

## Infant Mortality Statistics from the 2003 Period Linked Birth/Infant Death Data Set

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### Abstract

**Objectives**—This report presents 2003 period infant mortality statistics from the linked birth/infant death data file by a variety of maternal and infant characteristics. The linked file differs from the mortality file, which is based entirely on death certificate data.

**Methods**—Descriptive tabulations of data are presented and interpreted. Excluding rates by cause of death, the infant mortality rate is now published with two decimal places.

**Results**—The U.S. infant mortality rate was 6.84 infant deaths per 1,000 live births in 2003, a return to the rate in 2001, compared with 6.95 in 2002. Infant mortality rates ranged from 4.83 per 1,000 live

births for Asian or Pacific Islander mothers to 13.60 for non-Hispanic black mothers. Among Hispanics, rates ranged from 4.57 for Cuban mothers to 8.18 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. Infants born at the lowest birthweights and gestational ages have a large impact on overall U.S. infant mortality. Nearly one-half (49 percent) of all infant deaths in the U.S. in 2003 occurred to the 0.8 percent of infants whose birthweight was less than 1,000 grams. The three leading causes of infant death—Congenital malformations, low birthweight, and SIDS—taken

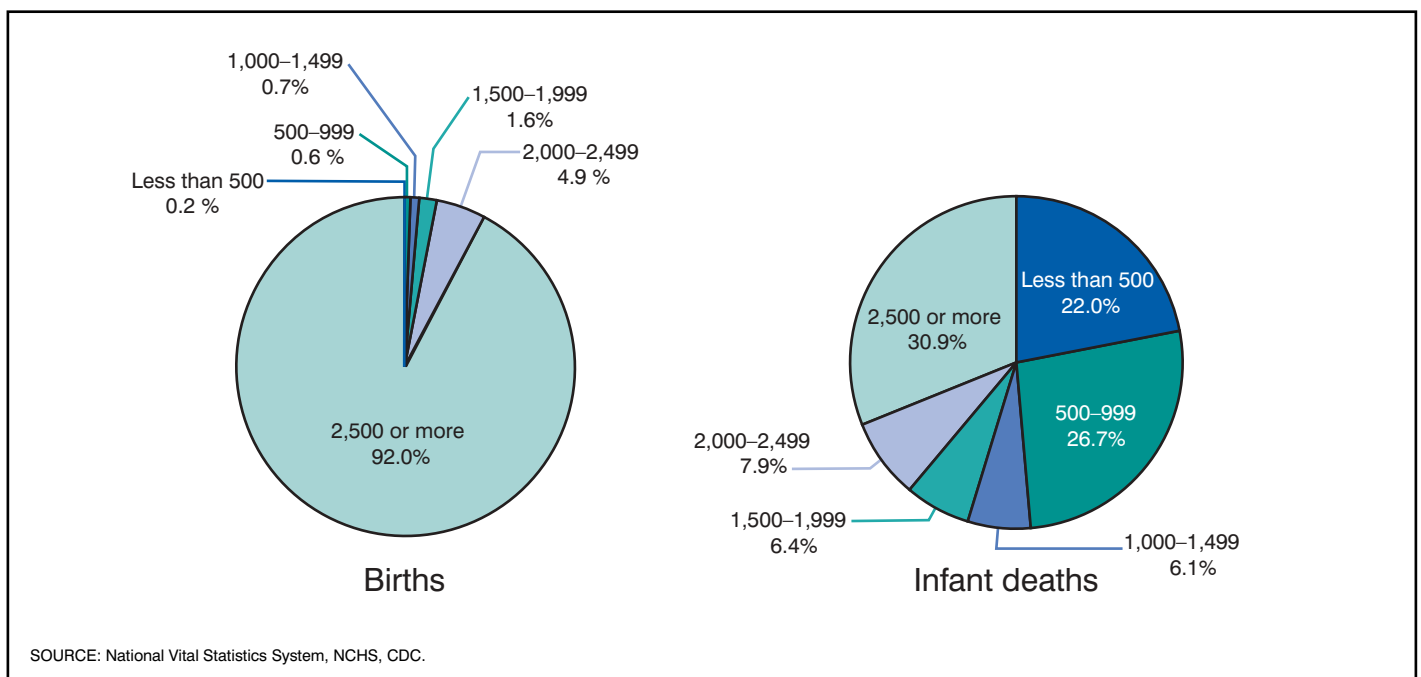


Figure 1. Percentage of live births and infant deaths by birthweight in grams, 2003

together accounted for 45 percent of all infant deaths. For infants of non-Hispanic black mothers, the cause-specific infant mortality rate for low birthweight was nearly four times that for infants of non-Hispanic white mothers. For infants of non-Hispanic black and American Indian mothers, the SIDS rates were more than double the rate for non-Hispanic white mothers.

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

## Introduction

This report presents infant mortality data from the 2003 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, Puerto Rico, the Virgin Islands, or Guam during 2003. 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–C, and Figures 1–3). 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 further 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 (linked file). The linked file is used for analysis and for calculating infant mortality rates by race and ethnicity that are more accurately measured from the birth certificate. A more detailed discussion of the differences in the number of infant deaths and infant mortality rates between the linked file and the mortality file is presented in the "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 2003. When the birth and death occurred in different States, the State of death was responsible 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 computer lists of unlinked infant death records and records with inconsistent data between the birth and death certificates to each State. State additions and corrections were incorporated, and a final national linked file was produced. In 2003, 99.0 percent of all infant death records were successfully

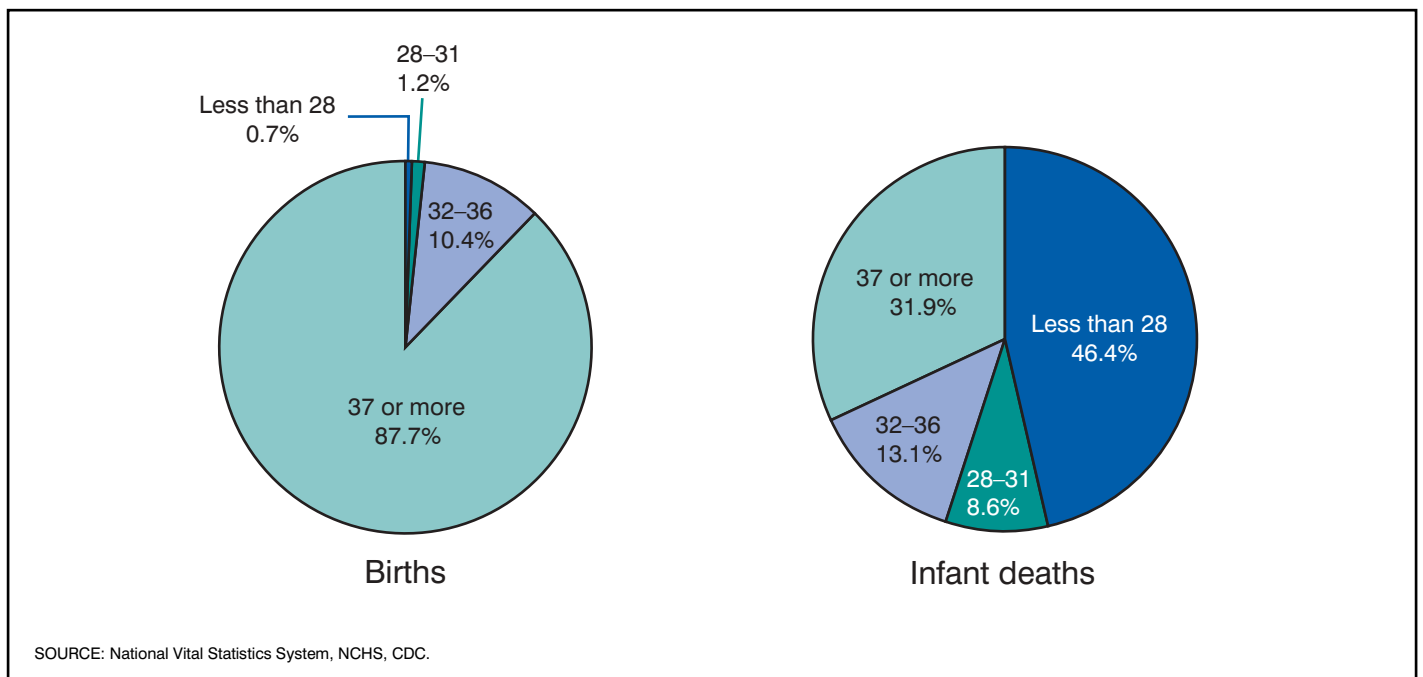
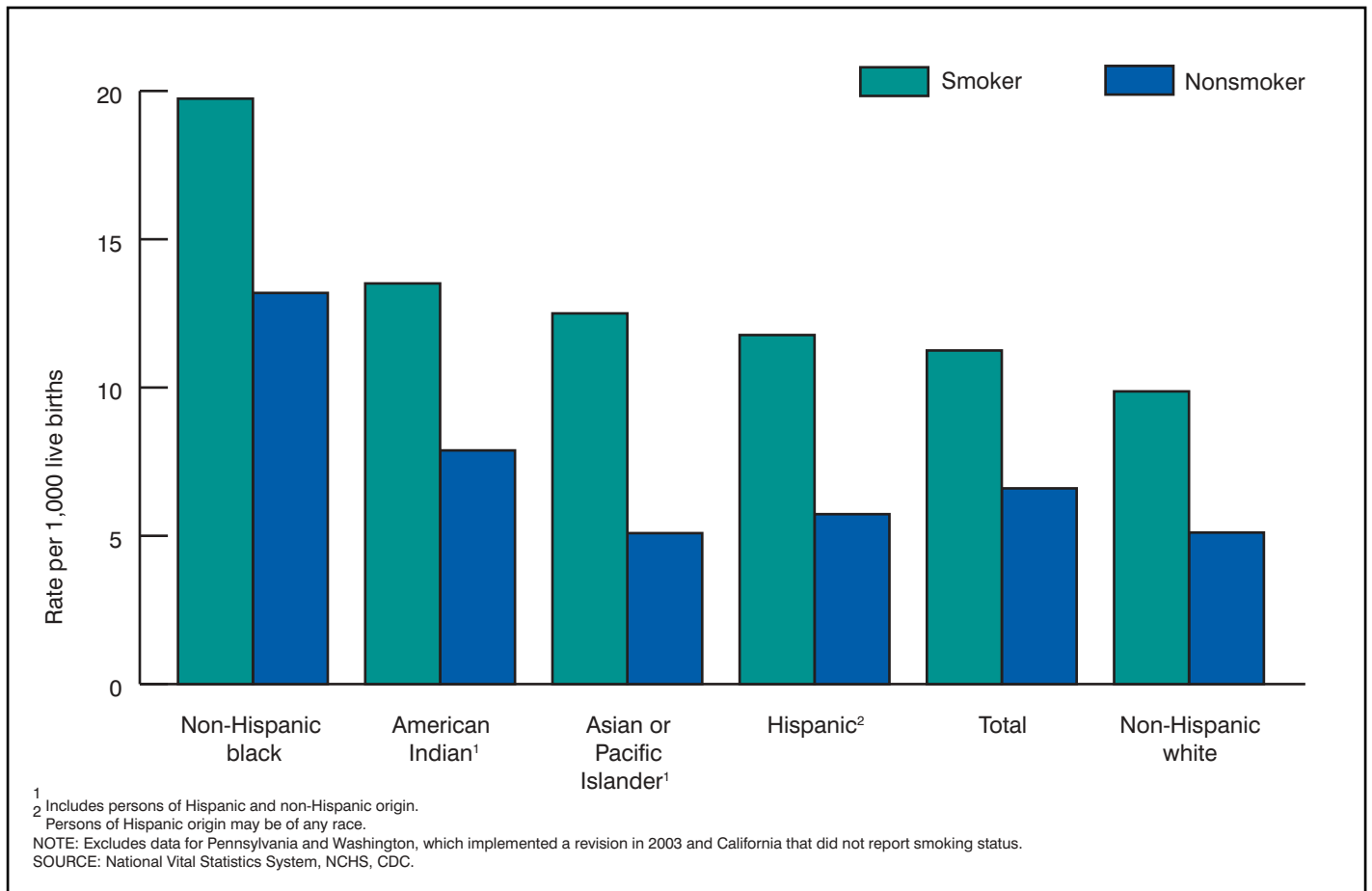


Figure 2. Percentage of live births and infant deaths by period of gestation in weeks, 2003



**Figure 3. Infant mortality rates by smoking status of the mother during pregnancy by race and ethnicity, 2003**

matched to their corresponding birth records. Records were weighted to adjust for the 1.0 percent of infant death records that were not linked to their corresponding birth certificates (see the “[Technical Notes](#)”).

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 2003 (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 as 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). Issues of this report for data years previous to 1999 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). Issues related to comparability between ICD revisions are discussed in the “[Technical Notes](#).”

This report includes data for two States, Pennsylvania and Washington, that implemented the 2003 revision of the U.S. Standard Certificate of Live Birth in 2003 (revised), as well as the 48 States and the District of Columbia for which data are based on the 1989 revision

of the U.S. Standard Certificate of Live Birth (unrevised). Revised and unrevised data are combined when comparable. See *National Vital Statistics Report “Births: Final Data for 2003”* for more information (3).

### 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 here by race and detailed Hispanic origin of mother. The linked file is particularly useful for computing accurate infant mortality rates for this purpose because the race and Hispanic origin 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

file, 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). Race information from the birth certificate is generally considered to be more reliable than that from the death certificate where the race and ethnicity 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 and ethnic specific infant mortality rates between the two data files (2,6).

*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, birthweight, and cause-of-death classification is also presented in the “[Technical Notes](#).”

## Results and Discussion

### Trends in infant mortality

The overall 2003 infant mortality rate from the linked file was 6.84 infant deaths per 1,000 live births, not significantly lower than the rate in 2002 (6.95) and a return to the rate in 2001 ([Table C](#)) (the overall rate in 2003 from the mortality file was 6.85). Infant mortality rates for race and Hispanic origin groups were not significantly different in 2003 compared with 2002 ([Table C](#)).

The significant increase in the infant mortality rate from 2001 to 2002 generated considerable concern; it was the first such rise in more than 40 years. An intensive analysis of the 2001–02 increase in the infant mortality rate was published last year (7). This analysis discussed some of the potential explanatory factors that could account for the increase, concluding that the increase in the number of very small infants (less than 750 grams) was the principal factor. The increase did not continue in 2003.

The infant mortality rate was 10 percent lower in 2003 than in 1995 (7.57) ([Table C](#)). During this period, decreases have been observed for all race and ethnic groups, although only a few had significant declines. Significant declines were observed for infants of non-Hispanic white (9 percent), non-Hispanic black (7 percent), and Mexican mothers (9 percent).

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

There continues to be a wide variation in infant mortality rates by race and Hispanic origin of mother with the highest rate, 13.60 per 1,000 live births for infants of non-Hispanic black mothers, nearly three times greater than the lowest rate of 4.57 for infants of Cuban mothers. Rates were also high for infants of American Indian mothers (8.73) and Puerto Rican mothers (8.18) ([Tables A and B](#)). Rates were intermediate, but all below the U.S. rate, for infants of non-Hispanic

white (5.70), Mexican (5.49), and Central and South American mothers (5.04) ([Table B](#)). The rate was low for Asian or Pacific Islander mothers (4.83) ([Table A](#)).

### Infant mortality by State

Between 2002 and 2003, more States had decreases than increases in the infant mortality rate, but most changes were not significant. No State had a significant increase and two, Connecticut and Nebraska, had significant declines of 18 and 22 percent, respectively (detailed data not shown). Infant mortality rates varied considerably by State and within States by race and Hispanic origin of mother for 2001–03 ([Table 3](#)). To obtain statistically reliable rates by race and Hispanic origin, 3 years of data were combined. Infant mortality rates ranged from 10.53 for Mississippi to 4.33 for New Hampshire. The highest rate noted (10.94) was for the District of Columbia (DC); 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.

For infants of non-Hispanic black mothers, mortality rates ranged from 17.48 in Wisconsin to 8.39 in Minnesota. For infants of non-Hispanic white mothers, West Virginia had the highest infant mortality rate (7.65) and New Jersey had the lowest rate (3.92).

For infants of American Indian and Asian or Pacific Islander mothers, mortality rates could be reliably computed for only 15 and 27 States, respectively. For infants of American Indian mothers, mortality rates ranged from 12.66 in Wisconsin to 6.00 in New Mexico. Overall, infant mortality rates for infants of Asian or Pacific Islander mothers were the lowest, ranging from 3.38 in New York to 9.85 in Louisiana.

### Sex of infant

In 2003, the overall infant mortality rate for female infants was 6.07 per 1,000, 20 percent lower than the rate for male infants (7.59). Infant mortality rates were higher for male than female infants in each race group except American Indian ([Table 1](#)). Among Hispanics, this difference was not significant for infants of Cuban mothers ([Table 2](#)).

### Multiple births

For multiple births, the infant mortality rate was 30.99, more than five times the rate of 6.01 for single births ([Tables 1 and 2](#)). Infant mortality rates for multiple births were higher than rates for single births for all race and Hispanic-origin groups, except for Cubans for whom rates could not be reliably computed due to small numbers of events.

The risk of infant death increases with the increasing number of infants in the pregnancy. In 2003, the infant mortality rate for twins (28.66) was nearly five times the rate for single births (6.01). The rate for triplets (62.23) was 10 times, the rate for quadruplets (156.41) 26 times, and the rate for quintuplets and higher order births (242.86) was 40 times higher than the rate for single births (tabular data not shown).

For twins, the infant mortality rate declined significantly from 2002 (30.20) to 2003 (28.66). No other plurality group had a significant change in infant mortality from the year before.

Multiple pregnancy can lead to an accentuation of maternal risks and complications associated with pregnancy (3,8,9). For example, multiple births are much more likely to be born preterm and at low birthweight than single births (3,8,9). The higher risk profile of multiple

**Table A. Infant, neonatal, and postneonatal deaths and mortality rates by race of mother: United States, 2003 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 . . . . .                    | 4,090,007   | 27,995           | 18,935   | 9,060        | 6.84                                 | 4.63     | 2.22         |
| White . . . . .                        | 3,225,890   | 18,458           | 12,457   | 6,000        | 5.72                                 | 3.86     | 1.86         |
| Black . . . . .                        | 599,860     | 8,094            | 5,530    | 2,563        | 13.49                                | 9.22     | 4.27         |
| American Indian <sup>1</sup> . . . . . | 43,054      | 376              | 196      | 180          | 8.73                                 | 4.55     | 4.18         |
| Asian or Pacific Islander . . . . .    | 221,203     | 1,068            | 752      | 316          | 4.83                                 | 3.40     | 1.43         |

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

NOTES: 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. Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. In this table all women (including Hispanic women) are classified only according to their race. See reference 3.

**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, 2003 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> . . . . .        | 4,090,007   | 27,995           | 18,935   | 9,060        | 6.84                                 | 4.63     | 2.22         |
| Total Hispanic . . . . .                  | 912,331     | 5,151            | 3,573    | 1,579        | 5.65                                 | 3.92     | 1.73         |
| Mexican . . . . .                         | 654,507     | 3,595            | 2,462    | 1,133        | 5.49                                 | 3.76     | 1.73         |
| Puerto Rican . . . . .                    | 58,400      | 478              | 333      | 145          | 8.18                                 | 5.70     | 2.48         |
| Cuban . . . . .                           | 14,867      | 68               | 50       | 18           | 4.57                                 | 3.36     | *            |
| Central and South American . . . . .      | 135,585     | 684              | 494      | 189          | 5.04                                 | 3.64     | 1.39         |
| Other and unknown Hispanic . . . . .      | 48,972      | 326              | 232      | 94           | 6.66                                 | 4.74     | 1.92         |
| Non-Hispanic total <sup>2</sup> . . . . . | 3,149,067   | 22,396           | 14,994   | 7,402        | 7.11                                 | 4.76     | 2.35         |
| Non-Hispanic white . . . . .              | 2,321,921   | 13,228           | 8,797    | 4,431        | 5.70                                 | 3.79     | 1.91         |
| Non-Hispanic black . . . . .              | 576,047     | 7,836            | 5,335    | 2,501        | 13.60                                | 9.26     | 4.34         |
| Not stated . . . . .                      | 28,609      | 448              | 368      | 80           | ...                                  | ...      | ...          |

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

... 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.

NOTES: 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. Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.

**Table C. Infant mortality rates by race and Hispanic origin of mother: United States, 1995–2003 linked files**

| Race and Hispanic origin of mother     | 1995  | 1996  | 1997  | 1998  | 1999  | 2000  | 2001  | 2002  | 2003  | Percent Change | Percent Change |
|----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------------|----------------|
|                                        |       |       |       |       |       |       |       |       |       | 1995 to 2003   | 2002 to 2003   |
| All races . . . . .                    | 7.57  | 7.30  | 7.21  | 7.19  | 7.04  | 6.89  | 6.84  | 6.95  | 6.84  | -9.6           | -1.6**         |
| White . . . . .                        | 6.30  | 6.07  | 6.05  | 5.96  | 5.79  | 5.71  | 5.69  | 5.79  | 5.72  | -9.2           | -1.2**         |
| Black . . . . .                        | 14.58 | 14.13 | 13.69 | 13.80 | 13.99 | 13.48 | 13.34 | 13.81 | 13.50 | -7.4           | -2.2**         |
| American Indian <sup>1</sup> . . . . . | 9.04  | 9.95  | 8.69  | 9.34  | 9.29  | 8.30  | 9.65  | 8.64  | 8.73  | -3.4**         | 1.0**          |
| Asian or Pacific Islander . . . . .    | 5.27  | 5.20  | 4.98  | 5.54  | 4.85  | 4.87  | 4.73  | 4.77  | 4.83  | -8.3**         | 1.3**          |
| Hispanic . . . . .                     | 6.27  | 6.05  | 5.95  | 5.76  | 5.71  | 5.59  | 5.44  | 5.62  | 5.65  | -9.9           | 0.5**          |
| Mexican . . . . .                      | 6.03  | 5.84  | 5.83  | 5.60  | 5.51  | 5.43  | 5.22  | 5.42  | 5.49  | -9.0           | 1.3**          |
| Puerto Rican . . . . .                 | 8.88  | 8.60  | 7.86  | 7.78  | 8.35  | 8.21  | 8.53  | 8.20  | 8.18  | -7.9**         | -0.2**         |
| Cuban . . . . .                        | 5.29  | 5.07  | 5.51  | 3.63  | 4.66  | 4.54  | 4.28  | 3.72  | 4.57  | -13.6**        | 22.8**         |
| Central and South American . . . . .   | 5.52  | 5.02  | 5.45  | 5.28  | 4.68  | 4.64  | 4.98  | 5.06  | 5.04  | -8.7**         | -0.4**         |
| Non-Hispanic white . . . . .           | 6.28  | 6.04  | 6.02  | 5.98  | 5.76  | 5.70  | 5.72  | 5.80  | 5.70  | -9.2           | -1.7**         |
| Non-Hispanic black . . . . .           | 14.65 | 14.20 | 13.72 | 13.88 | 14.14 | 13.59 | 13.46 | 13.89 | 13.60 | -7.2           | -2.1**         |

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

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

NOTES: Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.

births has a substantial impact on overall infant mortality (7,8,10). For example, in 2003 multiples accounted for 3 percent of all live births, but 15 percent of all infant deaths in the U.S. (Table 1).

## Age at death

In 2003, more than two-thirds of all infant deaths (18,935 out of 27,995) occurred during the neonatal period (from birth through 27 days of age). The neonatal mortality rate, 4.63 deaths per 1,000 live births in 2003, was more than double the postneonatal (28 days to under 1 year) mortality rate of 2.22. Neonatal and postneonatal mortality rates for 2003 were essentially unchanged from the previous year.

The neonatal mortality rate for infants of non-Hispanic black mothers (9.26) was significantly higher than for all other race/ethnic groups and more than double those for non-Hispanic white, Asian or Pacific Islander, Mexican, Central and South American, and Cuban women. Neonatal mortality rates for Puerto Rican (5.70) and American Indian (4.55) women were intermediate between these two groups. Infants of non-Hispanic black and American Indian mothers had the highest postneonatal mortality rates of any group (4.34 and 4.18, respectively)—more than twice those for non-Hispanic white, Asian or Pacific Islander, Mexican, and Central and South American women. Postneonatal mortality rates were intermediate for Puerto Rican women (2.48) (Tables A and B).

## 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 (11–15).

Because of their much greater risk of death, infants born at the lowest birthweights and gestational ages have a large impact on overall U.S. infant mortality. Figure 1 shows the percent distribution of live births and infant deaths by birthweight. Births at less than 500 grams accounted for only 0.2 percent of births, but 22.0 percent of all infant deaths in the U.S. in 2003. Births at 500–999 grams accounted for 0.6 percent of births, but 26.7 percent of infant deaths. Together, births to infants weighing less than 1,000 grams accounted for 0.8 percent of births, and nearly one-half (48.6 percent) of all infant deaths in the U.S. in 2003. Conversely, 92.0 percent of infants born in the U.S. in 2003 weighed 2,500 grams or more, but these infants accounted for only 31.0 percent of infant deaths.

A similar pattern is found when data by period of gestation are examined (Figure 2). Births at less than 28 weeks of gestation accounted for 0.7 percent of all live births, and 46.4 percent of all infant deaths in the U.S. in 2003.

The percentage of infants born at low birthweight (less than 2,500 grams) varied greatly by race and ethnicity, from a low of 6.3 percent for births to Mexican mothers to a high of 13.6 percent for births to non-Hispanic black mothers (Tables 4 and 5). The percentage of preterm births (those born before 37 completed weeks of gestation) ranged from 10.5 percent for births to Asian or Pacific Islander mothers to 17.8 percent for births to non-Hispanic black mothers.

For all race and ethnic groups studied, infant mortality rates were much higher for low birthweight infants (59.04) than for infants with

birthweights of 2,500 grams or more (2.29). Overall, the infant mortality rate for very low birthweight infants (those with birthweights of less than 1,500 grams) was 252.00, more than 110 times the rate for infants with birthweights of 2,500 grams or more (Table 6). Similarly, the infant mortality rate for very preterm infants (those born at less than 32 weeks of gestation) was 188.24, 78 times the rate for infants born at term (2.42) (37–41 weeks of gestation) (Tables 1 and 2).

At least 86 percent of infants with birthweights of less than 500 grams died within the first year of life (Table 6). Reporting of deaths among these very small infants may be incomplete (data not shown). An infant's chances of survival increase rapidly with increasing birthweight. Infant mortality rates were lowest at birthweights of 3,000–4,499 grams.

Trends in birthweight-specific infant mortality rates for the period 1995 to 2003 are shown in Table 6. For the total population, non-Hispanic white, non-Hispanic black, and Hispanic mothers, declines were largest for infants weighing 2,500–4,499 grams (Table 6).

From 2002 to 2003, changes in birthweight-specific infant mortality rates were not statistically significant. Previously, the infant mortality rate for very low birthweight infants had increased significantly from 2001–02, as had rates for preterm and very preterm infants. Also, the number of live born infants and fetal deaths of very low birthweights (i.e., less than 500 grams) had increased (7).

## Prenatal care

Pennsylvania and Washington implemented the 2003 revision of the U.S. Standard Certificate of Live Birth in 2003. The question on the timing of prenatal care on the 2003 revision differs substantively from the question on the 1989 revision that is in use in the other States (3); thus, prenatal care data are not comparable between the two revisions. As a result, data for Pennsylvania and Washington were not included in the prenatal care tabulations in this report.

Although difficult to measure, the timing and quality of prenatal care received by the mother during pregnancy can be important to the infant's subsequent health and survival (16–19). Early comprehensive prenatal care can promote healthier pregnancies by providing health behavior advice, early detection and treatment of risk factors and symptoms, and monitoring (16,17). The initiation and subsequent utilization of prenatal care is also viewed as an indicator for access to care (19,20).

In 2003, the mortality rate for infants of mothers who began prenatal care after the first trimester of pregnancy or not at all was 8.96 per 1,000. This rate was 45 percent higher than the rate for infants of mothers who began care in the first trimester (6.20).

Overall, the infant mortality rate for women who began care in the third trimester (6.64) was lower than for women who began care in the second trimester (7.32). This is because women who began prenatal care in the third trimester had to have a period of gestation of at least 7 months, thus reducing the probability that the infant would be born preterm or of low birthweight. 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 used (Tables 1 and 2).

For each race and Hispanic origin group, infant mortality rates were higher for mothers who began prenatal care after the first trimester or no care, than for mothers who initiated prenatal care during the first trimester (Tables 1 and 2). These differences were significant for all but infants of American Indian, Puerto Rican, and Central or South

American mothers. Because of the small number of infant deaths for Cuban mothers with late or no care, a reliable rate could not be calculated.

## Maternal age

Infant mortality rates vary with maternal age; infants of teenage mothers and mothers aged 40 and over have the highest rates (10.22 and 8.60 respectively). The lowest rates are for infants of mothers in their late twenties and early thirties (Tables 1 and 2).

In 2003, among births to teenagers, infants of the youngest mothers (under age 15 years) had the highest rate (16.06). The rate for infants of mothers aged 15–17 years was 11.45; the rate for infants of mothers aged 18–19 years was 9.49 (tabular data not shown).

Within race and ethnic subgroups, among groups for which rates could be reliably computed, infant mortality rates for births to non-Hispanic white mothers less than 20 years of age were higher than for mothers aged 40 and over. In contrast, for Mexican mothers, rates for births to the oldest mothers were higher than rates for infants of teenagers.

Studies suggest that the higher mortality risk for infants of younger mothers may be related to socioeconomic factors as well as biologic immaturity (21); young maternal age might be a marker for poverty (22). 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) (23).

## Maternal education

Pennsylvania and Washington implemented the 2003 revision of the U.S. Standard Certificate of Live Birth in 2003. The question on education on the 2003 revision differs substantively from the question on the 1989 revision that is in use in the other States (3); thus, education data are not comparable between the two revisions. As a result, data for Pennsylvania and Washington were not included in the education tabulations in this report.

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 (24). However, infants of mothers with 0–8 years of education had a lower infant mortality rate compared to those with 9–11 years of education. This may be because most mothers with 0–8 years of education were born outside of the 50 States and the District of Columbia (25), and their infant mortality rates tend to be lower than for native-born mothers (see “Nativity”).

## Live-birth order

Infant mortality rates were generally higher for first births than for second births, and then generally increased as birth order increased (Tables 1 and 2). Overall, the infant mortality rate for first births (6.83) was 14 percent higher than for second births (5.98). The rate for fifth and higher order births (10.28) was 72 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, multiple births, and lower socioeconomic status (3,26).

## Marital status

Marital status may be a marker for the presence or absence of social, emotional, and financial resources (27, 28). Infants of mothers who are not married have been shown to be at higher risk for poor outcomes (29,30). In 2003, infants of married mothers had an infant mortality rate of 5.33 per 1,000, 45 percent lower than the rate for infants of unmarried mothers (9.71) (Tables 1 and 2). Within each race and Hispanic origin group, infants of unmarried mothers had higher rates of mortality, and with the exception of Puerto Rican, Cuban, and Central and South American infants, these differences were significant.

## Nativity

In 2003, the infant mortality rate for mothers born in the 50 States and the District of Columbia (7.15) was 37 percent higher than the rate for mothers born elsewhere (5.21). Among race and Hispanic-origin groups for whom infant mortality rates could be calculated, all had higher infant mortality rates for mothers born in the 50 States and the District of Columbia (the difference was not significant for Puerto Rican, Cuban, and Central and South American mothers) (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 migration selectivity and the social support for new mothers (31). 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 (32).

## Maternal smoking

Pennsylvania and Washington implemented the 2003 revision of the U.S. Standard Certificate of Live Birth in 2003. The question on smoking during pregnancy on the 2003 revision differs substantively from the question on the 1989 revision that is in use in the other States (3); thus, smoking during pregnancy data are not comparable between the two revisions. As a result, data for Pennsylvania and Washington were not included in the smoking during pregnancy tabulations in this report. Additionally, California does not report maternal smoking on the birth certificate.

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 (33,34).

The infant mortality rate for infants of smokers was 11.25 in 2003, 71 percent higher than the rate of 6.59 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 and Figure 3). Infant mortality rates for API mothers

who smoked during pregnancy were nearly two and one-half times the rates for nonsmokers.

## 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 2003 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 17 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 Newborn affected by complications of placenta, cord, and membranes (cord complications), accounted for 6 and 4 percent, respectively, of all infant deaths in 2003. Together, the five leading causes accounted for 55 percent of all infant deaths in the U.S. in 2003. The order of the five leading causes of death was the same in 2003 as in the previous year.

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

Infant mortality rates for the five leading causes of death were basically unchanged from 2002–03, except for SIDS, which decreased by 8 percent. Recent declines in SIDS may also reflect a change in the way SIDS is diagnosed by the medical community (35). When examined by race and ethnicity, none of the race/ethnic groups shown in [Table 7](#) had significant changes in cause-specific infant mortality rates from 2002–03.

When differences among cause-specific infant mortality rates were examined by race and ethnicity, infant mortality rates from Congenital malformations were 31 percent higher for non-Hispanic black, 47 percent higher for American Indian, and 19 percent higher for Mexican than for non-Hispanic white mothers.

Infants of non-Hispanic black mothers had the highest mortality rates from low birthweight. The rate for non-Hispanic black mothers was nearly four times the rate for non-Hispanic white mothers. The rate for Puerto Rican mothers was more than twice the rate for non-Hispanic white mothers.

SIDS rates were highest for American Indian and non-Hispanic black mothers—2.4 and 2.2 times those for non-Hispanic white mothers, respectively. As most SIDS deaths occur during the post-neonatal period, the high SIDS rates for infants of non-Hispanic black and American Indian mothers accounted for much of their elevated risk of postneonatal mortality. Compared with non-Hispanic white mothers, SIDS rates were 45 percent lower for Asian or Pacific Islander mothers, 51 percent lower for Mexican mothers, and 61 percent lower for Central and South American mothers.

For maternal complications and cord complications, infants of non-Hispanic black mothers had the highest mortality rates—2.8 and 2.2 times, respectively, than those for non-Hispanic white mothers. The higher percent of non-Hispanic black infants born at low birthweight

may help to explain their higher infant mortality rates from these causes, which occur predominantly among low birthweight infants. Compared with non-Hispanic white women, Mexican women had lower infant mortality rates from maternal complications (15 percent lower) and cord complications (23 percent lower).

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 among these groups. For example, 30 percent of the elevated infant mortality rate for non-Hispanic black mothers, when compared with non-Hispanic white mothers, can be accounted for by their higher rate from low birthweight, 8 percent by differences in maternal complications, and 7 percent by differences in SIDS. In other words, if non-Hispanic black infant mortality rates for these three causes could be reduced to the levels for non-Hispanic white infants, the difference in the infant mortality rate between non-Hispanic black and non-Hispanic white mothers would be reduced by 45 percent.

For American Indian mothers, 24 percent of their elevated infant mortality rate, when compared with non-Hispanic white mothers, can be accounted for by their higher SIDS rates, 20 percent by differences in Congenital malformations, and 11 percent by differences in low birthweight. Thus, if American Indian infant mortality rates for these three causes could be reduced to non-Hispanic white levels, the difference in the infant mortality rate between American Indian and non-Hispanic white mothers would be reduced by 55 percent.

Similarly, 35 percent of the difference between Puerto Rican and non-Hispanic white infant mortality rates can be accounted for by differences in low birthweight, 6 percent by differences in Congenital malformations, and 5 percent by differences in cord complications. If Puerto Rican infant mortality for these three causes could be reduced to non-Hispanic white levels, the difference in the infant mortality rate between Puerto Rican and non-Hispanic white infants would be reduced by 46 percent. In addition to helping to explain differences in infant mortality rates among 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, 2003 linked file**

| Characteristics                                                 | All races | Race of mother |        |                              |                           |
|-----------------------------------------------------------------|-----------|----------------|--------|------------------------------|---------------------------|
|                                                                 |           | White          | Black  | American Indian <sup>1</sup> | Asian or Pacific Islander |
| Infant mortality rates per 1,000 live births in specified group |           |                |        |                              |                           |
| Total . . . . .                                                 | 6.84      | 5.72           | 13.49  | 8.73                         | 4.83                      |
| Age at death:                                                   |           |                |        |                              |                           |
| Total neonatal . . . . .                                        | 4.63      | 3.86           | 9.22   | 4.55                         | 3.40                      |
| Early neonatal (less than 7 days) . . . . .                     | 3.70      | 3.09           | 7.37   | 3.41                         | 2.74                      |
| Late neonatal (7–27 days) . . . . .                             | 0.92      | 0.77           | 1.85   | 1.14                         | 0.66                      |
| Postneonatal . . . . .                                          | 2.22      | 1.86           | 4.27   | 4.18                         | 1.43                      |
| Sex:                                                            |           |                |        |                              |                           |
| Male . . . . .                                                  | 7.59      | 6.37           | 14.93  | 9.58                         | 5.15                      |
| Female . . . . .                                                | 6.07      | 5.04           | 12.00  | 7.84                         | 4.48                      |
| Plurality:                                                      |           |                |        |                              |                           |
| Single births . . . . .                                         | 6.01      | 4.99           | 12.01  | 8.39                         | 4.30                      |
| Plural births . . . . .                                         | 30.99     | 26.96          | 53.89  | 21.30                        | 23.93                     |
| Birthweight:                                                    |           |                |        |                              |                           |
| Less than 2,500 grams . . . . .                                 | 59.04     | 53.87          | 76.81  | 60.80                        | 42.94                     |
| Less than 1,500 grams . . . . .                                 | 252.00    | 240.00         | 278.56 | 253.94                       | 236.21                    |
| 1,500–2,499 grams . . . . .                                     | 15.00     | 15.19          | 15.19  | 18.70                        | 11.01                     |
| 2,500 grams or more . . . . .                                   | 2.29      | 2.08           | 3.56   | 4.52                         | 1.58                      |
| Period of gestation:                                            |           |                |        |                              |                           |
| Less than 32 weeks . . . . .                                    | 188.24    | 174.84         | 220.67 | 161.08                       | 176.03                    |
| 32–36 weeks . . . . .                                           | 8.53      | 8.15           | 9.90   | 11.59                        | 8.17                      |
| 37–41 weeks . . . . .                                           | 2.42      | 2.19           | 3.89   | 4.47                         | 1.67                      |
| 42 weeks or more . . . . .                                      | 2.88      | 2.60           | 4.69   | *                            | 1.78                      |
| Trimester of pregnancy prenatal care began: <sup>2</sup>        |           |                |        |                              |                           |
| First trimester . . . . .                                       | 6.20      | 5.24           | 12.56  | 7.99                         | 4.43                      |
| After first trimester or no care . . . . .                      | 8.96      | 7.39           | 14.41  | 10.15                        | 6.25                      |
| Second trimester . . . . .                                      | 7.32      | 6.25           | 11.18  | 9.67                         | 4.98                      |
| Third trimester . . . . .                                       | 6.64      | 6.12           | 8.92   | *                            | 4.41                      |
| No prenatal care . . . . .                                      | 34.06     | 25.22          | 53.66  | 32.00                        | 41.10                     |
| Age of mother:                                                  |           |                |        |                              |                           |
| Under 20 years . . . . .                                        | 10.22     | 8.67           | 14.75  | 9.43                         | 10.78                     |
| 20–24 years . . . . .                                           | 7.70      | 6.44           | 12.95  | 8.26                         | 6.56                      |
| 25–29 years . . . . .                                           | 5.97      | 4.98           | 12.85  | 8.93                         | 3.88                      |
| 30–34 years . . . . .                                           | 5.62      | 4.77           | 13.54  | 7.47                         | 4.14                      |
| 35–39 years . . . . .                                           | 6.10      | 5.17           | 13.89  | 9.64                         | 4.82                      |
| 40–54 years . . . . .                                           | 8.60      | 7.56           | 16.67  | *                            | 6.74                      |
| Educational attainment of mother: <sup>2</sup>                  |           |                |        |                              |                           |
| 0–8 years . . . . .                                             | 6.99      | 6.45           | 14.34  | 12.36                        | 6.41                      |
| 9–11 years . . . . .                                            | 9.35      | 7.80           | 15.19  | 9.01                         | 8.12                      |
| 12 years . . . . .                                              | 7.66      | 6.28           | 13.37  | 8.98                         | 6.05                      |
| 13–15 years . . . . .                                           | 6.21      | 5.12           | 11.93  | 6.42                         | 4.46                      |
| 16 years and over . . . . .                                     | 4.24      | 3.76           | 10.21  | 7.96                         | 3.61                      |
| Live-birth order:                                               |           |                |        |                              |                           |
| 1 . . . . .                                                     | 6.83      | 5.82           | 13.39  | 8.20                         | 4.87                      |
| 2 . . . . .                                                     | 5.98      | 5.07           | 12.15  | 8.14                         | 4.21                      |
| 3 . . . . .                                                     | 6.82      | 5.64           | 13.24  | 8.53                         | 4.90                      |
| 4 . . . . .                                                     | 8.22      | 6.60           | 14.84  | 10.36                        | 7.37                      |
| 5 or more . . . . .                                             | 10.28     | 8.04           | 17.18  | 11.56                        | 7.58                      |
| Marital status:                                                 |           |                |        |                              |                           |
| Married . . . . .                                               | 5.33      | 4.89           | 11.51  | 7.27                         | 4.20                      |
| Unmarried . . . . .                                             | 9.71      | 7.73           | 14.41  | 9.66                         | 8.36                      |
| Mother's place of birth:                                        |           |                |        |                              |                           |
| Born in the 50 States and DC . . . . .                          | 7.15      | 5.79           | 13.76  | 8.96                         | 6.31                      |
| Born elsewhere . . . . .                                        | 5.21      | 4.92           | 9.27   | *                            | 4.45                      |
| Maternal smoking during pregnancy: <sup>2,3</sup>               |           |                |        |                              |                           |
| Smoker . . . . .                                                | 11.25     | 9.96           | 19.71  | 13.36                        | 12.50                     |
| Nonsmoker . . . . .                                             | 6.59      | 5.27           | 13.05  | 7.85                         | 5.09                      |

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, 2003 linked file—Con.**

| Characteristics                                          | All races | Race of mother |         |                              |                           |
|----------------------------------------------------------|-----------|----------------|---------|------------------------------|---------------------------|
|                                                          |           | White          | Black   | American Indian <sup>1</sup> | Asian or Pacific Islander |
|                                                          |           | Live births    |         |                              |                           |
| Total                                                    | 4,090,007 | 3,225,890      | 599,860 | 43,054                       | 221,203                   |
| Sex:                                                     |           |                |         |                              |                           |
| Male                                                     | 2,093,564 | 1,652,166      | 305,215 | 22,019                       | 114,164                   |
| Female                                                   | 1,996,443 | 1,573,724      | 294,645 | 21,035                       | 107,039                   |
| Plurality:                                               |           |                |         |                              |                           |
| Single births                                            | 3,953,667 | 3,117,848      | 578,577 | 41,974                       | 215,268                   |
| Plural births                                            | 136,340   | 108,042        | 21,283  | 1,080                        | 5,935                     |
| Birthweight:                                             |           |                |         |                              |                           |
| Less than 2,500 grams                                    | 325,619   | 224,570        | 80,603  | 3,191                        | 17,255                    |
| Less than 1,500 grams                                    | 60,505    | 38,629         | 18,858  | 571                          | 2,447                     |
| 1,500–2,499 grams                                        | 265,114   | 185,941        | 61,745  | 2,620                        | 14,808                    |
| 2,500 grams or more                                      | 3,763,758 | 3,000,852      | 519,127 | 39,856                       | 203,923                   |
| Not stated                                               | 630       | 468            | 130     | 7                            | 25                        |
| Period of gestation:                                     |           |                |         |                              |                           |
| Less than 32 weeks                                       | 79,633    | 52,138         | 23,474  | 925                          | 3,096                     |
| 32–36 weeks                                              | 419,402   | 313,237        | 81,636  | 4,831                        | 19,698                    |
| 37–41 weeks                                              | 3,288,550 | 2,618,962      | 454,209 | 33,529                       | 181,850                   |
| 42 weeks or more                                         | 258,553   | 206,544        | 36,235  | 3,390                        | 12,384                    |
| Not stated                                               | 43,869    | 35,009         | 4,306   | 379                          | 4,175                     |
| Trimester of pregnancy prenatal care began: <sup>2</sup> |           |                |         |                              |                           |
| First trimester                                          | 3,189,811 | 2,562,471      | 425,307 | 28,145                       | 173,888                   |
| After first trimester or no care                         | 603,714   | 427,592        | 134,879 | 11,627                       | 29,616                    |
| Second trimester                                         | 469,651   | 336,408        | 101,347 | 8,585                        | 23,311                    |
| Third trimester                                          | 94,603    | 65,011         | 22,090  | 2,292                        | 5,210                     |
| No prenatal care                                         | 39,460    | 26,173         | 11,442  | 750                          | 1,095                     |
| Not stated                                               | 70,033    | 50,852         | 13,602  | 898                          | 4,681                     |
| Age of mother:                                           |           |                |         |                              |                           |
| Under 20 years                                           | 421,254   | 302,031        | 103,683 | 7,844                        | 7,696                     |
| 20–24 years                                              | 1,032,325 | 790,927        | 196,270 | 14,646                       | 30,482                    |
| 25–29 years                                              | 1,086,375 | 871,501        | 139,950 | 10,525                       | 64,399                    |
| 30–34 years                                              | 975,555   | 795,910        | 97,530  | 6,423                        | 75,692                    |
| 35–39 years                                              | 467,646   | 379,777        | 49,889  | 2,906                        | 35,074                    |
| 40–54 years                                              | 106,852   | 85,744         | 12,538  | 710                          | 7,860                     |
| Educational attainment of mother: <sup>2</sup>           |           |                |         |                              |                           |
| 0–8 years                                                | 233,843   | 210,713        | 14,570  | 1,699                        | 6,861                     |
| 9–11 years                                               | 588,289   | 443,340        | 121,101 | 10,547                       | 13,301                    |
| 12 years                                                 | 1,162,705 | 879,196        | 221,000 | 15,925                       | 46,584                    |
| 13–15 years                                              | 811,986   | 629,733        | 132,461 | 8,563                        | 41,229                    |
| 16 years and over                                        | 1,012,739 | 837,728        | 75,614  | 3,393                        | 96,004                    |
| Not stated                                               | 53,996    | 40,205         | 9,042   | 543                          | 4,206                     |
| Live-birth order:                                        |           |                |         |                              |                           |
| 1                                                        | 1,634,003 | 1,288,693      | 226,482 | 15,238                       | 103,590                   |
| 2                                                        | 1,320,479 | 1,057,831      | 174,614 | 11,788                       | 76,246                    |
| 3                                                        | 684,299   | 544,266        | 105,790 | 7,738                        | 26,505                    |
| 4                                                        | 267,686   | 205,042        | 49,948  | 4,152                        | 8,544                     |
| 5 or more                                                | 171,560   | 121,347        | 40,693  | 3,978                        | 5,542                     |
| Not stated                                               | 11,980    | 8,711          | 2,333   | 160                          | 776                       |
| Marital status:                                          |           |                |         |                              |                           |
| Married                                                  | 2,673,979 | 2,278,856      | 190,518 | 16,651                       | 187,954                   |
| Unmarried                                                | 1,416,028 | 947,034        | 409,342 | 26,403                       | 33,249                    |
| Mother's place of birth:                                 |           |                |         |                              |                           |
| Born in the 50 States and DC                             | 3,109,555 | 2,519,779      | 511,863 | 40,529                       | 37,384                    |
| Born elsewhere                                           | 965,213   | 696,325        | 83,600  | 2,426                        | 182,862                   |
| Not stated                                               | 15,239    | 9,786          | 4,397   | 99                           | 957                       |
| Maternal smoking during pregnancy: <sup>2,3</sup>        |           |                |         |                              |                           |
| Smoker                                                   | 354,591   | 301,072        | 43,740  | 6,738                        | 3,041                     |
| Nonsmoker                                                | 2,948,501 | 2,285,705      | 495,373 | 30,448                       | 136,975                   |
| Not stated                                               | 19,469    | 15,764         | 2,326   | 568                          | 811                       |

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, 2003 linked file—Con.**

| Characteristics                                          | All races | Race of mother |               |                              |                           |
|----------------------------------------------------------|-----------|----------------|---------------|------------------------------|---------------------------|
|                                                          |           | White          | Black         | American Indian <sup>1</sup> | Asian or Pacific Islander |
|                                                          |           |                | Infant deaths |                              |                           |
| Total                                                    | 27,995    | 18,458         | 8,094         | 376                          | 1,068                     |
| Age at death:                                            |           |                |               |                              |                           |
| Total neonatal                                           | 18,935    | 12,457         | 5,530         | 196                          | 752                       |
| Early neonatal (less than 7 days)                        | 15,152    | 9,975          | 4,423         | 147                          | 607                       |
| Late neonatal (7–27 days)                                | 3,783     | 2,482          | 1,107         | 49                           | 145                       |
| Postneonatal                                             | 9,060     | 6,000          | 2,563         | 180                          | 316                       |
| Sex:                                                     |           |                |               |                              |                           |
| Male                                                     | 15,882    | 10,526         | 4,558         | 211                          | 588                       |
| Female                                                   | 12,113    | 7,931          | 3,536         | 165                          | 480                       |
| Plurality:                                               |           |                |               |                              |                           |
| Single births                                            | 23,770    | 15,544         | 6,947         | 352                          | 926                       |
| Plural births                                            | 4,225     | 2,913          | 1,147         | 23                           | 142                       |
| Birthweight:                                             |           |                |               |                              |                           |
| Less than 2,500 grams                                    | 19,223    | 12,097         | 6,191         | 194                          | 741                       |
| Less than 1,500 grams                                    | 15,247    | 9,271          | 5,253         | 145                          | 578                       |
| 1,500–2,499 grams                                        | 3,976     | 2,825          | 938           | 49                           | 163                       |
| 2,500 grams or more                                      | 8,603     | 6,251          | 1,848         | 180                          | 323                       |
| Not stated                                               | 169       | 110            | 54            | 1                            | 4                         |
| Period of gestation:                                     |           |                |               |                              |                           |
| Less than 32 weeks                                       | 14,990    | 9,116          | 5,180         | 149                          | 545                       |
| 32–36 weeks                                              | 3,579     | 2,554          | 808           | 56                           | 161                       |
| 37–41 weeks                                              | 7,961     | 5,743          | 1,765         | 150                          | 304                       |
| 42 weeks or more                                         | 744       | 536            | 170           | 15                           | 22                        |
| Not stated                                               | 721       | 509            | 171           | 5                            | 36                        |
| Trimester of pregnancy prenatal care began: <sup>2</sup> |           |                |               |                              |                           |
| First trimester                                          | 19,772    | 13,434         | 5,342         | 225                          | 771                       |
| After first trimester or no care                         | 5,408     | 3,161          | 1,944         | 118                          | 185                       |
| Second trimester                                         | 3,436     | 2,103          | 1,133         | 83                           | 116                       |
| Third trimester                                          | 628       | 398            | 197           | 10                           | 23                        |
| No prenatal care                                         | 1,344     | 660            | 614           | 24                           | 45                        |
| Not stated                                               | 1,445     | 889            | 480           | 12                           | 64                        |
| Age of mother:                                           |           |                |               |                              |                           |
| Under 20 years                                           | 4,304     | 2,618          | 1,529         | 74                           | 83                        |
| 20–24 years                                              | 7,954     | 5,091          | 2,542         | 121                          | 200                       |
| 25–29 years                                              | 6,484     | 4,341          | 1,799         | 94                           | 250                       |
| 30–34 years                                              | 5,481     | 3,799          | 1,321         | 48                           | 313                       |
| 35–39 years                                              | 2,853     | 1,962          | 693           | 28                           | 169                       |
| 40–54 years                                              | 919       | 648            | 209           | 10                           | 53                        |
| Educational attainment of mother: <sup>2</sup>           |           |                |               |                              |                           |
| 0–8 years                                                | 1,634     | 1,360          | 209           | 21                           | 44                        |
| 9–11 years                                               | 5,503     | 3,459          | 1,840         | 95                           | 108                       |
| 12 years                                                 | 8,903     | 5,524          | 2,954         | 143                          | 282                       |
| 13–15 years                                              | 5,045     | 3,225          | 1,580         | 55                           | 184                       |
| 16 years and over                                        | 4,296     | 3,150          | 772           | 27                           | 347                       |
| Not stated                                               | 1,244     | 765            | 411           | 13                           | 55                        |
| Live-birth order:                                        |           |                |               |                              |                           |
| 1                                                        | 11,163    | 7,502          | 3,033         | 125                          | 504                       |
| 2                                                        | 7,900     | 5,361          | 2,122         | 96                           | 321                       |
| 3                                                        | 4,665     | 3,069          | 1,401         | 66                           | 130                       |
| 4                                                        | 2,201     | 1,354          | 741           | 43                           | 63                        |
| 5 or more                                                | 1,763     | 976            | 699           | 46                           | 42                        |
| Not stated                                               | 302       | 196            | 97            | –                            | 8                         |
| Marital status:                                          |           |                |               |                              |                           |
| Married                                                  | 14,243    | 11,139         | 2,193         | 121                          | 790                       |
| Unmarried                                                | 13,752    | 7,319          | 5,900         | 255                          | 278                       |

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, 2003 linked file—Con.**

| Characteristics                                   | All races | Race of mother |       |                              |                           |
|---------------------------------------------------|-----------|----------------|-------|------------------------------|---------------------------|
|                                                   |           | White          | Black | American Indian <sup>1</sup> | Asian or Pacific Islander |
|                                                   |           |                |       |                              | Infant deaths             |
| Mother's place of birth:                          |           |                |       |                              |                           |
| Born in the 50 States and DC . . . . .            | 22,241    | 14,597         | 7,044 | 363                          | 236                       |
| Born elsewhere . . . . .                          | 5,027     | 3,428          | 775   | 11                           | 813                       |
| Not stated . . . . .                              | 727       | 433            | 275   | 1                            | 18                        |
| Maternal smoking during pregnancy: <sup>2,3</sup> |           |                |       |                              |                           |
| Smoker . . . . .                                  | 3,990     | 3,000          | 862   | 90                           | 38                        |
| Nonsmoker . . . . .                               | 19,444    | 12,045         | 6,463 | 239                          | 697                       |
| Not stated . . . . .                              | 384       | 278            | 93    | 7                            | 6                         |

\* Figure does not meet standards 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 Pennsylvania and Washington, which implemented the 2003 Revision to the U.S. Standard Certificate of Live Birth for data year 2003. This change has resulted in a lack of comparability between data based on the 2003 Revision and data based on the 1989 Revision to the U.S. Certificate of Live Birth; see "Technical Notes."

<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 group for rate computations. Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. In this table all women (including Hispanic women) are classified only according to their race. See reference 3.

**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, 2003 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 . . . . .                                                 | 6.84                     | 5.65     | 5.49    | 8.18         | 4.57   | 5.04                       | 6.66                       | 7.11               | 5.70   | 13.60  |
| Age at death:                                                   |                          |          |         |              |        |                            |                            |                    |        |        |
| Total neonatal . . . . .                                        | 4.63                     | 3.92     | 3.76    | 5.70         | 3.36   | 3.64                       | 4.74                       | 4.76               | 3.79   | 9.26   |
| Early neonatal (less than 7 days) . . . . .                     | 3.70                     | 3.14     | 3.00    | 4.64         | 2.56   | 2.96                       | 3.94                       | 3.80               | 3.02   | 7.39   |
| Late neonatal (7–27 days) . . . . .                             | 0.92                     | 0.77     | 0.77    | 1.06         | *      | 0.69                       | 0.80                       | 0.96               | 0.77   | 1.88   |
| Postneonatal . . . . .                                          | 2.22                     | 1.73     | 1.73    | 2.48         | *      | 1.39                       | 1.92                       | 2.35               | 1.91   | 4.34   |
| Sex:                                                            |                          |          |         |              |        |                            |                            |                    |        |        |
| Male . . . . .                                                  | 7.59                     | 6.21     | 6.03    | 9.22         | 4.89   | 5.60                       | 7.10                       | 7.90               | 6.37   | 15.05  |
| Female . . . . .                                                | 6.07                     | 5.06     | 4.94    | 7.10         | 4.24   | 4.45                       | 6.19                       | 6.29               | 4.99   | 12.10  |
| Plurality:                                                      |                          |          |         |              |        |                            |                            |                    |        |        |
| Single births . . . . .                                         | 6.01                     | 5.11     | 5.02    | 7.11         | 3.62   | 4.47                       | 6.12                       | 6.21               | 4.89   | 12.10  |
| Plural births . . . . .                                         | 30.99                    | 29.28    | 28.06   | 42.76        | *      | 27.74                      | 26.28                      | 31.01              | 26.21  | 54.12  |
| Birthweight:                                                    |                          |          |         |              |        |                            |                            |                    |        |        |
| Less than 2,500 grams . . . . .                                 | 59.04                    | 57.47    | 58.28   | 59.04        | 52.53  | 53.23                      | 57.79                      | 58.73              | 52.02  | 76.46  |
| Less than 1,500 grams . . . . .                                 | 252.00                   | 255.82   | 259.14  | 247.26       | 210.78 | 243.72                     | 279.07                     | 248.67             | 231.69 | 276.92 |
| 1,500–2,499 grams . . . . .                                     | 15.00                    | 15.28    | 16.45   | 11.34        | *      | 12.80                      | 14.55                      | 14.85              | 15.10  | 15.16  |
| 2,500 grams or more . . . . .                                   | 2.29                     | 1.89     | 1.91    | 2.46         | *      | 1.57                       | 2.13                       | 2.40               | 2.15   | 3.60   |
| Period of gestation:                                            |                          |          |         |              |        |                            |                            |                    |        |        |
| Less than 32 weeks . . . . .                                    | 188.24                   | 169.04   | 165.06  | 190.19       | 167.91 | 170.48                     | 176.85                     | 190.82             | 175.45 | 219.63 |
| 32–36 weeks . . . . .                                           | 8.53                     | 7.58     | 7.74    | 9.31         | *      | 6.37                       | 6.60                       | 8.78               | 8.35   | 9.96   |
| 37–41 weeks . . . . .                                           | 2.42                     | 2.01     | 2.03    | 2.46         | *      | 1.71                       | 2.32                       | 2.53               | 2.26   | 3.92   |
| 42 weeks or more . . . . .                                      | 2.88                     | 2.48     | 2.59    | *            | *      | 2.27                       | *                          | 3.00               | 2.64   | 4.82   |
| Trimester of pregnancy prenatal care began: <sup>3</sup>        |                          |          |         |              |        |                            |                            |                    |        |        |
| First trimester . . . . .                                       | 6.20                     | 5.30     | 5.23    | 7.56         | 4.18   | 4.77                       | 5.66                       | 6.42               | 5.22   | 12.68  |
| After first trimester or no care . . . . .                      | 8.96                     | 6.17     | 6.01    | 9.78         | *      | 5.37                       | 7.12                       | 10.22              | 8.35   | 14.51  |
| Second trimester . . . . .                                      | 7.32                     | 5.36     | 5.25    | 7.41         | *      | 4.81                       | 6.05                       | 8.20               | 6.98   | 11.21  |
| Third trimester . . . . .                                       | 6.64                     | 4.41     | 4.43    | *            | *      | 4.09                       | *                          | 7.77               | 7.62   | 9.13   |
| No prenatal care . . . . .                                      | 34.06                    | 19.25    | 17.11   | 54.87        | *      | 19.84                      | *                          | 41.65              | 31.32  | 53.72  |
| Age of mother:                                                  |                          |          |         |              |        |                            |                            |                    |        |        |
| Under 20 years . . . . .                                        | 10.22                    | 6.77     | 6.42    | 10.93        | *      | 6.12                       | 6.70                       | 11.67              | 10.02  | 14.72  |
| 20–24 years . . . . .                                           | 7.70                     | 5.46     | 5.26    | 6.95         | *      | 5.24                       | 6.83                       | 8.44               | 6.87   | 13.08  |
| 25–29 years . . . . .                                           | 5.97                     | 4.97     | 4.83    | 7.98         | *      | 4.42                       | 5.73                       | 6.19               | 4.93   | 13.06  |
| 30–34 years . . . . .                                           | 5.62                     | 5.42     | 5.37    | 7.42         | *      | 4.83                       | 7.02                       | 5.59               | 4.56   | 13.64  |
| 35–39 years . . . . .                                           | 6.10                     | 6.28     | 6.32    | 8.42         | *      | 5.65                       | 6.82                       | 5.98               | 4.82   | 14.10  |
| 40–54 years . . . . .                                           | 8.60                     | 9.10     | 10.00   | *            | *      | 5.55                       | *                          | 8.34               | 7.12   | 16.45  |
| Educational attainment of mother: <sup>3</sup>                  |                          |          |         |              |        |                            |                            |                    |        |        |
| 0–8 years . . . . .                                             | 6.99                     | 5.61     | 5.44    | 11.92        | *      | 5.83                       | 7.34                       | 11.29              | 10.61  | 15.51  |
| 9–11 years . . . . .                                            | 9.35                     | 5.92     | 5.71    | 9.74         | *      | 5.45                       | 5.80                       | 11.62              | 9.85   | 15.38  |
| 12 years . . . . .                                              | 7.66                     | 5.52     | 5.39    | 7.78         | 4.62   | 5.30                       | 5.31                       | 8.28               | 6.62   | 13.50  |
| 13–15 years . . . . .                                           | 6.21                     | 5.11     | 5.21    | 6.97         | *      | 3.78                       | 5.66                       | 6.40               | 5.16   | 12.04  |
| 16 years and over . . . . .                                     | 4.24                     | 4.40     | 4.17    | 5.67         | 5.04   | 4.06                       | 4.90                       | 4.22               | 3.71   | 10.20  |
| Live-birth order:                                               |                          |          |         |              |        |                            |                            |                    |        |        |
| 1 . . . . .                                                     | 6.83                     | 5.88     | 5.65    | 8.34         | 4.16   | 5.51                       | 7.40                       | 7.00               | 5.76   | 13.49  |
| 2 . . . . .                                                     | 5.98                     | 4.98     | 4.93    | 6.60         | 4.35   | 4.47                       | 5.32                       | 6.21               | 5.07   | 12.33  |
| 3 . . . . .                                                     | 6.82                     | 5.24     | 5.18    | 8.51         | *      | 4.23                       | 5.02                       | 7.32               | 5.81   | 13.36  |
| 4 . . . . .                                                     | 8.22                     | 6.12     | 5.78    | 9.15         | *      | 5.48                       | 10.21                      | 9.00               | 6.84   | 14.96  |
| 5 or more . . . . .                                             | 10.28                    | 7.97     | 7.65    | 13.86        | *      | 7.00                       | *                          | 11.15              | 8.08   | 17.31  |
| Marital status:                                                 |                          |          |         |              |        |                            |                            |                    |        |        |
| Married . . . . .                                               | 5.33                     | 5.13     | 5.07    | 7.46         | 3.92   | 4.73                       | 5.51                       | 5.31               | 4.78   | 11.61  |
| Unmarried . . . . .                                             | 9.71                     | 6.28     | 6.04    | 8.64         | 6.00   | 5.42                       | 7.96                       | 11.00              | 8.66   | 14.52  |
| Mother's place of birth:                                        |                          |          |         |              |        |                            |                            |                    |        |        |
| Born in the 50 States and DC . . . . .                          | 7.15                     | 6.41     | 6.20    | 8.20         | 5.28   | 5.84                       | 6.37                       | 7.21               | 5.69   | 13.81  |
| Born elsewhere . . . . .                                        | 5.21                     | 5.08     | 5.03    | 7.94         | 3.96   | 4.92                       | 4.51                       | 5.33               | 4.36   | 9.59   |
| Maternal smoking during pregnancy: <sup>3,4</sup>               |                          |          |         |              |        |                            |                            |                    |        |        |
| Smoker . . . . .                                                | 11.25                    | 11.77    | 11.18   | 13.29        | *      | *                          | 13.76                      | 11.21              | 9.87   | 19.74  |
| Nonsmoker . . . . .                                             | 6.59                     | 5.73     | 5.58    | 7.77         | 4.79   | 5.26                       | 6.40                       | 6.79               | 5.11   | 13.19  |

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, 2003 linked file—Con.**

| 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   | Not stated |
| Live births                                              |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Total . . . . .                                          | 4,090,007                | 912,331  | 654,507 | 58,400       | 14,867 | 135,585                    | 48,972                     | 3,149,067          | 2,321,921 | 576,047 | 28,609     |
| Sex:                                                     |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Male . . . . .                                           | 2,093,564                | 465,230  | 333,692 | 29,817       | 7,560  | 69,246                     | 24,915                     | 1,613,723          | 1,191,196 | 293,061 | 14,611     |
| Female . . . . .                                         | 1,996,443                | 447,101  | 320,815 | 28,583       | 7,307  | 66,339                     | 24,057                     | 1,535,344          | 1,130,725 | 282,986 | 13,998     |
| Plurality:                                               |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Single births . . . . .                                  | 3,953,667                | 892,075  | 641,073 | 56,646       | 14,374 | 132,304                    | 47,678                     | 3,034,153          | 2,234,299 | 555,406 | 27,439     |
| Plural births . . . . .                                  | 136,340                  | 20,256   | 13,434  | 1,754        | 493    | 3,281                      | 1,294                      | 114,914            | 87,622    | 20,641  | 1,170      |
| Birthweight:                                             |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Less than 2,500 grams . . . . .                          | 325,619                  | 61,212   | 41,268  | 5,860        | 1,047  | 9,092                      | 3,945                      | 261,875            | 164,033   | 78,445  | 2,532      |
| Less than 1,500 grams . . . . .                          | 60,505                   | 10,738   | 7,112   | 1,185        | 204    | 1,592                      | 645                        | 49,146             | 27,964    | 18,370  | 621        |
| 1,500–2,499 grams . . . . .                              | 265,114                  | 50,474   | 34,156  | 4,675        | 843    | 7,500                      | 3,300                      | 212,729            | 136,069   | 60,075  | 1,911      |
| 2,500 grams or more . . . . .                            | 3,763,758                | 851,069  | 613,206 | 52,534       | 13,820 | 126,489                    | 45,020                     | 2,886,805          | 2,157,621 | 497,506 | 25,884     |
| Not stated . . . . .                                     | 630                      | 50       | 33      | 6            | *      | 4                          | 7                          | 387                | 267       | 96      | 193        |
| Period of gestation:                                     |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Less than 32 weeks . . . . .                             | 79,633                   | 15,405   | 10,487  | 1,488        | 268    | 2,229                      | 933                        | 63,501             | 36,905    | 22,848  | 727        |
| 32–36 weeks . . . . .                                    | 419,402                  | 90,283   | 64,066  | 6,551        | 1,483  | 13,029                     | 5,154                      | 326,344            | 224,058   | 79,146  | 2,775      |
| 37–41 weeks . . . . .                                    | 3,288,550                | 721,266  | 515,224 | 46,009       | 12,172 | 109,061                    | 38,800                     | 2,545,085          | 1,904,576 | 435,340 | 22,199     |
| 42 weeks or more . . . . .                               | 258,553                  | 63,292   | 45,575  | 4,109        | 897    | 9,256                      | 3,455                      | 193,615            | 144,119   | 34,670  | 1,646      |
| Not stated . . . . .                                     | 43,869                   | 22,085   | 19,155  | 243          | 47     | 2,010                      | 630                        | 20,522             | 12,263    | 4,043   | 1,262      |
| Trimester of pregnancy prenatal care began: <sup>3</sup> |                          |          |         |              |        |                            |                            |                    |           |         |            |
| First trimester . . . . .                                | 3,189,811                | 673,272  | 479,633 | 41,517       | 13,388 | 103,926                    | 34,808                     | 2,498,043          | 1,892,780 | 411,017 | 18,496     |
| After first trimester or no care . . . . .               | 603,714                  | 195,976  | 147,450 | 9,607        | 1,156  | 27,370                     | 10,393                     | 403,946            | 235,029   | 130,237 | 3,792      |
| Second trimester . . . . .                               | 469,651                  | 150,082  | 112,275 | 7,690        | 970    | 21,217                     | 7,930                      | 317,105            | 189,307   | 97,827  | 2,464      |
| Third trimester . . . . .                                | 94,603                   | 32,179   | 24,127  | 1,352        | 120    | 4,893                      | 1,687                      | 61,655             | 33,333    | 21,259  | 769        |
| No prenatal care . . . . .                               | 39,460                   | 13,715   | 11,048  | 565          | 66     | 1,260                      | 776                        | 25,186             | 12,389    | 11,151  | 559        |
| Not stated . . . . .                                     | 70,033                   | 18,931   | 14,026  | 1,291        | 112    | 2,106                      | 1,396                      | 48,851             | 31,005    | 12,746  | 2,251      |
| Age of mother:                                           |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Under 20 years . . . . .                                 | 421,254                  | 130,880  | 100,238 | 10,430       | 1,177  | 11,271                     | 7,764                      | 287,870            | 174,023   | 100,157 | 2,504      |
| 20–24 years . . . . .                                    | 1,032,325                | 273,311  | 203,315 | 19,004       | 2,608  | 33,587                     | 14,797                     | 752,619            | 522,283   | 189,023 | 6,395      |
| 25–29 years . . . . .                                    | 1,086,375                | 246,362  | 177,500 | 14,169       | 3,966  | 38,505                     | 12,222                     | 832,788            | 627,438   | 133,824 | 7,225      |
| 30–34 years . . . . .                                    | 975,555                  | 169,055  | 115,034 | 9,301        | 4,298  | 31,448                     | 8,974                      | 799,183            | 626,318   | 93,347  | 7,317      |
| 35–39 years . . . . .                                    | 467,646                  | 75,801   | 48,120  | 4,515        | 2,283  | 16,629                     | 4,254                      | 387,808            | 303,355   | 47,661  | 4,037      |
| 40–54 years . . . . .                                    | 106,852                  | 16,922   | 10,300  | 981          | 535    | 4,145                      | 961                        | 88,799             | 68,504    | 12,035  | 1,131      |
| Educational attainment of mother: <sup>3</sup>           |                          |          |         |              |        |                            |                            |                    |           |         |            |
| 0–8 years . . . . .                                      | 233,843                  | 179,656  | 149,187 | 1,929        | 179    | 24,683                     | 3,678                      | 53,298             | 33,456    | 12,377  | 889        |
| 9–11 years . . . . .                                     | 588,289                  | 234,794  | 188,165 | 13,651       | 1,505  | 21,466                     | 10,007                     | 351,378            | 212,023   | 117,282 | 2,117      |
| 12 years . . . . .                                       | 1,162,705                | 263,657  | 183,953 | 17,730       | 5,194  | 40,777                     | 16,003                     | 893,848            | 620,665   | 214,314 | 5,200      |
| 13–15 years . . . . .                                    | 811,986                  | 118,462  | 71,044  | 12,058       | 3,153  | 23,021                     | 9,186                      | 689,988            | 513,666   | 128,458 | 3,536      |
| 16 years and over . . . . .                              | 1,012,739                | 75,687   | 36,969  | 6,700        | 4,562  | 20,932                     | 6,524                      | 932,036            | 760,504   | 73,397  | 5,016      |
| Not stated . . . . .                                     | 53,996                   | 15,923   | 11,791  | 347          | 63     | 2,523                      | 1,199                      | 30,292             | 18,500    | 8,172   | 7,781      |
| Live-birth order:                                        |                          |          |         |              |        |                            |                            |                    |           |         |            |
| 1 . . . . .                                              | 1,634,003                | 330,033  | 227,448 | 22,913       | 6,969  | 53,522                     | 19,181                     | 1,292,851          | 961,903   | 217,196 | 11,119     |
| 2 . . . . .                                              | 1,320,479                | 280,461  | 198,082 | 18,020       | 5,283  | 43,848                     | 15,228                     | 1,031,631          | 780,028   | 167,442 | 8,387      |
| 3 . . . . .                                              | 684,299                  | 175,225  | 130,702 | 10,222       | 1,885  | 23,856                     | 8,560                      | 504,735            | 370,972   | 101,659 | 4,339      |
| 4 . . . . .                                              | 267,686                  | 76,317   | 58,997  | 4,262        | 493    | 8,940                      | 3,625                      | 189,498            | 129,617   | 48,204  | 1,871      |
| 5 or more . . . . .                                      | 171,560                  | 47,922   | 37,638  | 2,814        | 219    | 5,140                      | 2,111                      | 122,125            | 73,900    | 39,526  | 1,513      |
| Not stated . . . . .                                     | 11,980                   | 2,373    | 1,640   | 169          | 18     | 279                        | 267                        | 8,227              | 5,501     | 2,020   | 1,380      |
| Marital status:                                          |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Married . . . . .                                        | 2,673,979                | 501,709  | 368,763 | 23,461       | 10,200 | 73,168                     | 26,117                     | 2,153,458          | 1,774,925 | 181,206 | 18,812     |
| Unmarried . . . . .                                      | 1,416,028                | 410,622  | 285,744 | 34,939       | 4,667  | 62,417                     | 22,855                     | 995,609            | 546,996   | 394,841 | 9,797      |
| Mother's place of birth:                                 |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Born in the 50 States and DC . . . . .                   | 3,109,555                | 334,095  | 236,685 | 38,639       | 7,013  | 16,430                     | 35,328                     | 2,753,747          | 2,181,598 | 501,663 | 21,713     |
| Born elsewhere . . . . .                                 | 965,213                  | 576,245  | 416,948 | 19,399       | 7,838  | 118,976                    | 13,084                     | 383,605            | 133,209   | 70,707  | 5,363      |
| Not stated . . . . .                                     | 15,239                   | 1,991    | 874     | 362          | 16     | 179                        | 560                        | 11,715             | 7,114     | 3,677   | 1,533      |
| Maternal smoking during pregnancy: <sup>3,4</sup>        |                          |          |         |              |        |                            |                            |                    |           |         |            |
| Smoker . . . . .                                         | 354,591                  | 16,401   | 8,231   | 3,989        | 334    | 1,158                      | 2,689                      | 335,799            | 283,666   | 43,069  | 2,391      |
| Nonsmoker . . . . .                                      | 2,948,501                | 599,699  | 395,288 | 46,318       | 13,574 | 106,398                    | 38,121                     | 2,333,599          | 1,695,785 | 477,863 | 15,203     |
| Not stated . . . . .                                     | 19,469                   | 2,374    | 1,615   | 133          | 19     | 269                        | 338                        | 15,975             | 12,599    | 2,143   | 1,120      |

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, 2003 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 . . . . .                                          | 27,995                   | 5,151    | 3,595   | 478          | 68    | 684                        | 326                        | 22,396             | 13,228 | 7,836 | 448        |
| Age at death:                                            |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Total neonatal . . . . .                                 | 18,935                   | 3,572    | 2,463   | 333          | 50    | 494                        | 232                        | 14,994             | 8,798  | 5,336 | 368        |
| Early neonatal (less than 7 days) . . . . .              | 15,152                   | 2,865    | 1,962   | 271          | 38    | 401                        | 193                        | 11,956             | 7,021  | 4,255 | 331        |
| Late neonatal (7–27 days) . . . . .                      | 3,783                    | 707      | 501     | 62           | 12    | 93                         | 39                         | 3,038              | 1,777  | 1,081 | 37         |
| Postneonatal . . . . .                                   | 9,060                    | 1,579    | 1,133   | 145          | 18    | 189                        | 94                         | 7,402              | 4,431  | 2,501 | 80         |
| Sex:                                                     |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Male . . . . .                                           | 15,882                   | 2,889    | 2,012   | 275          | 37    | 388                        | 177                        | 12,746             | 7,589  | 4,412 | 247        |
| Female . . . . .                                         | 12,113                   | 2,262    | 1,584   | 203          | 31    | 295                        | 149                        | 9,650              | 5,639  | 3,424 | 201        |
| Plurality:                                               |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Single births . . . . .                                  | 23,770                   | 4,558    | 3,219   | 403          | 52    | 592                        | 292                        | 18,832             | 10,932 | 6,719 | 380        |
| Plural births . . . . .                                  | 4,225                    | 593      | 377     | 75           | 16    | 91                         | 34                         | 3,564              | 2,297  | 1,117 | 68         |
| Birthweight:                                             |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Less than 2,500 grams . . . . .                          | 19,223                   | 3,518    | 2,405   | 346          | 55    | 484                        | 228                        | 15,381             | 8,533  | 5,998 | 323        |
| Less than 1,500 grams . . . . .                          | 15,247                   | 2,747    | 1,843   | 293          | 43    | 388                        | 180                        | 12,221             | 6,479  | 5,087 | 279        |
| 1,500–2,499 grams . . . . .                              | 3,976                    | 771      | 562     | 53           | 12    | 96                         | 48                         | 3,160              | 2,054  | 911   | 44         |
| 2,500 grams or more . . . . .                            | 8,603                    | 1,606    | 1,171   | 129          | 13    | 198                        | 96                         | 6,916              | 4,643  | 1,793 | 81         |
| Not stated . . . . .                                     | 169                      | 26       | 19      | 3            | *     | 2                          | 2                          | 100                | 52     | 45    | 43         |
| Period of gestation:                                     |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Less than 32 weeks . . . . .                             | 14,990                   | 2,604    | 1,731   | 283          | 45    | 380                        | 165                        | 12,117             | 6,475  | 5,018 | 269        |
| 32–36 weeks . . . . .                                    | 3,579                    | 684      | 496     | 61           | 9     | 83                         | 34                         | 2,864              | 1,870  | 788   | 30         |
| 37–41 weeks . . . . .                                    | 7,961                    | 1,447    | 1,046   | 113          | 13    | 186                        | 90                         | 6,441              | 4,302  | 1,708 | 74         |
| 42 weeks or more . . . . .                               | 744                      | 157      | 118     | 13           | 1     | 21                         | 4                          | 580                | 380    | 167   | 7          |
| Not stated . . . . .                                     | 721                      | 259      | 204     | 8            | *     | 14                         | 32                         | 394                | 202    | 156   | 68         |
| Trimester of pregnancy prenatal care began: <sup>3</sup> |                          |          |         |              |       |                            |                            |                    |        |       |            |
| First trimester . . . . .                                | 19,772                   | 3,570    | 2,507   | 314          | 56    | 496                        | 197                        | 16,037             | 9,881  | 5,213 | 165        |
| After first trimester or no care . . . . .               | 5,408                    | 1,210    | 886     | 94           | 10    | 147                        | 74                         | 4,128              | 1,963  | 1,890 | 69         |
| Second trimester . . . . .                               | 3,436                    | 804      | 590     | 57           | 8     | 102                        | 48                         | 2,600              | 1,321  | 1,097 | 31         |
| Third trimester . . . . .                                | 628                      | 142      | 107     | 6            | *     | 20                         | 9                          | 479                | 254    | 194   | 7          |
| No prenatal care . . . . .                               | 1,344                    | 264      | 189     | 31           | 2     | 25                         | 17                         | 1,049              | 388    | 599   | 31         |
| Not stated . . . . .                                     | 1,445                    | 235      | 139     | 20           | 2     | 27                         | 46                         | 1,108              | 573    | 465   | 103        |
| Age of mother:                                           |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Under 20 years . . . . .                                 | 4,304                    | 886      | 644     | 114          | 8     | 69                         | 52                         | 3,360              | 1,744  | 1,474 | 58         |
| 20–24 years . . . . .                                    | 7,954                    | 1,493    | 1,069   | 132          | 15    | 176                        | 101                        | 6,352              | 3,589  | 2,473 | 108        |
| 25–29 years . . . . .                                    | 6,484                    | 1,225    | 858     | 113          | 15    | 170                        | 70                         | 5,159              | 3,091  | 1,748 | 100        |
| 30–34 years . . . . .                                    | 5,481                    | 917      | 618     | 69           | 16    | 152                        | 63                         | 4,464              | 2,854  | 1,273 | 99         |
| 35–39 years . . . . .                                    | 2,853                    | 476      | 304     | 38           | 10    | 94                         | 29                         | 2,319              | 1,462  | 672   | 58         |
| 40–54 years . . . . .                                    | 919                      | 154      | 103     | 12           | 4     | 23                         | 11                         | 741                | 488    | 198   | 24         |
| Educational attainment of mother: <sup>3</sup>           |                          |          |         |              |       |                            |                            |                    |        |       |            |
| 0–8 years . . . . .                                      | 1,634                    | 1,007    | 812     | 23           | *     | 144                        | 27                         | 602                | 355    | 192   | 26         |
| 9–11 years . . . . .                                     | 5,503                    | 1,391    | 1,074   | 133          | 9     | 117                        | 58                         | 4,083              | 2,088  | 1,804 | 29         |
| 12 years . . . . .                                       | 8,903                    | 1,456    | 992     | 138          | 24    | 216                        | 85                         | 7,402              | 4,109  | 2,894 | 45         |
| 13–15 years . . . . .                                    | 5,045                    | 605      | 370     | 84           | 12    | 87                         | 52                         | 4,419              | 2,649  | 1,547 | 21         |
| 16 years and over . . . . .                              | 4,296                    | 333      | 154     | 38           | 23    | 85                         | 32                         | 3,936              | 2,820  | 749   | 27         |
| Not stated . . . . .                                     | 1,244                    | 224      | 128     | 12           | *     | 22                         | 62                         | 831                | 395    | 382   | 190        |
| Live-birth order:                                        |                          |          |         |              |       |                            |                            |                    |        |       |            |
| 1 . . . . .                                              | 11,163                   | 1,941    | 1,284   | 191          | 29    | 295                        | 142                        | 9,053              | 5,545  | 2,929 | 170        |
| 2 . . . . .                                              | 7,900                    | 1,396    | 977     | 119          | 23    | 196                        | 81                         | 6,406              | 3,956  | 2,064 | 98         |
| 3 . . . . .                                              | 4,665                    | 919      | 677     | 87           | 12    | 101                        | 43                         | 3,696              | 2,157  | 1,358 | 50         |
| 4 . . . . .                                              | 2,201                    | 467      | 341     | 39           | 2     | 49                         | 37                         | 1,706              | 886    | 721   | 27         |
| 5 or more . . . . .                                      | 1,763                    | 382      | 288     | 39           | 2     | 36                         | 16                         | 1,362              | 597    | 684   | 20         |
| Not stated . . . . .                                     | 302                      | 46       | 29      | 2            | *     | 7                          | 8                          | 173                | 88     | 81    | 82         |
| Marital status:                                          |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Married . . . . .                                        | 14,243                   | 2,574    | 1,868   | 175          | 40    | 346                        | 144                        | 11,445             | 8,489  | 2,103 | 224        |
| Unmarried . . . . .                                      | 13,752                   | 2,577    | 1,727   | 302          | 28    | 338                        | 182                        | 10,951             | 4,739  | 5,733 | 223        |

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, 2003 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 DC . . . . .            | 22,241                   | 2,143    | 1,468   | 317          | 37    | 96                         | 225                        | 19,868             | 12,406 | 6,928 | 230        |
| Born elsewhere . . . . .                          | 5,027                    | 2,928    | 2,099   | 154          | 31    | 585                        | 59                         | 2,044              | 581    | 678   | 55         |
| Not stated . . . . .                              | 727                      | 80       | 28      | 7            | *     | 3                          | 42                         | 485                | 241    | 230   | 162        |
| Maternal smoking during pregnancy: <sup>3,4</sup> |                          |          |         |              |       |                            |                            |                    |        |       |            |
| Smoker . . . . .                                  | 3,990                    | 193      | 92      | 53           | 3     | 8                          | 37                         | 3,764              | 2,800  | 850   | 32         |
| Nonsmoker . . . . .                               | 19,444                   | 3,434    | 2,206   | 360          | 65    | 560                        | 244                        | 15,853             | 8,671  | 6,302 | 158        |
| Not stated . . . . .                              | 384                      | 31       | 17      | 5            | *     | 4                          | 5                          | 277                | 183    | 83    | 75         |

\* Figure does not meet standards 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 Pennsylvania and Washington, which implemented the 2003 Revision to the U.S. Standard Certificate of Live Birth for data year 2003. This change has resulted in a lack of comparability between data based on the 2003 Revision and data based on the 1989 Revision to the U.S. Certificate of Live Birth; see "Technical Notes."

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

NOTES: 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. Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.

**Table 3. Infant mortality rates by race and Hispanic origin of mother: United States and each State, Puerto Rico, Virgin Islands, and Guam, 2001–2003 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 or 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>                                      | 6.88  | 5.74                               | 13.55 | 9.00                         | 4.78                      | 5.57            | 5.74               | 13.65              |
| Alabama                                                         | 9.04  | 6.74                               | 14.09 | *                            | *                         | 7.00            | 6.71               | 14.09              |
| Alaska                                                          | 6.80  | 5.40                               | *     | 10.58                        | *                         | *               | 5.06               | *                  |
| Arizona                                                         | 6.62  | 6.13                               | 13.74 | 9.68                         | 6.21                      | 6.17            | 6.10               | 13.81              |
| Arkansas                                                        | 8.46  | 7.35                               | 13.08 | *                            | *                         | 5.27            | 7.63               | 13.08              |
| California                                                      | 5.32  | 5.00                               | 11.15 | 7.34                         | 4.34                      | 5.08            | 4.67               | 11.13              |
| Colorado                                                        | 5.98  | 5.50                               | 14.55 | *                            | 6.68                      | 6.31            | 5.16               | 14.24              |
| Connecticut                                                     | 5.95  | 5.04                               | 13.23 | *                            | *                         | 6.34            | 4.63               | 13.58              |
| Delaware                                                        | 9.53  | 7.48                               | 16.34 | *                            | *                         | 6.88            | 7.57               | 16.43              |
| District of Columbia                                            | 10.94 | 4.79                               | 14.42 | *                            | *                         | 7.18            | 3.82               | 14.81              |
| Florida                                                         | 7.42  | 5.72                               | 13.27 | 7.38                         | 5.14                      | 5.29            | 5.85               | 13.31              |
| Georgia                                                         | 8.66  | 6.36                               | 13.50 | *                            | 6.54                      | 6.41            | 6.34               | 13.46              |
| Hawaii                                                          | 7.05  | 5.71                               | *     | *                            | 7.34                      | 6.77            | 5.32               | *                  |
| Idaho                                                           | 6.21  | 6.19                               | *     | *                            | *                         | 6.98            | 5.99               | *                  |
| Illinois                                                        | 7.58  | 5.90                               | 15.50 | *                            | 5.42                      | 5.86            | 5.93               | 15.52              |
| Indiana                                                         | 7.66  | 6.94                               | 13.83 | *                            | *                         | 6.44            | 6.99               | 13.84              |
| Iowa                                                            | 5.56  | 5.35                               | 12.08 | *                            | *                         | 6.45            | 5.25               | 12.31              |
| Kansas                                                          | 7.07  | 6.44                               | 15.71 | *                            | *                         | 7.31            | 6.32               | 15.81              |
| Kentucky                                                        | 6.62  | 6.29                               | 10.01 | *                            | *                         | 4.92            | 6.34               | 10.07              |
| Louisiana                                                       | 9.83  | 6.87                               | 13.94 | *                            | 9.85                      | 4.48            | 6.97               | 13.92              |
| Maine                                                           | 5.17  | 5.11                               | *     | *                            | *                         | *               | 5.12               | *                  |
| Maryland                                                        | 7.96  | 5.48                               | 13.09 | *                            | 4.33                      | 6.04            | 5.40               | 13.21              |
| Massachusetts                                                   | 4.86  | 4.40                               | 9.49  | *                            | 3.40                      | 6.27            | 4.01               | 10.18              |
| Michigan                                                        | 8.23  | 6.49                               | 16.77 | *                            | 5.19                      | 7.29            | 6.35               | 16.71              |
| Minnesota                                                       | 5.12  | 4.67                               | 8.82  | 9.82                         | 5.48                      | 5.67            | 4.55               | 8.39               |
| Mississippi                                                     | 10.53 | 7.13                               | 14.77 | *                            | *                         | *               | 7.14               | 14.72              |
| Missouri                                                        | 7.91  | 6.56                               | 15.69 | *                            | 6.22                      | 7.01            | 6.52               | 15.75              |
| Montana                                                         | 7.33  | 7.00                               | *     | 9.42                         | *                         | *               | 6.86               | *                  |
| Nebraska                                                        | 6.41  | 5.78                               | 14.94 | *                            | *                         | 6.18            | 5.59               | 15.18              |
| Nevada                                                          | 5.80  | 5.14                               | 12.78 | *                            | 4.26                      | 4.44            | 5.40               | 12.81              |
| New Hampshire                                                   | 4.33  | 4.32                               | *     | *                            | *                         | *               | 4.20               | *                  |
| New Jersey                                                      | 5.91  | 4.61                               | 12.45 | *                            | 3.73                      | 6.06            | 3.92               | 13.08              |
| New Mexico                                                      | 6.07  | 5.98                               | *     | 6.00                         | *                         | 5.89            | 6.09               | *                  |
| New York                                                        | 5.98  | 4.91                               | 10.85 | 11.91                        | 3.38                      | 5.55            | 4.63               | 11.22              |
| North Carolina                                                  | 8.30  | 6.15                               | 15.13 | 11.05                        | 4.78                      | 6.07            | 6.15               | 15.12              |
| North Dakota                                                    | 7.48  | 6.93                               | *     | 11.40                        | *                         | *               | 6.84               | *                  |
| Ohio                                                            | 7.78  | 6.43                               | 15.48 | *                            | 5.11                      | 8.22            | 6.33               | 15.41              |
| Oklahoma                                                        | 7.76  | 7.11                               | 14.41 | 7.37                         | *                         | 5.62            | 7.19               | 14.25              |
| Oregon                                                          | 5.56  | 5.45                               | 9.30  | 8.93                         | 4.72                      | 4.72            | 5.61               | 9.35               |
| Pennsylvania                                                    | 7.39  | 6.30                               | 14.25 | *                            | 4.02                      | 7.97            | 5.97               | 14.11              |
| Rhode Island                                                    | 6.88  | 6.31                               | 11.14 | *                            | *                         | 8.75            | 5.30               | 11.84              |
| South Carolina                                                  | 8.88  | 6.01                               | 14.49 | *                            | 7.85                      | 5.30            | 6.09               | 14.52              |
| South Dakota                                                    | 6.86  | 5.76                               | *     | 12.65                        | *                         | *               | 5.75               | *                  |
| Tennessee                                                       | 9.08  | 7.02                               | 16.90 | *                            | 6.41                      | 6.61            | 7.06               | 16.87              |
| Texas                                                           | 6.24  | 5.57                               | 11.98 | *                            | 4.38                      | 5.38            | 5.70               | 11.94              |
| Utah                                                            | 5.16  | 5.01                               | *     | *                            | 7.95                      | 6.40            | 4.76               | *                  |
| Vermont                                                         | 5.07  | 5.14                               | *     | *                            | *                         | *               | 5.03               | *                  |
| Virginia                                                        | 7.51  | 5.67                               | 14.04 | *                            | 5.03                      | 4.89            | 5.74               | 14.15              |
| Washington                                                      | 5.68  | 5.42                               | 9.72  | 10.62                        | 4.72                      | 5.15            | 5.33               | 9.45               |
| West Virginia                                                   | 7.91  | 7.73                               | 12.85 | *                            | *                         | *               | 7.65               | 12.47              |
| Wisconsin                                                       | 6.83  | 5.57                               | 17.46 | 12.66                        | 6.64                      | 6.90            | 5.47               | 17.48              |
| Wyoming                                                         | 6.05  | 5.79                               | *     | *                            | *                         | *               | 5.64               | *                  |
| Puerto Rico                                                     | 9.43  | 9.28                               | 10.86 | ---                          | ---                       | ---             | ---                | ---                |
| Virgin Islands                                                  | 5.80  | *                                  | *     | *                            | *                         | *               | *                  | *                  |
| Guam                                                            | 9.12  | *                                  | *     | *                            | 9.39                      | *               | *                  | *                  |

\* Figure does not meet standards 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.

NOTES: Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.

**Table 4. Percent of live births with selected maternal and infant characteristics by race of mother: United States, 2003 linked file**

| Characteristic                                                        | All races | White | Black | American Indian <sup>1</sup> | Asian or Pacific Islander |
|-----------------------------------------------------------------------|-----------|-------|-------|------------------------------|---------------------------|
| Birthweight:                                                          |           |       |       |                              |                           |
| Less than 1,500 grams . . . . .                                       | 1.5       | 1.2   | 3.2   | 1.3                          | 1.1                       |
| Less than 2,500 grams . . . . .                                       | 8.0       | 7.0   | 13.5  | 7.4                          | 7.8                       |
| Preterm births <sup>2</sup> . . . . .                                 | 12.3      | 11.4  | 17.7  | 13.5                         | 10.5                      |
| Prenatal care beginning in the first trimester <sup>3</sup> . . . . . | 84.0      | 85.6  | 75.9  | 70.7                         | 85.4                      |
| Births to mothers under 20 years . . . . .                            | 10.3      | 9.3   | 17.3  | 18.3                         | 3.4                       |
| Fourth and higher order births . . . . .                              | 10.8      | 10.1  | 15.2  | 19.0                         | 6.3                       |
| Births to unmarried mothers . . . . .                                 | 34.6      | 29.2  | 68.4  | 61.5                         | 14.7                      |
| Mothers completing 12 or more years of school <sup>3</sup> . . . . .  | 78.3      | 78.2  | 76.1  | 69.5                         | 90.2                      |
| Mothers born in the 50 States and DC . . . . .                        | 76.3      | 78.8  | 86.7  | 95.1                         | 16.6                      |
| Mothers who smoked during pregnancy <sup>3,4</sup> . . . . .          | 10.7      | 11.7  | 8.2   | 18.2                         | 2.2                       |

<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 Pennsylvania and Washington, which implemented the 2003 Revision to the U.S. Standard Certificate of Live Birth for data year 2003. This change has resulted in a lack of comparability between data based on the 2003 Revision and data based on the 1989 Revision to the U.S. Certificate of Live Birth; see "Technical Notes."<sup>4</sup>Excludes data for California, which does not report tobacco use on the birth certificate.

NOTES: Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. In this table all women (including Hispanic women) are classified only according to their race. See reference 3.

**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, 2003 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     | 2.0          | 1.4   | 1.2                        | 1.3                        | 1.6                | 1.2   | 3.2   |
| Less than 2,500 grams . . . . .                                       | 8.0                      | 6.7      | 6.3     | 10.0         | 7.0   | 6.7                        | 8.1                        | 8.3                | 7.1   | 13.6  |
| Preterm births <sup>3</sup> . . . . .                                 | 12.3                     | 11.9     | 11.7    | 13.8         | 11.8  | 11.4                       | 12.6                       | 12.5               | 11.3  | 17.8  |
| Prenatal care beginning in the first trimester <sup>4</sup> . . . . . | 84.0                     | 77.4     | 76.5    | 81.1         | 92.0  | 79.1                       | 77.0                       | 85.9               | 88.8  | 75.9  |
| Births to mothers under 20 years . . . . .                            | 10.3                     | 14.3     | 15.3    | 17.9         | 7.9   | 8.3                        | 15.9                       | 9.1                | 7.5   | 17.4  |
| Fourth and higher order births . . . . .                              | 10.8                     | 13.7     | 14.8    | 12.2         | 4.8   | 10.4                       | 11.8                       | 9.9                | 8.8   | 15.3  |
| Births to unmarried mothers . . . . .                                 | 34.6                     | 45.0     | 43.7    | 59.8         | 31.4  | 46.0                       | 46.7                       | 31.6               | 23.6  | 68.5  |
| Mothers completing 12 or more years of school <sup>4</sup> . . . . .  | 78.3                     | 52.5     | 46.4    | 70.0         | 88.4  | 64.7                       | 69.8                       | 86.0               | 88.3  | 76.2  |
| Mothers born in the 50 States and DC . . . . .                        | 76.3                     | 36.7     | 36.2    | 66.6         | 47.2  | 12.1                       | 73.0                       | 87.7               | 94.2  | 87.6  |
| Mothers who smoked during pregnancy <sup>4,5</sup> . . . . .          | 10.7                     | 2.7      | 2.0     | 7.9          | 2.4   | 1.1                        | 6.6                        | 12.6               | 14.3  | 8.3   |

<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 Pennsylvania and Washington, which implemented the 2003 Revision to the U.S. Standard Certificate of Live Birth for data year 2003. This change has resulted in a lack of comparability between data based on the 2003 Revision and data based on the 1989 Revision to the U.S. Certificate of Live Birth; see "Technical Notes."<sup>5</sup>Excludes data for California, which does not report tobacco use on the birth certificate.

NOTES: Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.

**Table 6. Live births, infant, neonatal, and postneonatal deaths and mortality rates by race and Hispanic origin of mother and birthweight: United States, 2003 linked file, and percentage change in birthweight-specific infant mortality, 1995–2003 linked file**

| Race and birthweight             | Number in 2003 |               |                 |                     | Mortality rate per 1,000 live births in 2003 |          |              | Percent change in infant mortality rate 1995–2003 |
|----------------------------------|----------------|---------------|-----------------|---------------------|----------------------------------------------|----------|--------------|---------------------------------------------------|
|                                  | Live births    | Infant deaths | Neonatal deaths | Postneonatal deaths | Infant                                       | Neonatal | Postneonatal |                                                   |
| All races <sup>1</sup> . . . . . | 4,090,007      | 27,995        | 18,935          | 9,060               | 6.84                                         | 4.63     | 2.22         | -9.5                                              |
| Less than 2,500 grams . . . . .  | 325,619        | 19,223        | 15,762          | 3,461               | 59.04                                        | 48.41    | 10.63        | -8.6                                              |
| Less than 1,500 grams . . . . .  | 60,505         | 15,247        | 13,435          | 1,812               | 252.00                                       | 222.05   | 29.95        | -6.1                                              |
| Less than 500 grams . . . . .    | 7,060          | 6,110         | 5,975           | 136                 | 865.44                                       | 846.32   | 19.26        | -4.3**                                            |
| 500–749 grams . . . . .          | 11,515         | 5,489         | 4,747           | 742                 | 476.68                                       | 412.24   | 64.44        | -9.7                                              |
| 750–999 grams . . . . .          | 11,892         | 1,947         | 1,447           | 500                 | 163.72                                       | 121.68   | 42.05        | -10.1                                             |
| 1,000–1,249 grams . . . . .      | 13,635         | 945           | 717             | 227                 | 69.31                                        | 52.59    | 16.65        | -19.0                                             |
| 1,250–1,499 grams . . . . .      | 16,403         | 755           | 549             | 206                 | 46.03                                        | 33.47    | 12.56        | -15.7                                             |
| 1,500–1,999 grams . . . . .      | 63,891         | 1,781         | 1,182           | 600                 | 27.88                                        | 18.50    | 9.39         | -15.9                                             |
| 2,000–2,499 grams . . . . .      | 201,223        | 2,194         | 1,145           | 1,049               | 10.90                                        | 5.69     | 5.21         | -19.6                                             |
| 2,500 grams or more . . . . .    | 3,763,758      | 8,603         | 3,017           | 5,585               | 2.29                                         | 0.80     | 1.48         | -22.7                                             |
| 2,500–2,999 grams . . . . .      | 711,351        | 2,927         | 1,140           | 1,787               | 4.11                                         | 1.60     | 2.51         | -24.3                                             |
| 3,000–3,499 grams . . . . .      | 1,558,404      | 3,371         | 1,141           | 2,230               | 2.16                                         | 0.73     | 1.43         | -24.7                                             |
| 3,500–3,999 grams . . . . .      | 1,132,005      | 1,747         | 523             | 1,224               | 1.54                                         | 0.46     | 1.08         | -23.3                                             |
| 4,000–4,499 grams . . . . .      | 309,849        | 413           | 145             | 268                 | 1.33                                         | 0.47     | 0.86         | -26.7                                             |
| 4,500–4,999 grams . . . . .      | 46,715         | 111           | 49              | 62                  | 2.38                                         | 1.05     | 1.33         | 9.7**                                             |
| 5,000 grams or more . . . . .    | 5,434          | 34            | 20              | 14                  | 6.26                                         | 3.68     | *            | -25.1**                                           |
| Not stated . . . . .             | 630            | 169           | 155             | 14                  | ...                                          | ...      | ...          | *                                                 |
| White . . . . .                  | 3,225,890      | 18,458        | 12,457          | 6,000               | 5.72                                         | 3.86     | 1.86         | -9.2                                              |
| Less than 2,500 grams . . . . .  | 224,570        | 12,097        | 10,037          | 2,060               | 53.87                                        | 44.69    | 9.17         | -9.8                                              |
| Less than 1,500 grams . . . . .  | 38,629         | 9,271         | 8,303           | 968                 | 240.00                                       | 214.94   | 25.06        | -7.9                                              |
| Less than 500 grams . . . . .    | 4,035          | 3,510         | 3,450           | 60                  | 869.89                                       | 855.02   | 14.87        | -4.5**                                            |
| 500–749 grams . . . . .          | 6,840          | 3,328         | 2,954           | 373                 | 486.55                                       | 431.87   | 54.53        | -10.9                                             |
| 750–999 grams . . . . .          | 7,515          | 1,275         | 995             | 280                 | 169.66                                       | 132.40   | 37.26        | -12.0                                             |
| 1,000–1,249 grams . . . . .      | 8,952          | 630           | 507             | 124                 | 70.38                                        | 56.64    | 13.85        | -22.6                                             |
| 1,250–1,499 grams . . . . .      | 11,287         | 528           | 397             | 131                 | 46.78                                        | 35.17    | 11.61        | -15.7                                             |
| 1,500–1,999 grams . . . . .      | 44,495         | 1,248         | 860             | 389                 | 28.05                                        | 19.33    | 8.74         | -15.5                                             |
| 2,000–2,499 grams . . . . .      | 141,446        | 1,577         | 874             | 703                 | 11.15                                        | 6.18     | 4.97         | -18.6                                             |
| 2,500 grams or more . . . . .    | 3,000,852      | 6,251         | 2,322           | 3,929               | 2.08                                         | 0.77     | 1.31         | -22.4                                             |
| 2,500–2,999 grams . . . . .      | 511,562        | 2,050         | 854             | 1,196               | 4.01                                         | 1.67     | 2.34         | -24.0                                             |
| 3,000–3,499 grams . . . . .      | 1,221,031      | 2,397         | 866             | 1,531               | 1.96                                         | 0.71     | 1.25         | -26.1                                             |
| 3,500–3,999 grams . . . . .      | 952,131        | 1,354         | 419             | 935                 | 1.42                                         | 0.44     | 0.98         | -22.0                                             |
| 4,000–4,499 grams . . . . .      | 270,283        | 333           | 123             | 209                 | 1.23                                         | 0.46     | 0.77         | -22.6                                             |
| 4,500–4,999 grams . . . . .      | 41,179         | 92            | 44              | 48                  | 2.23                                         | 1.07     | 1.17         | 10.2**                                            |
| 5,000 grams or more . . . . .    | 4,666          | 25            | 16              | 9                   | 5.36                                         | *        | *            | -30.2**                                           |
| Not stated . . . . .             | 468            | 110           | 99              | 11                  | ...                                          | ...      | ...          | *                                                 |
| Black . . . . .                  | 599,860        | 8,094         | 5,530           | 2,563               | 13.49                                        | 9.22     | 4.27         | -7.4                                              |
| Less than 2,500 grams . . . . .  | 80,603         | 6,191         | 4,943           | 1,248               | 76.81                                        | 61.33    | 15.48        | -3.0**                                            |
| Less than 1,500 grams . . . . .  | 18,858         | 5,253         | 4,480           | 772                 | 278.56                                       | 237.56   | 40.94        | -2.5**                                            |
| Less than 500 grams . . . . .    | 2,705          | 2,334         | 2,265           | 68                  | 862.85                                       | 837.34   | 25.14        | -3.6**                                            |
| 500–749 grams . . . . .          | 4,159          | 1,909         | 1,560           | 349                 | 459.00                                       | 375.09   | 83.91        | -8.1                                              |
| 750–999 grams . . . . .          | 3,753          | 556           | 362             | 194                 | 148.15                                       | 96.46    | 51.69        | -9.1**                                            |
| 1,000–1,249 grams . . . . .      | 3,970          | 271           | 175             | 96                  | 68.26                                        | 44.08    | 24.18        | -8.3**                                            |
| 1,250–1,499 grams . . . . .      | 4,271          | 182           | 117             | 65                  | 42.61                                        | 27.39    | 15.22        | -12.3**                                           |
| 1,500–1,999 grams . . . . .      | 15,673         | 426           | 247             | 179                 | 27.18                                        | 15.76    | 11.42        | -16.0                                             |
| 2,000–2,499 grams . . . . .      | 46,072         | 513           | 216             | 297                 | 11.13                                        | 4.69     | 6.45         | -17.2                                             |
| 2,500 grams or more . . . . .    | 519,127        | 1,848         | 536             | 1,313               | 3.56                                         | 1.03     | 2.53         | -21.5                                             |
| 2,500–2,999 grams . . . . .      | 143,252        | 717           | 221             | 496                 | 5.01                                         | 1.54     | 3.46         | -19.6                                             |
| 3,000–3,499 grams . . . . .      | 228,445        | 764           | 211             | 552                 | 3.34                                         | 0.92     | 2.42         | -18.3                                             |
| 3,500–3,999 grams . . . . .      | 117,937        | 296           | 80              | 216                 | 2.51                                         | 0.68     | 1.83         | -27.9                                             |
| 4,000–4,499 grams . . . . .      | 25,443         | 51            | 17              | 34                  | 2.00                                         | *        | 1.34         | -53.9                                             |
| 4,500–4,999 grams . . . . .      | 3,546          | 14            | 4               | 10                  | *                                            | *        | *            | *                                                 |
| 5,000 grams or more . . . . .    | 504            | 7             | 3               | 4                   | *                                            | *        | *            | *                                                 |
| Not stated . . . . .             | 130            | 54            | 51              | 3                   | ...                                          | ...      | ...          | *                                                 |

See footnotes at end of table.

**Table 6. Live births, infant, neonatal, and postneonatal deaths and mortality rates by race and Hispanic origin of mother and birthweight: United States, 2003 linked file, and percentage change in birthweight-specific infant mortality, 1995–2003 linked file—Con.**

| Race and birthweight                   | Number in 2003 |               |                 |                     | Mortality rate per 1,000 live births in 2003 |          |              | Percent change in infant mortality rate 1995–2003 |
|----------------------------------------|----------------|---------------|-----------------|---------------------|----------------------------------------------|----------|--------------|---------------------------------------------------|
|                                        | Live births    | Infant deaths | Neonatal deaths | Postneonatal deaths | Infant                                       | Neonatal | Postneonatal |                                                   |
| American Indian <sup>2</sup> . . . . . | 43,054         | 376           | 196             | 180                 | 8.73                                         | 4.55     | 4.18         | -3.4**                                            |
| Less than 2,500 grams . . . . .        | 3,191          | 194           | 148             | 46                  | 60.80                                        | 46.38    | 14.42        | 5.6**                                             |
| Less than 1,500 grams . . . . .        | 571            | 145           | 124             | 21                  | 253.94                                       | 217.16   | 36.78        | 7.3**                                             |
| Less than 500 grams . . . . .          | 54             | 38            | 37              | 1                   | 703.70                                       | 685.19   | *            | -20.8**                                           |
| 500–749 grams . . . . .                | 108            | 55            | 47              | 8                   | 509.26                                       | 435.19   | *            | -16.4**                                           |
| 750–999 grams . . . . .                | 117            | 30            | 23              | 7                   | 256.41                                       | 196.58   | *            | *                                                 |
| 1,000–1,249 grams . . . . .            | 139            | 9             | 6               | 3                   | *                                            | *        | *            | *                                                 |
| 1,250–1,499 grams . . . . .            | 153            | 12            | 10              | 2                   | *                                            | *        | *            | *                                                 |
| 1,500–1,999 grams . . . . .            | 637            | 20            | 14              | 6                   | 31.40                                        | *        | *            | *                                                 |
| 2,000–2,499 grams . . . . .            | 1,983          | 29            | 10              | 19                  | 14.62                                        | *        | *            | -24.0**                                           |
| 2,500 grams or more . . . . .          | 39,856         | 180           | 47              | 133                 | 4.52                                         | 1.18     | 3.34         | -15.1**                                           |
| 2,500–2,999 grams . . . . .            | 7,010          | 47            | 18              | 29                  | 6.70                                         | *        | 4.14         | -36.5**                                           |
| 3,000–3,499 grams . . . . .            | 15,841         | 72            | 16              | 56                  | 4.55                                         | *        | 3.54         | -6.2**                                            |
| 3,500–3,999 grams . . . . .            | 12,314         | 42            | 10              | 32                  | 3.41                                         | *        | 2.60         | -16.6**                                           |
| 4,000–4,499 grams . . . . .            | 3,883          | 16            | 2               | 14                  | *                                            | *        | *            | *                                                 |
| 4,500–4,999 grams . . . . .            | 701            | 1             | –               | 1                   | *                                            | *        | *            | *                                                 |
| 5,000 grams or more . . . . .          | 107            | 1             | –               | 1                   | *                                            | *        | *            | *                                                 |
| Not stated . . . . .                   | 7              | 1             | 1               | –                   | ...                                          | ...      | ...          | ...                                               |
| Asian or Pacific Islander . . . . .    | 221,203        | 1,068         | 752             | 316                 | 4.83                                         | 3.40     | 1.43         | -8.5**                                            |
| Less than 2,500 grams . . . . .        | 17,255         | 741           | 634             | 107                 | 42.94                                        | 36.74    | 6.20         | -7.3**                                            |
| Less than 1,500 grams . . . . .        | 2,447          | 578           | 528             | 50                  | 236.21                                       | 215.77   | 20.43        | -1.5**                                            |
| Less than 500 grams . . . . .          | 266            | 228           | 222             | 6                   | 857.14                                       | 834.59   | *            | -5.2**                                            |
| 500–749 grams . . . . .                | 408            | 197           | 185             | 12                  | 482.84                                       | 453.43   | *            | -6.5**                                            |
| 750–999 grams . . . . .                | 507            | 85            | 66              | 19                  | 167.65                                       | 130.18   | *            | -12.3**                                           |
| 1,000–1,249 grams . . . . .            | 574            | 34            | 29              | 5                   | 59.23                                        | 50.52    | *            | -34.8**                                           |
| 1,250–1,499 grams . . . . .            | 692            | 33            | 25              | 8                   | 47.69                                        | 36.13    | *            | -35.6**                                           |
| 1,500–1,999 grams . . . . .            | 3,086          | 87            | 61              | 26                  | 28.19                                        | 19.77    | 8.43         | -31.6**                                           |
| 2,000–2,499 grams . . . . .            | 11,722         | 76            | 46              | 30                  | 6.48                                         | 3.92     | 2.56         | -37.8                                             |
| 2,500 grams or more . . . . .          | 203,923        | 323           | 113             | 210                 | 1.58                                         | 0.55     | 1.03         | -26.7                                             |
| 2,500–2,999 grams . . . . .            | 49,527         | 112           | 47              | 66                  | 2.26                                         | 0.95     | 1.33         | -35.4                                             |
| 3,000–3,499 grams . . . . .            | 93,087         | 138           | 47              | 91                  | 1.48                                         | 0.50     | 0.98         | -23.2                                             |
| 3,500–3,999 grams . . . . .            | 49,623         | 55            | 14              | 40                  | 1.11                                         | *        | 0.81         | -20.5**                                           |
| 4,000–4,499 grams . . . . .            | 10,240         | 13            | 3               | 10                  | *                                            | *        | *            | *                                                 |
| 4,500–4,999 grams . . . . .            | 1,289          | 4             | 1               | 3                   | *                                            | *        | *            | *                                                 |
| 5,000 grams or more . . . . .          | 157            | 1             | 1               | –                   | *                                            | *        | *            | *                                                 |
| Not stated . . . . .                   | 25             | 4             | 4               | –                   | ...                                          | ...      | ...          | *                                                 |
| Hispanic . . . . .                     | 912,331        | 5,151         | 3,573           | 1,579               | 5.65                                         | 3.92     | 1.73         | -9.9                                              |
| Less than 2,500 grams . . . . .        | 61,212         | 3,518         | 2,944           | 575                 | 57.47                                        | 48.10    | 9.39         | -6.3                                              |
| Less than 1,500 grams . . . . .        | 10,738         | 2,747         | 2,441           | 306                 | 255.82                                       | 227.32   | 28.50        | -2.8**                                            |
| Less than 500 grams . . . . .          | 1,146          | 991           | 966             | 24                  | 864.75                                       | 842.93   | 20.94        | -1.0**                                            |
| 500–749 grams . . . . .                | 2,090          | 1,057         | 926             | 131                 | 505.74                                       | 443.06   | 62.68        | -6.5**                                            |
| 750–999 grams . . . . .                | 2,123          | 374           | 302             | 72                  | 176.17                                       | 142.25   | 33.91        | -7.0**                                            |
| 1,000–1,249 grams . . . . .            | 2,450          | 175           | 138             | 36                  | 71.43                                        | 56.33    | 14.69        | -16.3**                                           |
| 1,250–1,499 grams . . . . .            | 2,929          | 150           | 108             | 42                  | 51.21                                        | 36.87    | 14.34        | -5.9**                                            |
| 1,500–1,999 grams . . . . .            | 11,675         | 354           | 250             | 104                 | 30.32                                        | 21.41    | 8.91         | -10.2**                                           |
| 2,000–2,499 grams . . . . .            | 38,799         | 417           | 252             | 165                 | 10.75                                        | 6.50     | 4.25         | -17.2                                             |
| 2,500 grams or more . . . . .          | 851,069        | 1,606         | 605             | 1,001               | 1.89                                         | 0.71     | 1.18         | -24.6                                             |
| 2,500–2,999 grams . . . . .            | 157,630        | 561           | 251             | 309                 | 3.56                                         | 1.59     | 1.96         | -20.6                                             |
| 3,000–3,499 grams . . . . .            | 366,590        | 620           | 223             | 397                 | 1.69                                         | 0.61     | 1.08         | -25.9                                             |
| 3,500–3,999 grams . . . . .            | 252,283        | 319           | 88              | 231                 | 1.26                                         | 0.35     | 0.92         | -31.3                                             |
| 4,000–4,499 grams . . . . .            | 63,699         | 72            | 27              | 44                  | 1.13                                         | 0.42     | 0.69         | -25.3**                                           |
| 4,500–4,999 grams . . . . .            | 9,620          | 27            | 11              | 16                  | 2.81                                         | *        | *            | -7.0**                                            |
| 5,000 grams or more . . . . .          | 1,247          | 8             | 5               | 3                   | *                                            | *        | *            | *                                                 |
| Not stated . . . . .                   | 50             | 26            | 23              | 3                   | ...                                          | ...      | ...          | *                                                 |

See footnotes at end of table.

**Table 6. Live births, infant, neonatal, and postneonatal deaths and mortality rates by race and Hispanic origin of mother and birthweight: United States, 2003 linked file, and percentage change in birthweight-specific infant mortality, 1995–2003 linked file—Con.**

| Race and birthweight            | Number in 2003 |               |                 |                     | Mortality rate per 1,000 live births in 2003 |          |              | Percent change in infant mortality rate 1995–2003 |
|---------------------------------|----------------|---------------|-----------------|---------------------|----------------------------------------------|----------|--------------|---------------------------------------------------|
|                                 | Live births    | Infant deaths | Neonatal deaths | Postneonatal deaths | Infant                                       | Neonatal | Postneonatal |                                                   |
| Non-Hispanic white . . . . .    | 2,321,921      | 13,228        | 8,797           | 4,431               | 5.70                                         | 3.79     | 1.91         | -9.2                                              |
| Less than 2,500 grams . . . . . | 164,033        | 8,533         | 7,038           | 1,495               | 52.02                                        | 42.91    | 9.11         | -11.6                                             |
| Less than 1,500 grams . . . . . | 27,964         | 6,479         | 5,812           | 667                 | 231.69                                       | 207.84   | 23.85        | -10.2                                             |
| Less than 500 grams . . . . .   | 2,856          | 2,483         | 2,446           | 36                  | 869.40                                       | 856.44   | 12.61        | -5.7**                                            |
| 500–749 grams . . . . .         | 4,752          | 2,260         | 2,016           | 244                 | 475.59                                       | 424.24   | 51.35        | -13.2                                             |
| 750–999 grams . . . . .         | 5,421          | 898           | 690             | 208                 | 165.65                                       | 127.28   | 38.37        | -13.4                                             |
| 1,000–1,249 grams . . . . .     | 1,000          | 458           | 369             | 88                  | 69.93                                        | 56.34    | 13.44        | -24.0                                             |
| 1,250–1,499 grams . . . . .     | 8,386          | 381           | 291             | 91                  | 45.43                                        | 34.70    | 10.85        | -18.2                                             |
| 1,500–1,999 grams . . . . .     | 32,970         | 888           | 604             | 284                 | 26.93                                        | 18.32    | 8.61         | -18.3                                             |
| 2,000–2,499 grams . . . . .     | 103,099        | 1,166         | 622             | 544                 | 11.31                                        | 6.03     | 5.28         | -18.5                                             |
| 2,500 grams or more . . . . .   | 2,157,621      | 4,643         | 1,708           | 2,935               | 2.15                                         | 0.79     | 1.36         | -21.4                                             |
| 2,500–2,999 grams . . . . .     | 356,426        | 1,487         | 598             | 889                 | 4.17                                         | 1.68     | 2.49         | -24.8                                             |
| 3,000–3,499 grams . . . . .     | 858,603        | 1,781         | 645             | 1,136               | 2.07                                         | 0.75     | 1.32         | -25.3                                             |
| 3,500–3,999 grams . . . . .     | 701,090        | 1,033         | 327             | 705                 | 1.47                                         | 0.47     | 1.01         | -19.3                                             |
| 4,000–4,499 grams . . . . .     | 206,495        | 261           | 96              | 165                 | 1.26                                         | 0.46     | 0.80         | -20.6                                             |
| 4,500–4,999 grams . . . . .     | 31,591         | 63            | 31              | 32                  | 1.99                                         | 0.98     | 1.01         | 7.1**                                             |
| 5,000 grams or more . . . . .   | 3,416          | 18            | 11              | 7                   | *                                            | *        | *            | *                                                 |
| Not stated . . . . .            | 267            | 52            | 51              | 1                   | ...                                          | ...      | ...          | *                                                 |
| Non-Hispanic black . . . . .    | 576,047        | 7,836         | 5,335           | 2,501               | 13.60                                        | 9.26     | 4.34         | -7.2                                              |
| Less than 2,500 grams . . . . . | 78,445         | 5,998         | 4,778           | 1,220               | 76.46                                        | 60.91    | 15.55        | -3.3**                                            |
| Less than 1,500 grams . . . . . | 18,370         | 5,087         | 4,330           | 757                 | 276.92                                       | 235.71   | 41.21        | -2.9**                                            |
| Less than 500 grams . . . . .   | 2,617          | 2,254         | 2,188           | 66                  | 861.29                                       | 836.07   | 25.22        | -3.8**                                            |
| 500–749 grams . . . . .         | 4,060          | 1,851         | 1,509           | 342                 | 455.91                                       | 371.67   | 84.24        | -8.3                                              |
| 750–999 grams . . . . .         | 3,659          | 544           | 352             | 192                 | 148.67                                       | 96.20    | 52.47        | -9.1**                                            |
| 1,000–1,249 grams . . . . .     | 3,858          | 263           | 169             | 94                  | 68.17                                        | 43.81    | 24.36        | -8.3**                                            |
| 1,250–1,499 grams . . . . .     | 4,176          | 175           | 112             | 63                  | 41.91                                        | 26.82    | 15.09        | -13.2**                                           |
| 1,500–1,999 grams . . . . .     | 15,229         | 416           | 242             | 174                 | 27.32                                        | 15.89    | 11.43        | -15.4                                             |
| 2,000–2,499 grams . . . . .     | 44,846         | 495           | 207             | 289                 | 11.04                                        | 4.62     | 6.44         | -17.7                                             |
| 2,500 grams or more . . . . .   | 497,506        | 1,793         | 515             | 1,278               | 3.60                                         | 1.04     | 2.57         | -21.2                                             |
| 2,500–2,999 grams . . . . .     | 138,511        | 700           | 214             | 486                 | 5.05                                         | 1.55     | 3.51         | -18.9                                             |
| 3,000–3,499 grams . . . . .     | 218,983        | 737           | 201             | 536                 | 3.37                                         | 0.92     | 2.45         | -18.2                                             |
| 3,500–3,999 grams . . . . .     | 112,182        | 288           | 77              | 211                 | 2.57                                         | 0.69     | 1.88         | -27.1                                             |
| 4,000–4,499 grams . . . . .     | 24,006         | 50            | 17              | 33                  | 2.08                                         | *        | 1.37         | -53.0                                             |
| 4,500–4,999 grams . . . . .     | 3,340          | 13            | 4               | 9                   | *                                            | *        | *            | *                                                 |
| 5,000 grams or more . . . . .   | 484            | 5             | 2               | 3                   | *                                            | *        | *            | *                                                 |
| Not stated . . . . .            | 96             | 45            | 42              | 3                   | ...                                          | ...      | ...          | *                                                 |

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

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

... Category not applicable.

- Quantity zero.

<sup>1</sup>Includes races other than white or black.<sup>2</sup>Includes Aleuts and Eskimos.

NOTES: 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. Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.

**Table 7. Infant deaths and mortality rates for the five leading causes of infant death, by race and Hispanic origin of mother: United States, 2003 linked file**

[Rates per 100,000 live births in specified group]

| Cause of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i> ) | All races |        |       | Non-Hispanic white |        |       | Non-Hispanic black <sup>1</sup> |        |         | American Indian <sup>2,3</sup> |        |       | Asian and Pacific Islander <sup>4</sup> |        |       |
|------------------------------------------------------------------------------------------------------|-----------|--------|-------|--------------------|--------|-------|---------------------------------|--------|---------|--------------------------------|--------|-------|-----------------------------------------|--------|-------|
|                                                                                                      | Rank      | Number | Rate  | Rank               | Number | Rate  | Rank                            | Number | Rate    | Rank                           | Number | Rate  | Rank                                    | Number | Rate  |
| All causes . . . . .                                                                                 | ...       | 27,995 | 684.5 | ...                | 13,227 | 569.7 | ...                             | 7,838  | 1,360.7 | ...                            | 376    | 872.9 | ...                                     | 1,068  | 482.9 |
| Congenital malformations, deformations, and chromosomal abnormalities . . . . . (Q00–Q99)            | 1         | 5,640  | 137.9 | 1                  | 2,973  | 128.0 | 2                               | 965    | 167.5   | 1                              | 81     | 187.6 | 1                                       | 259    | 117.2 |
| Disorders related to short gestation and low birth weight, not elsewhere classified . . . . . (P07)  | 2         | 4,849  | 118.6 | 2                  | 1,847  | 79.5  | 1                               | 1,807  | 313.7   | 3                              | 48     | 112.6 | 2                                       | 192    | 86.9  |
| Sudden infant death syndrome . . . . . (R95)                                                         | 3         | 2,162  | 52.9  | 3                  | 1,173  | 50.5  | 3                               | 627    | 108.8   | 2                              | 53     | 124.0 | 3                                       | 61     | 27.7  |
| Newborn affected by maternal complications of pregnancy . . . . . (P01)                              | 4         | 1,708  | 41.8  | 4                  | 780    | 33.6  | 4                               | 542    | 94.1    | 9                              | 7      | *     | 4                                       | 59     | 26.7  |
| Newborn affected by complications of placenta, cord and membranes . . . . . (P02)                    | 5         | 1,092  | 26.7  | 5                  | 543    | 23.4  | 6                               | 297    | 51.6    | 6                              | 13     | *     | 5                                       | 32     | 14.3  |

| Cause of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i> ) | Total Hispanic |        |       | Mexican |        |       | Puerto Rican |        |       | Central and South American <sup>5</sup> |        |       |
|------------------------------------------------------------------------------------------------------|----------------|--------|-------|---------|--------|-------|--------------|--------|-------|-----------------------------------------|--------|-------|
|                                                                                                      | Rank           | Number | Rate  | Rank    | Number | Rate  | Rank         | Number | Rate  | Rank                                    | Number | Rate  |
| All causes . . . . .                                                                                 | ...            | 5,150  | 564.5 | ...     | 3,594  | 549.1 | ...          | 478    | 818.5 | ...                                     | 684    | 504.5 |
| Congenital malformations, deformations, and chromosomal abnormalities . . . . . (Q00–Q99)            | 1              | 1,316  | 144.2 | 1       | 994    | 151.9 | 2            | 83     | 142.1 | 1                                       | 160    | 118.0 |
| Disorders related to short gestation and low birth weight, not elsewhere classified . . . . . (P07)  | 2              | 864    | 94.7  | 2       | 565    | 86.3  | 1            | 98     | 167.8 | 2                                       | 124    | 91.5  |
| Sudden infant death syndrome . . . . . (R95)                                                         | 4              | 234    | 25.6  | 4       | 162    | 24.8  | 3            | 31     | 53.1  | 6                                       | 27     | 19.9  |
| Newborn affected by maternal complications of pregnancy . . . . . (P01)                              | 3              | 277    | 30.4  | 3       | 187    | 28.6  | 4            | 24     | 41.1  | 3                                       | 42     | 31.0  |
| Newborn affected by complications of placenta, cord and membranes . . . . . (P02)                    | 5              | 192    | 21.0  | 5       | 118    | 18.0  | 5            | 21     | 36.0  | 4                                       | 29     | 21.4  |

... Category not applicable.

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

<sup>1</sup>For non-Hispanic blacks, infections specific to the perinatal period was the fifth leading cause of death, with 314 deaths and a rate of 54.5.

<sup>2</sup>Includes Aleuts and Eskimos.

<sup>3</sup>For American Indians, Accidents (unintentional injuries) was the fourth leading cause of death with 20 deaths and a rate of 46.7. Influenza and Pneumonia was the fifth leading cause of death; however, with only 14 deaths, a reliable infant mortality rate could not be computed. Maternal complications was tied for the ninth leading cause with Diseases of the circulatory system, Respiratory distress of newborn, and Necrotizing enterocolitis of newborn.

<sup>4</sup>For Asian or Pacific Islanders, Diseases of the circulatory system was tied for the fifth leading cause of death.

<sup>5</sup>For Central and South Americans, Infections specific to the perinatal period was the fifth leading cause of death, with 28 deaths and a rate of 20.7.

NOTES: Reliable cause-specific infant mortality rates cannot be computed for Cubans because of the small number of infant deaths (68). Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. See reference 3.



## Technical Notes

### Differences between period and cohort data

From 1983 to 1991, NCHS produced linked files in a birth cohort format (36). Beginning with 1995 data, linked files are produced first using a period format and then subsequently using a birth cohort format. The 2003 period linked file contains a numerator file that consists of all infant deaths occurring in 2003 that have been linked to their corresponding birth certificates, whether the birth occurred in 2002 or in 2003. In contrast, the 2003 birth cohort linked file will contain a numerator file that consists of all infant deaths to babies born in 2003 whether the death occurred in 2003 or 2004.

Although the birth cohort format has methodological advantages, it creates delays in data availability, because 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.

For the 2003 file, NCHS accepted birth records that could be linked to infant deaths even if registered after the closure of the 2003 birth file (less than 100 cases). This improved the infant birth/death linkage and made the denominator file distinctly different from the official 2003 birth file.

### Weighting

A record weight is added to the linked file to compensate for the 1.0 percent (in 2003) 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 95.6–100.0 percent with all but four areas—California, Louisiana, New Jersey, and Texas at 97.5 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 occurrence at birth and age at death (less than 7 days, 7–27 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 2003 linked file started with 28,012 infant death records. Of these 28,012 records, 27,727 were linked; 285 were unlinked because corresponding birth certificates could not be identified. The 28,012 linked and unlinked records contained 17 records of infants whose mother's usual place of residence was outside the United States. These 17 records were excluded to derive a weighted total of 27,995 infant deaths. Thus, all total calculations for 2003 in this report used a weighted total of 27,995 infant deaths (Tables A, B, C, 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 2003 period linked file of 6.84 is nearly the same as the 2003 vital statistics mortality file (6.85) (2). The number of infant deaths differs slightly; the number in the mortality file was 28,025 (2). Differences in numbers of infant deaths between the two data sources are primarily due to geographic coverage differences. As for the vital statistics mortality file, all deaths occurring in the 50 States and the District of Columbia are included

**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, 2003 linked file**

| State                      | Percent linked by State of occurrence of death |
|----------------------------|------------------------------------------------|
| United States <sup>1</sup> | 99.0                                           |
| Alabama                    | 100.0                                          |
| Alaska                     | 100.0                                          |
| Arizona                    | 99.3                                           |
| Arkansas                   | 100.0                                          |
| California                 | 97.4                                           |
| Colorado                   | 100.0                                          |
| Connecticut                | 100.0                                          |
| Delaware                   | 100.0                                          |
| District of Columbia       | 99.0                                           |
| Florida                    | 99.9                                           |
| Georgia                    | 100.0                                          |
| Hawaii                     | 100.0                                          |
| Idaho                      | 100.0                                          |
| Illinois                   | 98.2                                           |
| Indiana                    | 99.2                                           |
| Iowa                       | 100.0                                          |
| Kansas                     | 98.6                                           |
| Kentucky                   | 99.7                                           |
| Louisiana                  | 95.6                                           |
| Maine                      | 100.0                                          |
| Maryland                   | 100.0                                          |
| Massachusetts              | 98.2                                           |
| Michigan                   | 100.0                                          |
| Minnesota                  | 100.0                                          |
| Mississippi                | 100.0                                          |
| Missouri                   | 100.0                                          |
| Montana                    | 98.6                                           |
| Nebraska                   | 100.0                                          |
| Nevada                     | 100.0                                          |
| New Hampshire              | 100.0                                          |
| New Jersey                 | 96.6                                           |
| New Mexico                 | 98.6                                           |
| New York                   | 99.1                                           |
| North Carolina             | 99.8                                           |
| North Dakota               | 100.0                                          |
| Ohio                       | 99.6                                           |
| Oklahoma                   | 97.6                                           |
| Oregon                     | 99.7                                           |
| Pennsylvania               | 99.5                                           |
| Rhode Island               | 100.0                                          |
| South Carolina             | 100.0                                          |
| South Dakota               | 100.0                                          |
| Tennessee                  | 100.0                                          |
| Texas                      | 97.0                                           |
| Utah                       | 100.0                                          |
| Vermont                    | 100.0                                          |
| Virginia                   | 100.0                                          |
| Washington                 | 98.8                                           |
| West Virginia              | 100.0                                          |
| Wisconsin                  | 100.0                                          |
| Wyoming                    | 100.0                                          |
| Puerto Rico                | 99.6                                           |
| Virgin Islands             | 100.0                                          |
| Guam                       | 100.0                                          |

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

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. Also, 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 2003, 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 2003" (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 (37,38).

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 4.6 percent of the births in 2003 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 0.006 percent of all birth records in 2003 (3).

For the linked file, not stated birthweight was imputed for 3,007 records or 0.07 percent of the birth records in 2003 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, the not stated value for birthweight was retained. This imputation was done to improve the accuracy of birthweight-specific infant mortality rates, because the percent of records with not stated birthweight was higher for infant

deaths (3.85 percent before imputation) than for live births (0.09 percent before imputation). The imputation reduced the percent of not stated records to 0.61 percent for infant deaths, and 0.02 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 (ICD). 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 (39,40).

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 (41,42).

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

Changes in classification of causes of death due to these revisions may result in discontinuities in cause-of-death trends. Measures of this discontinuity are essential to the interpretation of mortality trends and are discussed in detail in other NCHS publications (2,43,44).

## 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" (45). 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 (IMR) 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.

For the first time the National Center for Health Statistics (NCHS) is publishing the infant mortality rate with two digits after the decimal place per 1,000 live births. Displaying two digits after the decimal place for rates such as the IMR provides a more sensitive and precise measurement. This is particularly noticeable when examining differences in rates among groups or over time. For example, the published total IMR for 2002 was 7.0; this rate with two decimal places is 6.95. The rate for 2003 is 6.84 and would be 6.8 if calculated to one decimal place. The difference between years by one decimal place is 0.2, but when using two decimal places the difference is 0.11—nearly half the difference shown by one decimal. For rates per 100,000 live births (by cause of death) the IMR continues to be shown for one decimal place. Adding an additional decimal for rates per 100,000 does not increase precision as it does for rates per 1,000.

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 (46). 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 (2). 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:

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

where  $D$  is the number of deaths and

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

where  $B$  is the number of births.

For example, let us say that for group A the number of infant deaths was 238 while the number of live births was 32,650 yielding an infant mortality rate of 7.29 infant deaths per 1,000 live births.

$$\text{The RSE of the deaths} = 100 \cdot \sqrt{\frac{1}{238}} = 6.48,$$

$$\text{while the RSE of the births} = 100 \cdot \sqrt{\frac{1}{32,650}} = 0.55.$$

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

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

The RSE of the IMR for the example above

$$= 100 \cdot \sqrt{\frac{1}{238} + \frac{1}{32,650}} = 6.51.$$

*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:

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

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

Thus, for group A:

$$\text{Lower: } 7.29 - \left( 1.96 \cdot 7.29 \cdot \frac{6.51}{100} \right) = 6.36$$

$$\text{Upper: } 7.29 + \left( 1.96 \cdot 7.29 \cdot \frac{6.51}{100} \right) = 8.22$$

Thus the chances are 95 out of 100 that the true IMR for Group A lies somewhere in the 6.36–8.22 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](#).

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

**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  |          |          |          |

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

where  $D_{adj}$  is the adjusted number of infant deaths (rounded to the nearest integer) used to take into account the RSE of the number of infant deaths and live births, and is computed as follows:

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

$L (.95, D_{adj})$  and  $U (.95, D_{adj})$  refer to the values in [Table II](#) corresponding to the value of  $D_{adj}$ .

For example, let us say that for group B the number of infant deaths was 73, the number of live births was 11,422, and the infant mortality rate was 6.39.

$$D_{adj} = \frac{(73 \cdot 11,422)}{(73 + 11,422)} = 73$$

Therefore the 95 percent confidence interval (using the formula in [Table II](#) for 1–99 infant deaths) =

Lower:  $6.39 \cdot 0.78384 = 5.01$

Upper:  $6.39 \cdot 1.25735 = 8.03$

*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 ( $R_1$  and  $R_2$ ) to be compared are based on 100 or more deaths, the following z-test may be used to define a significance test statistic:

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

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 Center for Health Statistics (NCHS) at 1-866-441-6247. Data are also available in selected issues of the *Vital and Health Statistics*, Series 20 reports, the *National Vital Statistics Reports* (formerly the *Monthly Vital Statistics Report*) through NCHS. Additional unpublished tabulations are available from: <http://www.cdc.gov/nchs>.

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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, Candace Cosgrove, Annie Liu, Jordan Sacks, and Manju Sharma (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 NCHS senior editor Demarius V. Miller and NOVA Contractor Laura Drescher, typeset by Jacqueline M. Davis, and graphics were produced by Zorica Thomas Whalen, NOVA contractor, Office of Information Services, Information Design and Publishing Staff.

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## Suggested citation

Mathews TJ, MacDorman MF. Infant mortality statistics from the 2003 period linked birth/infant death data set. National vital statistics reports; vol 54 no 16. Hyattsville, MD: National Center for Health Statistics. 2006.

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06-0112 (5/2006)  
CS103294  
T25071  
DHHS Publication No. (PHS) 2006-1120

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