant deaths in the birth cohort. Beginning with 1995 data, the period linked file is the basis for all official NCHS linked file statistics.

### Weighting

A record weight is added to the linked file to compensate for the 1.1 percent (in 2001) of infant death records that could not be linked to their corresponding birth certificates. This procedure was initiated in 1995. Records for Puerto Rico, the Virgin Islands, and Guam are not weighted. The percent of records linked varied by registration area (from 95.6 to 100.0 percent with all but four areas—Louisiana, Nevada, New Jersey, and West Virginia at 97 percent or higher) (table I). The number of infant deaths in the linked file for the 50 States and the District of Columbia was weighted to equal the sum of the linked plus unlinked infant deaths by State of residence at birth and age at death (less than 1 day, 1–27 days, and 28 days to under 1 year). The addition of the weight greatly reduced the potential for bias in comparing infant mortality rates by characteristics.

The 2001 linked file started with 27,560 infant death records. Of these 27,560 records, 27,268 were linked; 292 were unlinked because corresponding birth certificates could not be identified. The 27,560 linked and unlinked records contained 37 records of infants whose mother's usual place of residence is outside of the United States. These 37 records were excluded to derive a weighted total of 27,523 infant deaths. Thus, all total calculations for 2001 in this report used a weighted total of 27,523 infant deaths (tables A, B, D, 1, 2, 6, and 7).

### Comparison of infant mortality data between the linked file and the vital statistics mortality file

The overall infant mortality rate from the 2001 period linked file of 6.8 is the same as the 2001 vital statistics mortality file. The number of infant deaths differs slightly; the number in the mortality file

**Table I. Percent of infant death records which were linked to their corresponding birth records: United States and each State, Puerto Rico, Virgin Islands, and Guam, 2001 linked file**

State	Percent linked by State of occurrence of death
United States <sup>1</sup>	98.9
Alabama	100.0
Alaska	98.7
Arizona	98.8
Arkansas	99.3
California	97.9
Colorado	99.0
Connecticut	100.0
Delaware	100.0
District of Columbia	98.9
Florida	99.7
Georgia	100.0
Hawaii	98.1
Idaho	98.9
Illinois	98.0
Indiana	99.0
Iowa	100.0
Kansas	98.0
Kentucky	98.3
Louisiana	95.6
Maine	98.8
Maryland	99.6
Massachusetts	99.8
Michigan	99.9
Minnesota	99.7
Mississippi	100.0
Missouri	99.7
Montana	100.0
Nebraska	100.0
Nevada	96.6
New Hampshire	100.0
New Jersey	96.5
New Mexico	100.0
New York	98.7
North Carolina	99.8
North Dakota	100.0
Ohio	99.9
Oklahoma	97.5
Oregon	100.0
Pennsylvania	99.8
Rhode Island	100.0
South Carolina	100.0
South Dakota	100.0
Tennessee	100.0
Texas	97.4
Utah	100.0
Vermont	100.0
Virginia	99.9
Washington	100.0
West Virginia	94.5
Wisconsin	100.0
Wyoming	100.0
Puerto Rico	99.0
Virgin Islands	100.0
Guam	100.0

<sup>1</sup> Excludes data for Puerto Rico, Virgin Islands, and Guam.

was 27,568 (2). Differences in numbers of infant deaths between the two data sources can be traced to three different causes:

1. geographic coverage differences
2. additional quality control
3. weighting

Differences in geographic coverage are due to the fact that for the vital statistics mortality file, all deaths occurring in the 50 States

and the District of Columbia are included regardless of the place of birth of the infant. In contrast, to be included in the linked file, both the birth and death must occur in the 50 States and the District of Columbia. In addition to the mortality quality control review, the linkage process subjects infant death records to an additional round of quality control (2). Every year, a few records are voided from the file at this stage because they are found to be fetal deaths, deaths at ages over 1 year, or duplicate death certificates. Finally, although every effort has been made to design weights that will accurately reflect the distribution of deaths by characteristics, weighting may contribute to small differences in numbers and rates by specific variables between these two data sets.

### Marital status

National estimates of births to unmarried women are based on two methods of determining marital status. In 2001 marital status was based on a direct question in 48 States and the District of Columbia. In the two States (Michigan and New York) that used inferential procedures to compile birth statistics by marital status, a birth is inferred as nonmarital if either of these factors, listed in priority-of-use order, is present: a paternity acknowledgment was received or the father's name is missing. For more information on the inferential procedures and on the changes in reporting, see "Technical Notes" in "Births: Final Data for 2001" (3).

### Period of gestation and birthweight

The primary measure used to determine the gestational age of the newborn is the interval between the first day of the mother's last normal menstrual period (LMP) and the date of birth. It is subject to error for several reasons, including imperfect maternal recall or misidentification of the LMP because of postconception bleeding, delayed ovulation, or intervening early miscarriage. These data are edited for LMP-based gestational ages that are clearly inconsistent with the infant's plurality and birthweight (see below), but reporting problems for this item persist and many occur more frequently among some subpopulations and among births with shorter gestations (44,45).

The U.S. Standard Certificate of Live Birth contains an item, "clinical estimate of gestation," which is compared with length of gestation computed from the date the LMP began when the latter appears to be inconsistent with birthweight. This is done for normal-weight births of apparently short gestations and very-low-birthweight births reported to be full term. The clinical estimate was also used if the LMP date was not reported. The period of gestation for 4.9 percent of the births in 2001 was based on the clinical estimate of gestation. For 97 percent of these records, the clinical estimate was used because the LMP date was not reported. For the remaining 3 percent, the clinical estimate was used because it was consistent with the reported birthweight, whereas the LMP-based gestation was not. In cases where the reported birthweight was inconsistent with both the LMP-computed gestation and the clinical estimate of gestation, the LMP-computed gestation was used and birthweight was reclassified as "not stated." This was necessary for about 283 births or 0.007 percent of all birth records in 2001 (3).

For the linked file, not stated birthweight was imputed for 1,913 records or 0.05 percent of the birth records in 2001 when birthweight

was not stated but the period of gestation was known. In this case, birthweight was assigned the value from the previous record with the same period of gestation, maternal race, sex, and plurality. If birthweight and period of gestation were both unknown (1,311 records in 2001) the not stated value for birthweight was retained. This imputation was done to improve the accuracy of birthweight-specific infant mortality rates, since the percent of records with not stated birthweight was higher for infant deaths (3.92 percent before imputation) than for live births (0.08 percent before imputation). The imputation reduced the percent of not stated records to 1.42 percent for infant deaths, and 0.04 percent for births. The not stated birthweight cases in the natality/birth file, as distinct from the linked file, are not imputed (3).

### Cause-of-death classification

The mortality statistics presented in this report were compiled in accordance with the World Health Organization (WHO) regulations, which specify that member nations classify and code causes of death in accordance with the current revision of the *International Statistical Classification of Diseases and Related Health Problems*. The ICD provides the basic guidance used in virtually all countries to code and classify causes of death. The ICD not only details disease classification but also provides definitions, tabulation lists, the format of the death certificate, and the rules for coding cause of death. Cause-of-death data presented in this report were coded by procedures outlined in annual issues of the *NCHS Instruction Manual* (46,47).

In this report tabulations of cause-of-death statistics are based solely on the underlying cause of death. The underlying cause is defined by WHO as "the disease or injury which initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" (4). It is selected from the conditions entered by the physician in the cause-of-death section of the death certificate. When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection rules and modifications. Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. This is captured in NCHS multiple cause-of-death statistics (48,49).

### Changes in cause-of-death classification

About every 10 to 20 years, the *International Classification of Diseases* is revised to take into account advances in medical knowledge. Effective with deaths occurring in 1999, the United States began using the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10) (4); during the period 1979-98, causes were coded and classified according to the Ninth Revision (ICD-9) (5).

ICD-10 has many changes from ICD-9, including considerably greater detail, shifts in inclusion terms and titles from one category, section, or chapter to another; regroupings of diseases; new titles and sections; and modifications in coding rules (4). As a result, serious breaks occur in comparability for a number of causes of death. Measures of this discontinuity are essential to the interpretation of mortality trends, and are discussed in detail in other NCHS publications (2,50).

## Tabulation lists and cause-of-death ranking

The cause-of-death rankings for ICD-10 are based on the List of 130 Selected Causes of Infant Death. The tabulation lists and rules for ranking leading causes of death are published in the *NCHS Instruction Manual*, Part 9, "ICD-10 Cause-of-Death Lists for Tabulating Mortality Statistics, Effective 1999" (51). Briefly, category titles that begin with the words "Other" and "All other" are not ranked to determine the leading causes of death. When one of the titles that represents a subtotal is ranked (for example, Influenza and pneumonia (J10–J18)), its component parts are not ranked (in this case, Influenza (J10–J11) and Pneumonia (J12–J18)).

## Computation of rates

Infant mortality rates are the most commonly used index for measuring the risk of dying during the first year of life. For the linked birth/infant death data set 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. Both the mortality file and the linked birth/infant death file use this computation method but due to unique numbers of infant deaths, as explained in the section above on the comparison of these two files, the rates will often differ for specific variables (particularly for race and ethnicity). Infant mortality rates use the number of live births in the denominator to approximate the population at risk of dying before the first birthday. In contrast to the infant mortality rates based on live births, infant death rates, used only in age-specific death rates with the mortality file, use the estimated population of persons under 1 year of age as the denominator. For all variables, not stated responses were shown in tables of frequencies, but were dropped before rates were computed.

As stated previously, infant death records for the 50 States and the District of Columbia in the linked file are weighted so that the infant mortality rates are not underestimated for those areas that did not successfully link all records.

## Random variation in infant mortality rates

The number of infant deaths and live births reported for an area represent complete counts of such events. As such, they are not subject to sampling error, although they are subject to nonsampling error in the registration process. However, when the figures are used for analytic purposes, such as the comparison of rates over time, for different areas, or among different subgroups, 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 (52). As a result, numbers of births, deaths, and infant mortality rates are subject to random variation. 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. When the number of events is large, the relative standard error 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 data. Such infrequent events may be assumed to follow a Poisson probability distribution (53).

Estimates of relative standard errors (RSEs) and 95-percent confidence intervals are shown below.

The formula for the RSE of infant deaths and live births is:

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

where  $D$  is the number of deaths and

$$RSE(B) = 100 \cdot \sqrt{\frac{1}{B}}$$

where  $B$  is the number of births.

For example, let us say that for Group A the number of infant deaths was 104 while the number of live births was 27,380 yielding an infant mortality rate of 3.8 infant deaths per 1,000 live births.

$$\text{The RSE of the deaths} = 100 \cdot \sqrt{\frac{1}{104}} = 9.81,$$

$$\text{while the RSE of the births} = 100 \cdot \sqrt{\frac{1}{27,380}} = 0.60$$

The formula for the RSE of the infant mortality rate (IMR) is:

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

$$\text{The RSE of the IMR} = 100 \cdot \sqrt{\frac{1}{104} + \frac{1}{27,380}} = 9.82$$

*Binomial distribution*—When the number of events is greater than 100, the binomial distribution is used to estimate the 95-percent confidence intervals as follows:

$$\text{Lower: } R_1 - 1.96 \cdot R_1 \cdot \frac{RSE(R_1)}{100}$$

$$\text{Upper: } R_1 + 1.96 \cdot R_1 \cdot \frac{RSE(R_1)}{100}$$

Thus, for Group A:

$$\text{Lower: } 3.8 - \left(1.96 \cdot 3.8 \cdot \frac{9.82}{100}\right) = 3.1$$

$$\text{Upper: } 3.8 + \left(1.96 \cdot 3.8 \cdot \frac{9.82}{100}\right) = 4.5$$

Thus the chances are 95 out of 100 that the true infant mortality rate for Group A lies somewhere in the 3.1 to 4.5 interval.

*Poisson distribution*—When the number of events in the numerator is less than 100 the confidence interval for the rate can be estimated based on the Poisson distribution using the values in [table II](#).

$$\text{Lower: } IMR \cdot L(.95, D_{adj})$$

$$\text{Upper: } IMR \cdot U(.95, D_{adj})$$

where  $D_{adj}$  is the adjusted number of infant deaths (rounded to the

Table II. Values of *L* and *U* for calculating 95-percent confidence limits for numbers of events and rates when the number of events is less than 100

<i>N</i>	<i>L</i>	<i>U</i>	<i>N</i>	<i>L</i>	<i>U</i>
1	0.02532	5.57164	51	0.74457	1.31482
2	0.12110	3.61234	52	0.74685	1.31137
3	0.20622	2.92242	53	0.74907	1.30802
4	0.27247	2.56040	54	0.75123	1.30478
5	0.32470	2.33367	55	0.75334	1.30164
6	0.36698	2.17658	56	0.75539	1.29858
7	0.40205	2.06038	57	0.75739	1.29562
8	0.43173	1.97040	58	0.75934	1.29273
9	0.45726	1.89831	59	0.76125	1.28993
10	0.47954	1.83904	60	0.76311	1.28720
11	0.49920	1.78928	61	0.76492	1.28454
12	0.51671	1.74680	62	0.76669	1.28195
13	0.53246	1.71003	63	0.76843	1.27943
14	0.54671	1.67783	64	0.77012	1.27698
15	0.55969	1.64935	65	0.77178	1.27458
16	0.57159	1.62394	66	0.77340	1.27225
17	0.58254	1.60110	67	0.77499	1.26996
18	0.59266	1.58043	68	0.77654	1.26774
19	0.60207	1.56162	69	0.77806	1.26556
20	0.61083	1.54442	70	0.77955	1.26344
21	0.61902	1.52861	71	0.78101	1.26136
22	0.62669	1.51401	72	0.78244	1.25933
23	0.63391	1.50049	73	0.78384	1.25735
24	0.64072	1.48792	74	0.78522	1.25541
25	0.64715	1.47620	75	0.78656	1.25351
26	0.65323	1.46523	76	0.78789	1.25165
27	0.65901	1.45495	77	0.78918	1.24983
28	0.66449	1.44528	78	0.79046	1.24805
29	0.66972	1.43617	79	0.79171	1.24630
30	0.67470	1.42756	80	0.79294	1.24459
31	0.67945	1.41942	81	0.79414	1.24291
32	0.68400	1.41170	82	0.79533	1.24126
33	0.68835	1.40437	83	0.79649	1.23965
34	0.69253	1.39740	84	0.79764	1.23807
35	0.69654	1.39076	85	0.79876	1.23652
36	0.70039	1.38442	86	0.79987	1.23499
37	0.70409	1.37837	87	0.80096	1.23350
38	0.70766	1.37258	88	0.80203	1.23203
39	0.71110	1.36703	89	0.80308	1.23059
40	0.71441	1.36172	90	0.80412	1.22917
41	0.71762	1.35661	91	0.80514	1.22778
42	0.72071	1.35171	92	0.80614	1.22641
43	0.72370	1.34699	93	0.80713	1.22507
44	0.72660	1.34245	94	0.80810	1.22375
45	0.72941	1.33808	95	0.80906	1.22245
46	0.73213	1.33386	96	0.81000	1.22117
47	0.73476	1.32979	97	0.81093	1.21992
48	0.73732	1.32585	98	0.81185	1.21868
49	0.73981	1.32205	99	0.81275	1.21746
50	0.74222	1.31838			

nearest integer) used to take into account the RSE of the number of infant deaths and live births, and is computed as follows:

$$D_{adj} = \frac{D \cdot B}{D + B}$$

*L* (.95, *D<sub>adj</sub>*) and *U* (.95, *D<sub>adj</sub>*) refer to the values in table II corresponding to the value of *D<sub>adj</sub>*.

For example, let us say that for Group B the number of infant deaths was 47, the number of live births was 8,901, and the infant mortality rate was 5.3.

$$D_{adj} = \frac{(47 \cdot 8,901)}{(47 + 8,901)} = 47$$

Therefore the 95-percent confidence interval (using the formula for 1–99 infant deaths) =

Lower:  $5.3 \cdot 0.73476 = 3.9$

Upper:  $5.3 \cdot 1.32979 = 7.0$

*Comparison of two infant mortality rates*—If either of the two rates to be compared is based on less than 100 deaths, compute the confidence intervals for both rates and check to see if they overlap. If so, the difference is not statistically significant at the 95-percent level. If they do not overlap, the difference is statistically significant. If both of the two rates (*R*<sub>1</sub> and *R*<sub>2</sub>) to be compared are based on 100 or more deaths, the following z-test may be used to define a significance test statistic:

$$z = \frac{R_1 - R_2}{\sqrt{R_1^2 \left(\frac{RSE(R_1)}{100}\right)^2 + R_2^2 \left(\frac{RSE(R_2)}{100}\right)^2}}$$

If  $|z| \geq 1.96$ , then the difference is statistically significant at the 0.05 level and if  $|z| < 1.96$ , the difference is not significant.

### **Availability of linked file data**

Linked file data are available on CD-ROM from the National Technical Information Service (NTIS) and the Government Printing Office (GPO). Data are also available in selected issues of the *Vital and Health Statistics*, Series 20 reports and the *National Vital Statistics Reports* (formerly the *Monthly Vital Statistics Report*) through NCHS. Additional unpublished tabulations are available from NCHS through the Internet site at <http://www.cdc.gov/nchs>. Selected variables from the linked file are also available for tabulation on CDC WONDER at <http://wonder.cdc.gov/lbdj.shtml>.

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Acknowledgments

This report was prepared in the Division of Vital Statistics under the general direction of Stephanie J. Ventura, Chief of the Reproductive Statistics Branch (RSB). Nicholas Pace, Chief of Systems, Programming, and Statistical Resources Branch (SPSRB), Steve Steimel, Gail Parr, Manju Sharma, Jordan Sacks, Bonita Gross, and Jaleh Mousavi (SPSRB) provided computer programming support and statistical tables. Yashu Patel of RSB provided assistance with content review. The Registration Methods staff and the Data Acquisition and Evaluation Branch provided consultation to State vital statistics offices regarding collection of the birth and death certificate data on which this report is based. This report was edited by Demarius V. Miller, typeset by Jacqueline M. Davis, and graphics were produced by Jarmila G. Ogburn of the Publications Branch, Division of Data Services.

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**Suggested citation**

Mathews TJ, Menacker F, MacDorman MF. Infant mortality statistics from the 2001 period linked birth/infant death data set. National vital statistics reports; vol 52 no 2. Hyattsville, Maryland: National Center for Health Statistics. 2003.

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HEALTH & HUMAN SERVICES

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DHHS Publication No. (PHS) 2003-1120  
PRS 03-0426 (9/2003)

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