

Infant Mortality Statistics From the 2006 Period Linked Birth/Infant Death Data Set

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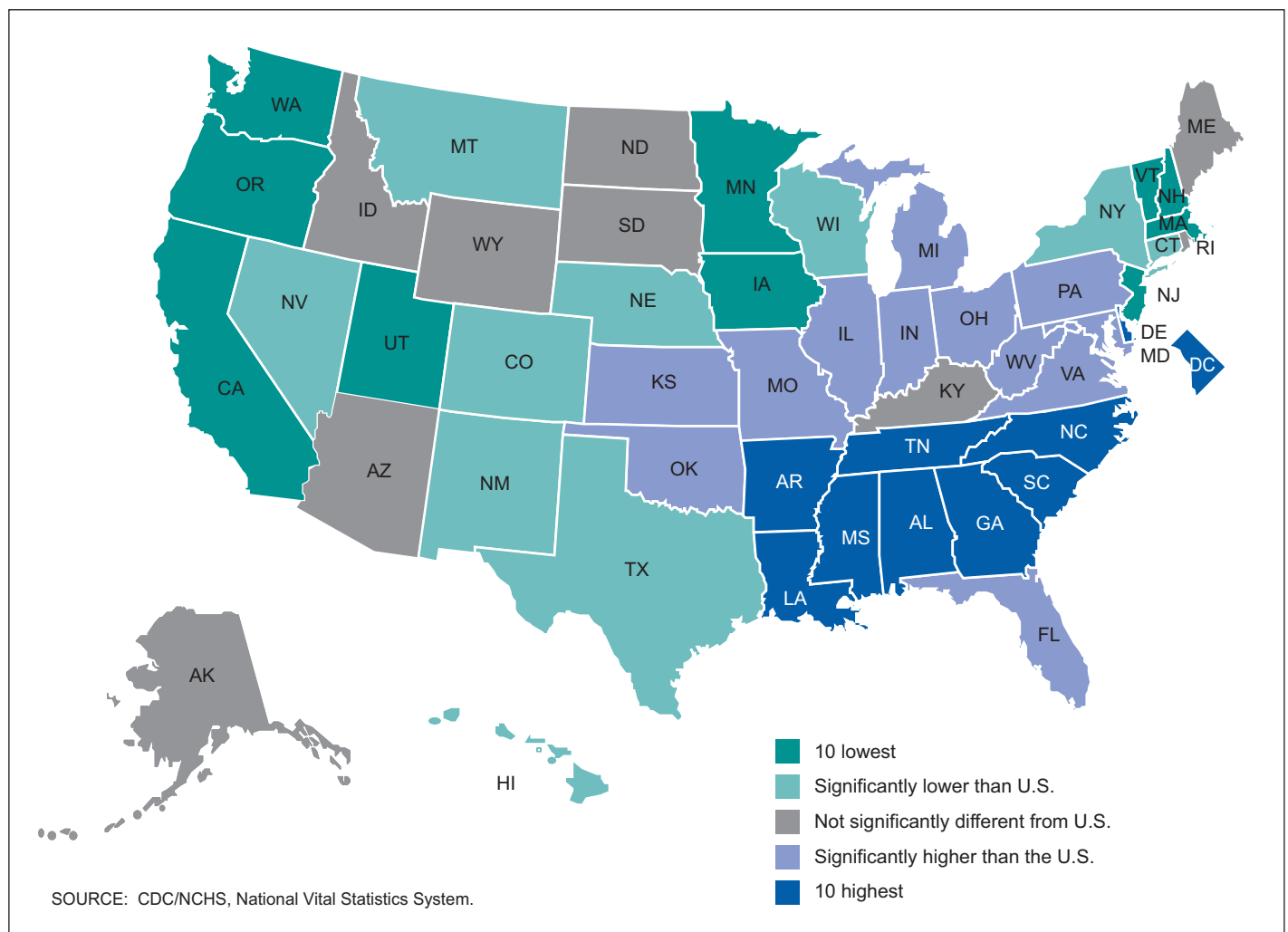


Figure 1. Infant mortality rates by state: United States, 2004–2006

Abstract

Objectives—This report presents 2006 period infant mortality statistics from the linked birth/infant death data set (linked 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.

Results—The U.S. infant mortality rate was 6.68 infant deaths per 1,000 live births in 2006, a 3 percent decline from 6.86 in 2005. Infant mortality rates ranged from 4.52 per 1,000 live births for Central and South American mothers to 13.35 for non-Hispanic black mothers. Infant mortality rates were higher for those infants whose mothers were born in the 50 states or the District of Columbia, were unmarried, or were born in multiple deliveries. Infant mortality was also higher for male infants and infants born preterm or at low birthweight. The neonatal mortality rate was essentially unchanged in 2006 (4.46) from 2005 (4.54). The postneonatal mortality rate decreased 4 percent, from 2.32 in 2005 to 2.22 in 2006. Infants born at the lowest gestational ages and birthweights have a large impact on overall U.S. infant mortality. For example, more than half of all infant deaths in the United States in 2006 (54 percent) occurred to the 2 percent of infants born very preterm (less than 32 weeks of gestation). Still, infant mortality rates for late preterm infants (34–36 weeks of gestation) were three times those for term infants (37–41 weeks). The three leading causes of infant death—congenital malformations, low birthweight, and sudden infant death syndrome—taken together accounted for 46 percent of all infant deaths. The percentage of infant deaths that were “preterm-related” was 36.1 percent in 2006. The preterm-related infant mortality rate for non-Hispanic black mothers was 3.4 times higher and the rate for Puerto Rican mothers was 84 percent higher than for non-Hispanic white mothers.

Keywords: infant health • birthweight • gestational age • maternal characteristics

Introduction

This report presents infant mortality data from the 2006 period linked file. The linked file contains a numerator file consisting of all infant deaths occurring in 2006 that have been linked to their corresponding birth certificates, whether the birth occurred in 2005 or in 2006.

In the linked file, 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 2006 (1). 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 (2). This report presents infant mortality data by race and Hispanic origin of the mother, birthweight, period of gestation, sex of infant, plurality, maternal age, live-birth order, mother’s marital status, mother’s place of birth, age at death, and underlying cause of death (Tables 1–8 and A–E; Figures 1–6). Other variables available in the linked file (1) but 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 exclusively from the vital statistics mortality file, provides further information on trends in infant mortality and causes of infant death (3). The linked file is used for analysis and for calculating infant mortality rates by race and ethnicity, which are more accurately measured from the birth certificate. Some rates calculated from the mortality file differ from those published using the linked file. 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 “[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 (CDC) 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 2006. 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 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 2006, 98.7 percent of all infant death records were successfully linked or matched to their corresponding birth records. Records were weighted to adjust for the 1.3 percent of infant death records that were not linked to their corresponding birth certificates; see “[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 2006 (2).

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

Cause-of-death statistics in this publication are classified in accordance with the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD–10)* (4); see “[Technical Notes](#).”

This report includes data based on the 1989 and 2003 revisions of the birth certificate. Nineteen states and Puerto Rico implemented the 2003 revision of the U.S. Standard Certificate of Live Birth on or before January 1, 2006 (revised). The remaining reporting areas include data which are based on the 1989 revision of the U.S. Standard Certificate of Live Birth (unrevised). Revised and unrevised data are

combined when comparable. For more information, see *National Vital Statistics Reports*, Volume 57 Number 7, "Births: Final Data for 2006" (2).

Three key data items are considered noncomparable between the 1989 and 2003 revisions: trimester of pregnancy in which prenatal care began, maternal educational attainment, and maternal smoking during pregnancy (2). Because infants who died in 2006 were born in both 2005 and 2006, this report includes data on these three topics from the 12 states that implemented the 2003 revision as of January 1, 2005 (see respective text sections and "Technical Notes"). The 12 states are Florida, Idaho, Kansas, Kentucky, Nebraska, New Hampshire, New York (excluding New York City), Pennsylvania, South Carolina, Tennessee, Texas, and Washington. Results for these three items from the limited reporting area are not generalizable to the country as a whole (2).

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 are 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 and that for the numerator is the race of the decedent as reported on the death certificate (2,3,5). Thus, standard infant mortality rates can be based on inconsistent race

information. In addition, race information from the birth certificate reported by the mother is considered to be more reliable than that from the death certificate, where the race and ethnicity of the deceased infant are reported by the funeral director based on information provided by an informant or by observation. These different reporting methods can lead to differences in race- and ethnicity-specific infant mortality rates between the two data files (3,5).

The 2003 revision of the U.S. Standard Certificate of Live Birth allows the reporting of more than one race (multiple races) for each parent (6,7). Information on this change is presented in a recent report (2). Twenty-three states reported multiple race on their birth certificates for either part or all of 2006. To provide uniformity and comparability of data, multiple race is imputed to a single race (see "Technical Notes").

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 "Technical Notes." Additional information on maternal age, marital status, period of gestation, birthweight, and cause-of-death classification is also presented in "Technical Notes."

Results and Discussion

Trends in infant mortality

The overall 2006 infant mortality rate from the linked file was 6.68 infant deaths per 1,000 live births, 3 percent lower than the 2005 rate of 6.86 (Table C); the 2006 rate from the mortality file was 6.69 (3). The neonatal mortality rate for 2006 (4.46) was not significantly different from 2005 (4.54). The postneonatal mortality rate decreased from 2.32 in 2005 to 2.22 in 2006 (Tables A and B for 2006 data).

While the infant mortality rate was 9 percent lower in 2000 (6.89) than in 1995 (7.57), the rate has declined only 3 percent since 2000 (Figure 2 and Table C). Significant declines in 2006 from 2005 were observed for infants of non-Hispanic white mothers (3 percent) and the total of Hispanic mothers (4 percent) (Table C).

Table A. Infant, neonatal, and postneonatal deaths and mortality rates, by race of mother: United States, 2006 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	4,265,593	28,509	19,041	9,468	6.68	4.46	2.22
White	3,310,331	18,422	12,292	6,130	5.57	3.71	1.85
Black	666,494	8,595	5,778	2,818	12.90	8.67	4.23
American Indian or Alaska Native	47,720	395	205	190	8.28	4.30	3.98
Asian or Pacific Islander	241,048	1,097	766	331	4.55	3.18	1.37

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. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

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, 2006 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 ¹	4,265,593	28,509	19,041	9,468	6.68	4.46	2.22
Total Hispanic	1,039,079	5,622	3,883	1,739	5.41	3.74	1.67
Mexican	718,148	3,837	2,679	1,158	5.34	3.73	1.61
Puerto Rican	66,932	536	364	172	8.01	5.44	2.57
Cuban	16,936	86	61	24	5.08	3.60	1.42
Central and South American	165,321	748	515	233	4.52	3.12	1.41
Other and unknown Hispanic	71,742	415	264	151	5.78	3.68	2.10
Non-Hispanic total ²	3,196,111	22,493	14,820	7,673	7.04	4.64	2.40
Non-Hispanic white	2,308,654	12,884	8,410	4,474	5.58	3.64	1.94
Non-Hispanic black	617,260	8,241	5,525	2,716	13.35	8.95	4.40
Not stated	30,403	395	338	57	...	...	...

... Category not applicable.

¹Origin of mother not stated included in "All origins" but not distributed among origins.

²Includes 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. 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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Infant mortality by race and Hispanic origin of mother

As in past years, infant mortality rates in 2006 varied considerably by race and Hispanic origin of mother (8.9). The highest rate, 13.35 per 1,000 live births, was for infants of non-Hispanic black mothers, nearly three times greater than the lowest rate of 4.52 for infants of Central and South American mothers and 4.55 for API mothers. Rates were also fairly high for infants of AIAN (8.28) and Puerto Rican (8.01) mothers. Rates were intermediate, but all below the U.S. rate, for infants of non-Hispanic white (5.58) and Mexican (5.34) mothers. Cuban mothers (5.08) also had a low rate (Figure 2; Tables A–C).

Infant mortality by state

In 2006, compared with 2005, only three states had significant changes in infant mortality rates. Rates declined in South Carolina

(12 percent), California (5 percent), and Texas (5 percent) (Table D). To obtain statistically reliable rates by race and Hispanic origin, three years of data were combined (Table 3). Across the United States, rates are generally higher in the South and Midwest and lower elsewhere (Figure 1). For 2004–2006, infant mortality rates ranged from 10.63 for Mississippi to 4.93 for Massachusetts. The highest rate noted, 12.57, was for the District of Columbia (D.C.); however, the D.C. rate is more appropriately compared with rates for other large U.S. cities because of the high concentration of women at high risk in these areas.

For infants of non-Hispanic black mothers, mortality rates ranged from 20.85 in Hawaii to 8.12 in Washington. For infants of non-Hispanic white mothers, Oklahoma had the highest infant mortality rate (7.68) and Hawaii had the lowest rate (3.66) among states. Among the 41 states where infant mortality rates could be reliably computed for Hispanic mothers, Rhode Island had the highest rate (7.95) and Minnesota had the lowest (4.27).

Table C. Infant mortality rates, by race and Hispanic origin of mother: United States, 1995, 2000–2006 linked files

Race and Hispanic origin of mother	1995	2000	2001	2002	2003	2004	2005	2006	Percent change	
									2000–2006	2005–2006
All races	7.57	6.89	6.84	6.95	6.84	6.78	6.86	6.68	**–3.0	**–2.6
White	6.30	5.71	5.69	5.79	5.72	5.66	5.73	5.57	**–2.5	**–2.8
Black	14.58	13.48	13.34	13.81	13.50	13.25	13.26	12.90	**–4.3	–2.7
American Indian or Alaska Native	9.04	8.30	9.65	8.64	8.73	8.45	8.06	8.28	–0.2	2.7
Asian or Pacific Islander	5.27	4.87	4.73	4.77	4.83	4.67	4.89	4.55	–6.6	–7.0
Hispanic	6.27	5.59	5.44	5.62	5.65	5.55	5.62	5.41	–3.2	**–3.7
Mexican	6.03	5.43	5.22	5.42	5.49	5.47	5.53	5.34	–1.7	–3.4
Puerto Rican	8.88	8.21	8.53	8.20	8.18	7.82	8.30	8.01	–2.4	–3.5
Cuban	5.29	4.54	4.28	3.72	4.57	4.55	4.42	5.08	11.9	14.9
Central and South American	5.52	4.64	4.98	5.06	5.04	4.65	4.68	4.52	–2.6	–3.4
Non-Hispanic white	6.28	5.70	5.72	5.80	5.70	5.66	5.76	5.58	–2.1	**–3.1
Non-Hispanic black	14.65	13.59	13.46	13.89	13.60	13.60	13.63	13.35	–1.8	–2.1

** Significant at $p < 0.05$.

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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

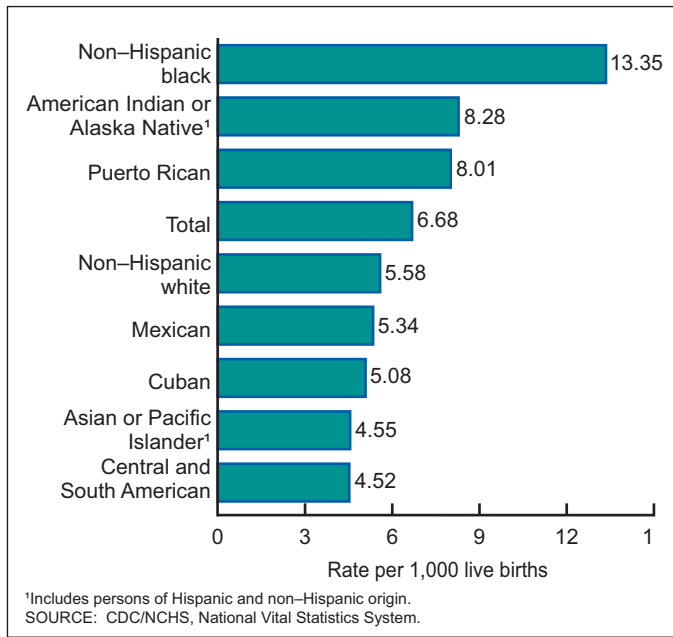


Figure 2. Infant mortality rates, by race and ethnicity of mother: United States, 2006

Mortality rates could be reliably computed for only 13 states for infants of AIAN mothers and for 31 states for infants of API mothers. For infants of AIAN mothers, mortality rates ranged from 12.28 in South Dakota to 6.30 in California. Mortality rates for infants of API mothers ranged from 8.64 in Iowa to 3.19 in Connecticut.

Sex of infant

In 2006, the overall mortality rate for male infants was 7.31 per 1,000 live births, 21 percent higher than the rate for female infants (6.02). Infant mortality rates were higher for male than female infants in each race and Hispanic-origin group (Tables 1 and 2), although the difference was not significant for infants of Cuban and Central and South American mothers.

Multiple births

For multiple births, the infant mortality rate was 30.07, more than five times the rate of 5.87 for singleton births (Tables 1 and 2). Infant mortality rates for multiple births were higher than the rates for singleton births for all race and Hispanic-origin groups.

The risk of infant death increases with the increasing number of infants in the pregnancy. In 2006, the infant mortality rate for twins (27.92) was nearly five times the rate for singleton births (5.87). The rate for triplets (69.63) was nearly 12 times and the rate for quadruplets (146.48) was 25 times higher than the rate for singleton births (Figure 3). A reliable infant mortality rate for quintuplet and higher order births could not be computed due to small numbers of infant deaths for that category. Infant mortality rates for singleton and twin births were significantly lower in 2006 than in 2005, while the infant mortality rate for triplets was significantly higher in 2006 compared with 2005.

Multiple pregnancy can lead to an accentuation of maternal risks and complications associated with pregnancy (2,10–12). For example, multiple births are much more likely to be preterm and of low birthweight than singleton births (2,10–12). The higher risk profile of multiple births

Table D. Infant mortality rates, by state: 2000, 2005, and 2006 linked files

[By place of residence]

State	Infant mortality rate per 1,000 live births			Percent change 2005–2006
	2000	2005	2006	
Total	6.89	6.86	6.68	**–2.6
Alabama	9.51	9.53	8.98	–5.7
Alaska	6.92	5.93	7.00	18.1
Arizona	6.75	6.85	6.36	–7.2
Arkansas	8.23	7.83	8.45	7.9
California	5.42	5.32	5.04	**–5.2
Colorado	6.14	6.44	5.77	–10.5
Connecticut	6.51	5.85	6.17	5.5
Delaware	9.59	9.02	8.09	–10.3
District of Columbia	12.13	13.67	11.85	–13.3
Florida	6.91	7.24	7.26	0.3
Georgia	8.45	8.07	8.07	0.0
Hawaii	8.09	6.58	5.85	–11.2
Idaho	7.56	5.98	6.82	14.0
Illinois	8.48	7.38	7.29	–1.2
Indiana	7.79	8.04	7.91	–1.6
Iowa	6.43	5.44	5.12	–5.9
Kansas	6.55	7.37	7.15	–3.0
Kentucky	7.10	6.73	7.50	11.4
Louisiana	9.03	9.85	9.96	1.1
Maine	4.85	6.87	6.29	–8.5
Maryland	7.51	7.30	7.95	9.0
Massachusetts	4.61	5.13	4.85	–5.3
Michigan	8.19	7.89	7.33	–7.0
Minnesota	5.62	5.09	5.18	1.8
Mississippi	10.64	11.46	10.53	–8.1
Missouri	7.19	7.52	7.45	–1.0
Montana	6.02	7.25	6.00	–17.3
Nebraska	7.18	5.66	5.54	–2.2
Nevada	6.45	5.66	6.62	16.9
New Hampshire	5.82	5.27	5.91	12.2
New Jersey	6.26	5.17	5.44	5.3
New Mexico	6.72	6.17	5.71	–7.5
New York	6.40	5.82	5.64	–3.0
North Carolina	8.60	8.81	8.09	–8.2
North Dakota	8.34	5.96	5.92	–0.7
Ohio	7.66	8.17	7.76	–5.1
Oklahoma	8.40	7.95	7.96	0.1
Oregon	5.57	5.99	5.38	–10.1
Pennsylvania	7.10	7.29	7.65	5.0
Rhode Island	6.24	6.46	6.22	–3.6
South Carolina	8.77	9.46	8.32	**–12.1
South Dakota	5.22	6.98	6.88	–1.4
Tennessee	9.11	8.77	8.65	–1.3
Texas	5.60	6.55	6.19	**–5.4
Utah	5.32	4.52	5.12	13.3
Vermont	6.46	6.49	5.68	–12.4
Virginia	6.91	7.47	7.10	–5.0
Washington	5.20	5.07	4.70	–7.3
West Virginia	7.38	8.16	7.07	–13.3
Wisconsin	6.64	6.54	6.37	–2.5
Wyoming	6.72	6.63	6.78	2.2

** Significant at $p < 0.05$.

has a substantial impact on overall infant mortality (10,13–15). For example, in 2006 multiples accounted for 3 percent of all live births, but 15 percent of all infant deaths in the United States (Table 1).

Age at death

In 2006, two-thirds of all infant deaths (19,041 out of 28,509) occurred during the neonatal period (from birth through 27 days of

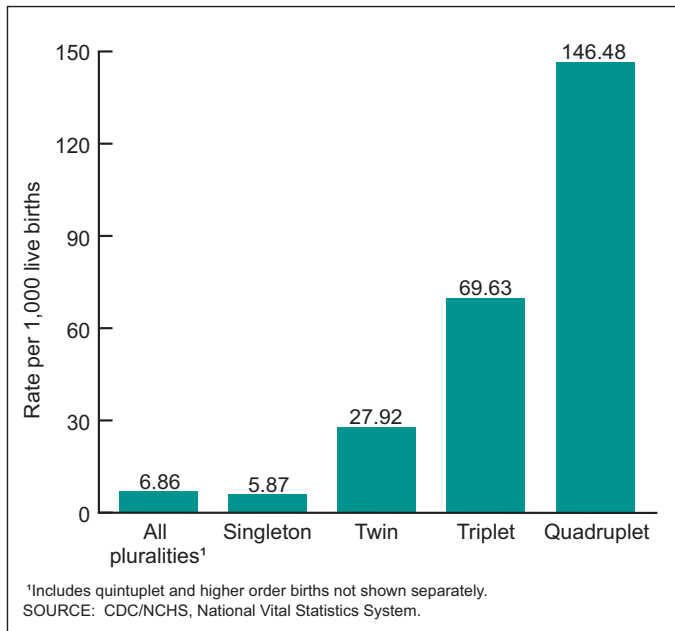


Figure 3. Infant mortality rates, by plurality: United States, 2006

age) (Tables A and B). In 2006, the neonatal mortality rate was 4.46 deaths per 1,000 live births, essentially unchanged from the previous year (4.54). The 2006 postneonatal (28 days to under 1 year) mortality rate of 2.22 was 4 percent lower than the 2005 rate (2.32) but was not significantly different from the 2004 rate (2.25) (2004 and 2005 data not shown).

The neonatal mortality rate for infants of non-Hispanic black mothers (8.95) was more than twice those for infants of AIAN (4.30), non-Hispanic white (3.64), API (3.18), Mexican (3.73), Central and South American (3.12), and Cuban women (3.60) (Figure 4). The neonatal mortality rate for Puerto Rican women (5.44) was the second highest after that for non-Hispanic black women. Neonatal mortality rates did not decline significantly for any race or ethnic group in 2006 from 2005 (data not shown).

Infants of non-Hispanic black (4.40) and AIAN (3.98) mothers had the highest postneonatal mortality rates of any group—more than twice that for non-Hispanic white women (1.94) (Figure 4). The postneonatal mortality rate for Puerto Rican women (2.57) was 32 percent higher than for non-Hispanic white women. In contrast, postneonatal mortality rates for Mexican (1.61), API (1.37), and Central and South American women (1.41) were 17–29 percent lower than for non-Hispanic white women (Figure 4; Tables A and B). Postneonatal mortality rates declined in 2006 from 2005 for non-Hispanic white (2.05 to 1.94, respectively) and Mexican (1.75 to 1.61, respectively) women; rates for other race and Hispanic origin groups were essentially unchanged (2005 data not shown).

Period of gestation

The gestational age of an infant is perhaps the most important predictor of his or her subsequent health and survival. Infants born too small and too soon have a much greater risk of death and both short- and long-term disability than those born at term (37–41 weeks of gestation), and the percentage of preterm births has been linked to variations in infant mortality rates between countries (16–21). Infant

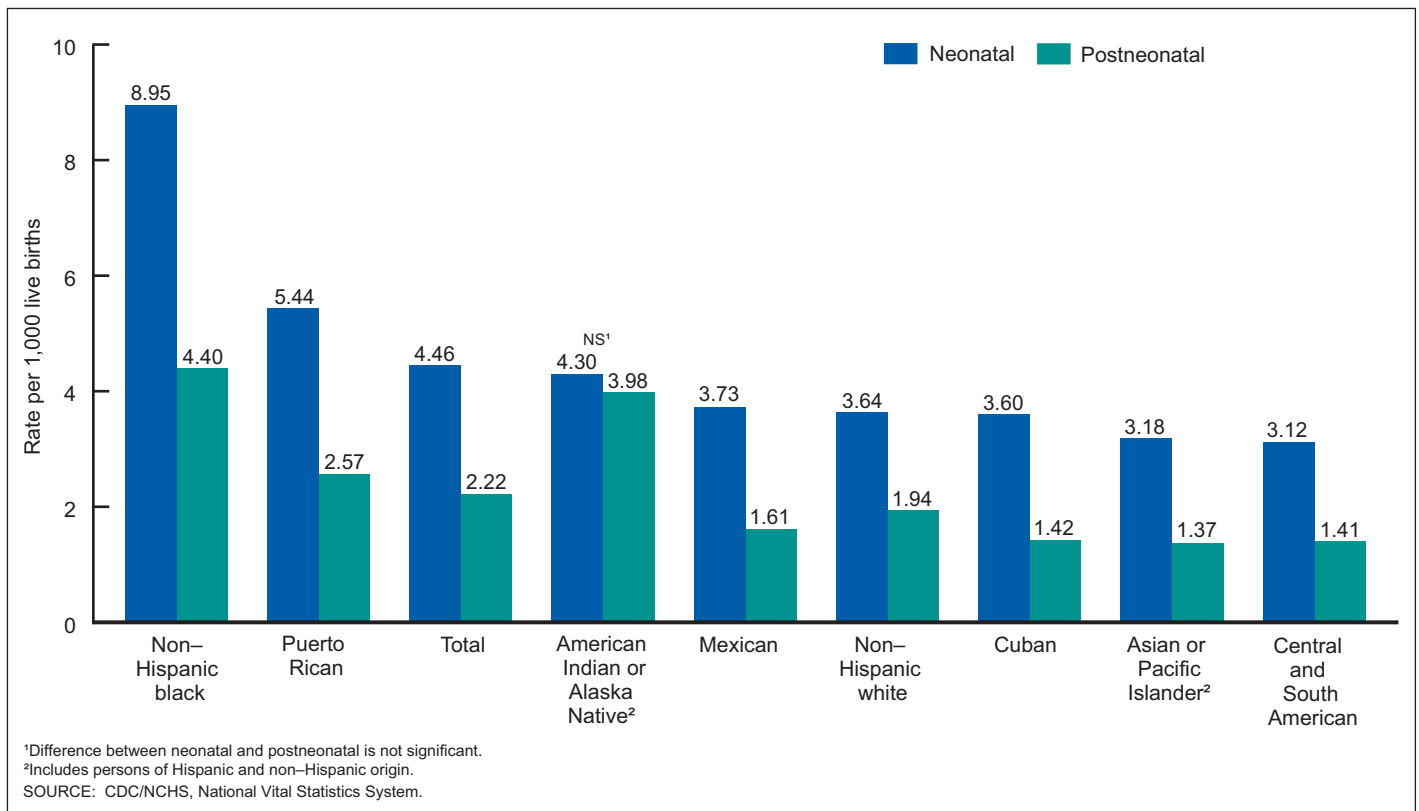


Figure 4. Neonatal and postneonatal mortality rates, by race and ethnicity of mother: United States, 2006

mortality rates are highest for very preterm (less than 32 weeks) infants, and the risk decreases sharply with increasing gestational age (16–20). In 2006, the infant mortality rate for very preterm infants (175.94) was 74 times the rate of 2.39 for term infants (Table E). The mortality rate for infants born at 32–33 weeks of gestation was 16.19, nearly seven times the rate for term infants. Although mortality falls with increasing gestational age, even infants born only a few weeks early have a substantially increased risk of death when compared with term infants (22–24). In 2006, the infant mortality rate for late preterm infants (34–36 weeks of gestation) was 7.08, 2.9 times the rate for term infants. Even within the term period, infants born at 37–39 weeks of gestation had mortality rates that were 28 percent higher than those for infants born at 40–41 weeks of gestation (Tables 1 and 2).

Because of their much greater risk of death, infants born at the lowest gestational ages have a large impact on overall U.S. infant mortality. For example, infants born very preterm accounted for only 2 percent of births but more than one-half of all infant deaths (54 percent) in the United States in 2006 (Table E). Conversely, infants born at 37 weeks of gestation or more accounted for 87 percent of births but 32 percent of infant deaths.

After a plateau from 2000 to 2005, the infant mortality rate for very preterm infants declined by 4 percent in 2006 from 2005. In 2006, the infant mortality rate for very preterm infants was 175.94, compared with

183.24 in 2005 and 180.95 in 2000 (Table E). Changes in 2006 from 2005 for other specific gestational age categories were not statistically significant.

There were large differences in the percentage of preterm births by race and ethnicity, and these differences have a large impact on infant mortality rates (15,25). In 2006, the percentage of preterm births ranged from 10.9 percent of births to API mothers to 18.5 percent of births to non-Hispanic black mothers (Tables 4 and 5). The percentage of preterm births in the United States has been increasing since the mid-1980s (2). A portion of the increase is related to a rise in multiple births (in part due to growth in the use of assisted reproductive technologies), although the percentage of preterm births has also risen for singletons (2). Changes in the medical management of pregnancy (i.e., increases in cesarean section and induction of labor for preterm infants) may have also had an impact (2,12,22,26–28).

Some differences occurred in gestational age-specific infant mortality rates by race and ethnicity (Tables 1 and 2). Infant mortality rates were significantly higher for non-Hispanic black than for non-Hispanic white mothers for the gestational age categories less than 32 weeks, 34–36 weeks, 37–41 weeks, and 42 weeks or more. When compared with non-Hispanic white mothers, infant mortality rates were higher for AIAN mothers at 34–36 weeks and 37–41 weeks of gestation, while infant mortality rates were higher for Puerto Rican mothers at less than 32 weeks of gestation. Compared with non-Hispanic white mothers,

Table E. Infant mortality rates, and percent distribution of live births and infant deaths, by period of gestation: United States, 2000–2006 linked files

Year	All gestational ages ¹	Preterm (less than 37 weeks)					
		Total preterm	Very preterm (less than 32 weeks)	32–33 weeks	Late preterm (34–36 weeks)	Term (37–41 weeks)	Post-term (42 weeks or more)
Infant mortality rate ¹							
2006	6.68	35.15	175.94	16.19	7.08	2.39	2.80
2005	6.86	36.55	183.24	16.69	7.30	2.43	2.66
2004	6.78	36.56	182.47	16.06	7.32	2.39	2.87
2003	6.84	37.21	188.24	16.42	7.12	2.42	2.88
2002	6.95	37.86	186.39	17.63	7.66	2.48	3.07
2001	6.84	36.94	181.00	17.62	7.32	2.54	2.95
2000	6.89	37.88	180.95	17.37	7.96	2.59	2.91
Percent distribution of infant deaths ²							
2006	100.0	68.1	54.3	4.0	9.8	29.5	2.4
2005	100.0	68.6	54.9	3.9	9.8	29.1	2.3
2004	100.0	68.3	54.7	3.8	9.7	29.1	2.7
2003	100.0	68.1	55.0	3.8	9.3	29.2	2.7
2002	100.0	67.3	53.7	4.0	9.7	29.6	3.0
2001	100.0	66.1	52.8	3.8	9.0	30.9	3.0
2000	100.0	65.6	52.0	3.7	9.4	31.2	3.2
Percent distribution of live births ²							
2006	100.0	12.8	2.0	1.6	9.1	81.5	5.7
2005	100.0	12.7	2.0	1.6	9.1	81.4	5.8
2004	100.0	12.5	2.0	1.6	8.9	81.3	6.2
2003	100.0	12.3	2.0	1.6	8.8	81.3	6.4
2002	100.0	12.1	2.0	1.5	8.6	81.2	6.7
2001	100.0	11.9	1.9	1.5	8.4	81.2	6.9
2000	100.0	11.6	1.9	1.5	8.1	81.1	7.3

¹Infant mortality rates are deaths less than 1 year per 1,000 live births in specified group.

²Infant deaths and births with not stated gestational age are subtracted from the total number of events used as denominators for percentage computations.

infant mortality rates for API mothers were lower at 34–36 weeks of gestation; for Mexican mothers, infant mortality rates were lower at 37–41 weeks of gestation; and for Central and South American mothers, infant mortality rates were lower at both less than 32 weeks and 37–41 weeks of gestation.

Birthweight

Birthweight is another important predictor of infant health. It is closely associated but does not exactly correspond with the period of gestation. Infant mortality rates are highest for the smallest infants and decrease sharply as birthweight increases. In 2006, infant mortality rates were much higher for low birthweight (less than 2,500 grams) infants (55.38 per 1,000) than for infants with birthweights of 2,500 grams or more (2.24) (Table 1). The infant mortality rate for very low birthweight (less than 1,500 grams) infants was 240.44, more than 100 times the rate for infants with birthweights of 2,500 grams or more. When detailed birthweight categories are examined (Table 6), 85 percent of infants with birthweights of less than 500 grams (1 lb. 1 oz. or less) died within the first year of life. Reporting of deaths among these very small infants may be incomplete (29). An infant's chances of survival increases rapidly with increasing birthweight: Infant mortality rates were lowest at birthweights of 3,000–4,999 grams.

Because of their much higher mortality rates, infants born at the lowest birthweights have a substantial impact on overall infant mortality rates. For example, infants born weighing less than 1,000 grams accounted for only 0.7 percent of births but nearly one-half of all infant deaths (48.0 percent) in the United States in 2006 (tabular data not shown). Conversely, 91.7 percent of infants born in the United States in 2006 weighed 2,500 grams or more, but these infants accounted for less than one-third of infant deaths (31.0 percent). The large race and Hispanic-origin variations in the percentage of births at low birthweight (less than 2,500 grams)—from 6.6 percent for Mexican mothers to 14.0 percent for non-Hispanic black mothers—mean that some race or ethnic groups are disproportionately impacted by the high infant mortality rates for low birthweight infants (Tables 4 and 5).

From 2000 to 2006, infant mortality rates for the total population declined by 10 percent for infants weighing 1,000–1,249 grams and by 8–14 percent for infants weighing 1,500–3,999 grams at birth (Table 6). Changes for other detailed birthweight categories were not statistically significant.

For non-Hispanic white women from 2000 to 2006, birthweight-specific infant mortality rates declined for specific birthweight categories (1,000–1,249 grams and 2,000–3,499 grams), while for non-Hispanic black and Hispanic women, declines were significant for infants with birthweights of 2,500–3,999 grams. No significant changes for any detailed birthweight category were observed for AIAN and API women. The infant mortality rates for several race and Hispanic origin groups declined for one or both of the summary categories less than 2,500 grams or 2,500 grams or more (Table 6).

Prenatal care

This report includes data on the timing of prenatal care based only on the 12 states that had implemented the 2003 Revision to the U.S. Standard Certificate of Live Birth as of January 1, 2005 (2). The 2003 revision of the birth certificate introduced substantive changes

in item wording and to the sources of prenatal information (see “Methods” and “Technical Notes”). Accordingly, prenatal care data based on the 2003 and 1989 revisions are not directly comparable. Only rates based on the 2003 revised data are shown in this report (see Table II, “Technical Notes”).

The timing and quality of prenatal care received by the mother during pregnancy is important to the infant's subsequent health and survival (30–33). Early comprehensive prenatal care can promote healthier pregnancies by providing health behavior advice as well as early detection and treatment of risk factors and symptoms (30,31). The initiation and subsequent utilization of prenatal care is also viewed as an indicator for access to care (33).

Maternal age

Infant mortality rates vary with maternal age: Infants of teenage mothers (9.78) and mothers aged 40 years and over (8.01) have the highest rates. The lowest rates are for infants of mothers in their late twenties and early thirties (Tables 1 and 2).

In 2006, among births to teenagers, infants of the youngest mothers (under 15 years) had the highest mortality rate (18.14). The rate for infants of mothers aged 15–17 was 10.42, a 9-percent decrease from 2005 (11.40); the rate for infants of mothers aged 18–19 was 9.30 in 2006 compared with 9.60 in 2005 (tabular data not shown); and the rate for infants of mothers aged 20–24 decreased 4 percent from 7.86 in 2005 to 7.55 in 2006.

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

Maternal education

Information on educational attainment in this report is drawn from the 12 states that had implemented the 2003 U.S. Standard Certificate of Live Birth as of January 1, 2005 (2). The format of the education item on the 2003 revised birth certificate substantively differs from that of the unrevised (1989) standard certificate (see “Methods” and “Technical Notes”). Only rates based on the 2003 revised data are shown in this report (see Table II, “Technical Notes”).

Infant mortality rates are known to decrease with increasing educational levels, which may reflect socioeconomic differences; women with more education tend to have higher income levels (9,34).

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 (6.69) was 14 percent higher than for second births (5.89). The rate for fifth and higher order births (10.13) 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 (2,35).

Marital status

Marital status may be a marker for the presence or absence of social, emotional, and financial resources (36,37). Infants of mothers who are not married have been shown to be at higher risk for poor outcomes (38,39). In 2006, infants of unmarried mothers had an infant mortality rate of 9.19 per 1,000, 80 percent higher than the rate for infants of married mothers (5.11) (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 AIAN and Cuban infants, these differences were significant.

Nativity

In 2006, the infant mortality rate for mothers born in the 50 states and the District of Columbia (7.03) was 38 percent higher than the rate for mothers born elsewhere (5.09) (Figure 5; Tables 1 and 2). Among race and Hispanic origin groups for whom infant mortality rates could be calculated, except for Puerto Rican, Cuban, and Central and South American mothers, mothers born in the 50 states and the District of Columbia had higher infant mortality rates than mothers born elsewhere (Tables 1 and 2).

A variety of 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, social support, and risk behaviors (40,41). 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 (42).

Maternal smoking

Information on smoking during pregnancy in this report is based on the 2003 revision of the birth certificate, which differs substantively from that of the unrevised (1989) standard certificate (2). For the 2006 linked file, revised data are available for 11 of the 12 states that revised their certificates as of January 1, 2005; Florida revised the certificate but had a noncomparable question (see “Methods” and “Technical Notes”). Only rates based on the 2003 revised data are shown in this report (see Table II, “Technical Notes”).

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 (43,44). Maternal smoking has also been shown to increase the risk of respiratory infections and inhibit allergic immune responses in infants (45,46).

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 2006 was

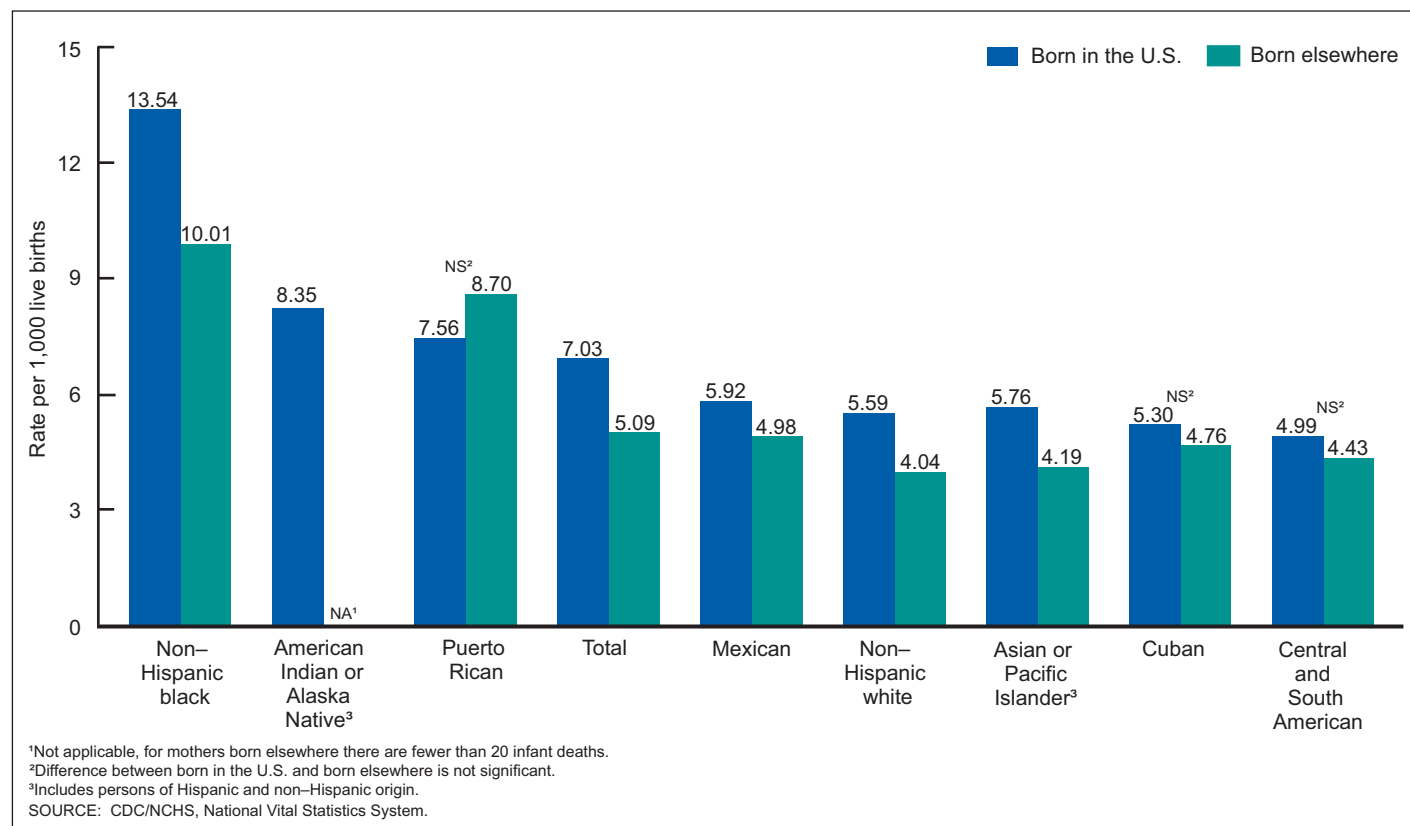


Figure 5. Infant mortality rates, by mother’s place of birth and race and ethnicity of mother: United States, 2006

Congenital malformations, deformations and chromosomal abnormalities (congenital malformations), accounting for 21 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) at 8 percent of infant deaths. The fourth and fifth leading causes—Newborn affected by maternal complications of pregnancy (maternal complications), followed by Accidents (unintentional injuries)—accounted for 6 percent and 4 percent, respectively, of all infant deaths in 2006. Together the five leading causes accounted for 56 percent of all infant deaths in the United States in 2006. The order of the top four leading causes was the same as in 2005. The fifth leading cause of death in 2006 was unintentional injuries, which was ranked sixth in 2005. Newborn affected by complications of placenta, cord and membranes (cord complications) was fifth in 2005 but dropped to sixth in 2006. Infant mortality rates for the five leading causes did not change significantly in 2006 from 2005, except for maternal complications, which declined by 8 percent in 2006 from a year earlier (2005 data not shown).

In 2006, the rank order of 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 women, for whom low birthweight was the leading cause.

When differences between cause-specific infant mortality rates were examined by race and ethnicity, infant mortality rates from Congenital malformations were 38 percent higher for non-Hispanic black and 20 percent higher for Mexican than for non-Hispanic white women. Infant mortality rates from Congenital malformations were 14 percent lower for API than for non-Hispanic white women.

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 AIAN and non-Hispanic black mothers—2.1 and 1.9 times those for non-Hispanic white mothers, respectively. As most SIDS deaths occur during the postneonatal period, the high SIDS rates for infants of non-Hispanic black and AIAN mothers accounted for much of their elevated risk of postneonatal mortality. Compared with non-Hispanic white mothers, SIDS rates were 54 percent lower for Mexican mothers, 59 percent lower for API mothers, and 73 percent lower for Central and South American mothers.

For maternal complications (e.g., incompetent cervix, premature rupture of membranes, and multiple pregnancy, among others), infants of non-Hispanic black mothers had the highest mortality rates—2.8 times those for non-Hispanic white mothers. Rates for Puerto Rican mothers were 74 percent higher than for non-Hispanic white mothers. Infants of non-Hispanic black and Puerto Rican women have a much higher percentage of low birthweight (Tables 4 and 5), which may help to explain their higher infant mortality rates from maternal complications, as this cause occurs predominantly among low birthweight infants. Infant mortality rates from maternal complications were 26 percent lower for API and 52 percent lower for Central and South American women than for non-Hispanic white women.

For AIAN women, infant mortality rates from unintentional injuries were triple those for non-Hispanic white women. For non-Hispanic black women, rates from unintentional injuries were double those for non-Hispanic white women. Infant mortality rates from unintentional injuries were 47 percent lower for Mexican and 50 percent lower for API women than for non-Hispanic white women.

An examination of cause-specific differences in infant mortality rates among race and Hispanic origin groups can help in understanding overall differences in infant mortality rates among these groups. For example, 29 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, and 7 percent by differences in maternal complications. In other words, if non-Hispanic black infant mortality rates for these two 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 36 percent.

For AIAN mothers, 24 percent of their elevated infant mortality rate, when compared with non-Hispanic white mothers, can be accounted for by their higher SIDS rate and 19 percent by differences in unintentional injuries. Thus, if AIAN infant mortality rates for these two causes could be reduced to non-Hispanic white levels, the difference in the infant mortality rate between AIAN and non-Hispanic white mothers would be reduced by 43 percent.

Similarly, 37 percent of the difference between Puerto Rican and non-Hispanic white infant mortality rates can be accounted for by differences in low birthweight and 10 percent by differences in maternal complications. Thus, if Puerto Rican infant mortality from these two 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 47 percent.

Preterm-related causes of death

In order to more fully assess the impact of preterm birth on infant mortality, CDC researchers have developed a grouping of *preterm-related* causes of death. A cause of death is considered preterm related if 75 percent or more of infants whose deaths were attributed to that cause were born at less than 37 weeks of gestation, and the cause of death was a direct consequence of preterm birth based on a clinical evaluation and review of the literature (47,48).

This grouping was developed because it is difficult, using traditional analyses of the leading causes of infant death, to assess the overall impact of preterm-related infant deaths on infant mortality. In particular, the category of Disorders related to short gestation and low birthweight, not elsewhere classified, includes the phrase “not elsewhere classified,” indicating that many other preterm-related infant deaths are classified to other cause-of-death categories.

The comprehensive list of preterm-related cause-of-death categories (ICD-10 codes) is shown in the Table 8 footnote. Note that even this more comprehensive listing probably underestimates the total impact of preterm-related infant death, as some cause-of-death categories (notably those beginning with the words “other” and “all other”) had a high percentage of preterm infant deaths but lacked sufficient specificity to be able to establish the etiologic connection to prematurity with any degree of certainty.

Table 8 shows trends in preterm-related infant mortality by race and Hispanic origin of mother from 2000 to 2006. Of the total 28,509 infant deaths in the United States in 2006, 10,303 were preterm related. In 2006, 36.1 percent of all infant deaths in the United States were preterm related, slightly lower than in 2005 (36.5 percent), but still 4 percent higher than in 2000 (34.6 percent).

The impact of preterm-related infant deaths varied considerably by maternal race and ethnicity. In 2006, 45 percent of infant deaths to non-Hispanic black women and 41 percent of infant deaths to Puerto Rican women were due to preterm-related causes, while percentages were somewhat lower for other race and ethnic groups (Table 8).

Preterm-related infant mortality rates varied considerably by race and ethnicity of the mother (Figure 6 and Table 8). Preterm-related infant mortality rates were 3.4 times higher for non-Hispanic black (6.01) than for non-Hispanic white mothers (1.79). In fact, in 2006 the preterm-related infant mortality rate for non-Hispanic black mothers was higher than the total infant mortality rate for non-Hispanic white, Mexican, Central and South American, and API women. The preterm-related infant mortality rate for Puerto Rican women (3.30) was 84 percent higher than for non-Hispanic white women. Preterm-related infant mortality rates for API (1.49) and Central and South American (1.52) women were significantly lower than for non-Hispanic white women. Changes in preterm-related infant mortality rates in 2006 from 2005 were not statistically significant except for API women, who had a 14 percent decline in preterm-related infant mortality.

As with the leading causes of death, it is possible to compute the contribution of preterm-related infant mortality to race and ethnic differences in infant mortality rates. Thus, 54 percent of the difference

between the non-Hispanic black and non-Hispanic white infant mortality rates is due to preterm-related causes. If preterm-related infant mortality for non-Hispanic black women could be reduced to non-Hispanic white levels, the difference in the infant mortality rate between non-Hispanic black and non-Hispanic white mothers would be reduced by 54 percent.

Similarly, for Puerto Rican women, 62 percent of the difference in infant mortality rates compared with non-Hispanic white women is due to differences in preterm-related causes of death, and reducing preterm-related infant mortality for Puerto Rican women to the levels for non-Hispanic white women would lower the difference in rates between the two groups by the same percentage. In addition to helping to explain differences in infant mortality rates between various groups, comparisons such as these can be helpful in targeting prevention efforts.

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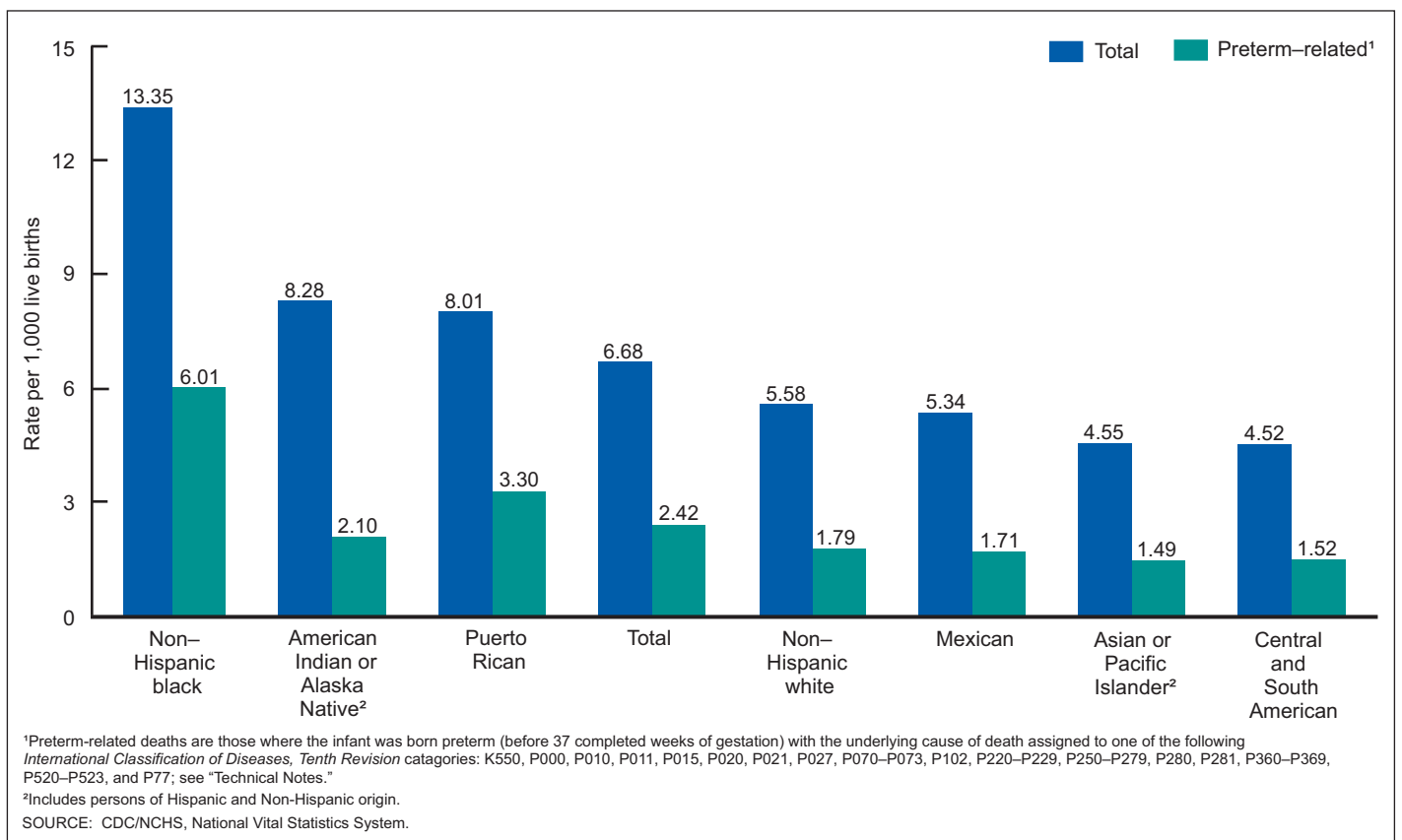


Figure 6. Total and preterm-related infant mortality rates, by race and ethnicity of mother: United States, 2006

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Table 1. Infant mortality rates, live births, and infant deaths, by selected characteristics and race of mother: United States, 2006 linked file

Characteristic	All races	Race of mother			
		White	Black	American Indian or Alaska Native	Asian or Pacific Islander
Infant mortality rates per 1,000 live births in specified group					
Total	6.68	5.57	12.90	8.28	4.55
Age at death					
Total neonatal	4.46	3.71	8.67	4.30	3.18
Early neonatal (less than 7 days)	3.55	2.95	6.93	3.29	2.56
Late neonatal (7–27 days)	0.91	0.77	1.74	1.03	0.63
Postneonatal	2.22	1.85	4.23	3.98	1.37
Sex					
Male	7.31	6.12	13.91	9.54	5.09
Female	6.02	4.98	11.84	6.96	3.98
Plurality					
Single births	5.87	4.87	11.39	7.84	3.96
Plural births	30.07	25.57	52.18	26.38	24.32
Birthweight					
Less than 2,500 grams	55.38	50.10	72.95	54.71	38.55
Less than 1,500 grams	240.44	228.21	269.15	227.56	206.82
1,500–2,499 grams	14.11	13.95	15.09	18.81	11.04
2,500 grams or more	2.24	2.06	3.33	4.49	1.50
Period of gestation					
Less than 32 weeks	175.94	162.26	208.41	139.88	160.22
32–33 weeks	16.19	15.83	17.11	*	16.91
34–36 weeks	7.08	6.61	9.11	9.69	5.27
37–41 weeks	2.39	2.17	3.68	4.85	1.65
37–39 weeks	2.58	2.34	3.96	4.79	1.74
40–41 weeks	2.02	1.84	3.06	5.05	1.46
42 weeks or more	2.80	2.65	3.83	*	2.09
Age of mother					
Under 20 years	9.78	8.30	13.94	8.83	9.51
20–24 years	7.55	6.26	12.72	8.45	5.40
25–29 years	5.95	4.99	11.94	8.28	4.09
30–34 years	5.32	4.46	12.96	7.67	3.39
35–39 years	6.09	5.14	13.73	6.68	5.28
40–54 years	8.01	6.92	14.88	*	7.80
Live-birth order					
1	6.69	5.61	13.15	7.82	4.25
2	5.89	5.08	11.14	6.87	4.21
3	6.39	5.24	12.33	7.79	5.00
4	7.78	6.30	13.80	10.61	7.02
5 or more	10.13	7.88	16.97	12.86	7.57
Marital status					
Married	5.11	4.68	10.71	7.28	4.17
Unmarried	9.19	7.33	13.82	8.82	6.48
Mother's place of birth					
Born in the 50 states and D.C.	7.03	5.66	13.36	8.35	5.76
Born elsewhere	5.09	4.82	8.65	*	4.19

See footnotes at end of table.

Table 1. Infant mortality rates, live births, and infant deaths, by selected characteristics and race of mother: United States, 2006 linked file—Con.

Characteristic	Race of mother				
	All races	White	Black	American Indian or Alaska Native	Asian or Pacific Islander
Live births					
Total	4,265,593	3,310,331	666,494	47,720	241,048
Sex					
Male	2,184,260	1,695,886	339,844	24,308	124,222
Female	2,081,333	1,614,445	326,650	23,412	116,826
Plurality					
Single births	4,121,964	3,199,491	641,869	46,545	234,059
Plural births	143,629	110,840	24,625	1,175	6,989
Birthweight					
Less than 2,500 grams	353,460	239,310	90,940	3,601	19,609
Less than 1,500 grams	64,456	40,366	20,710	624	2,756
1,500–2,499 grams	289,004	198,944	70,230	2,977	16,853
2,500 grams or more	3,911,038	3,070,169	575,385	44,111	221,373
Not stated	1,095	852	169	8	66
Period of gestation					
Less than 32 weeks	86,547	55,756	26,294	1,008	3,489
32–33 weeks	68,579	48,264	16,129	874	3,312
34–36 weeks	387,791	285,839	77,746	4,848	19,358
37–41 weeks	3,456,424	2,709,329	508,501	37,292	201,302
37–39 weeks	2,303,021	1,792,662	349,822	24,410	136,127
40–41 weeks	1,153,403	916,667	158,679	12,882	65,175
42 weeks or more	240,589	190,709	34,959	3,451	11,470
Not stated	25,663	20,434	2,865	247	2,117
Age of mother					
Under 20 years	441,834	311,948	113,616	8,385	7,885
20–24 years	1,080,451	818,260	213,884	16,447	31,860
25–29 years	1,181,909	935,936	166,862	12,197	66,914
30–34 years	950,267	756,478	104,123	6,780	82,886
35–39 years	498,620	399,118	53,964	3,143	42,395
40–54 years	112,512	88,591	14,045	768	9,108
Live-birth order					
1	1,697,000	1,312,347	257,537	16,754	110,362
2	1,354,418	1,067,145	189,937	12,947	84,389
3	716,673	563,322	115,040	8,725	29,586
4	288,771	220,968	53,640	4,618	9,545
5 or more	185,022	131,031	43,480	4,431	6,080
Not stated	23,709	15,518	6,860	245	1,086
Marital status					
Married	2,623,623	2,206,767	198,596	16,892	201,368
Unmarried	1,641,970	1,103,564	467,898	30,828	39,680
Mother's place of birth					
Born in the 50 states and D.C.	3,191,345	2,545,857	555,151	44,659	45,678
Born elsewhere	1,058,707	755,713	105,652	2,952	194,390
Not stated	15,541	8,761	5,691	109	980

See footnotes at end of table.

Table 1. Infant mortality rates, live births, and infant deaths, by selected characteristics and race of mother: United States, 2006 linked file—Con.

Characteristic	Race of mother				
	All races	White	Black	American Indian or Alaska Native	Asian or Pacific Islander
Infant deaths					
Total	28,509	18,422	8,595	395	1,097
Age at death					
Total neonatal	19,041	12,292	5,778	205	766
Early neonatal (less than 7 days)	15,148	9,760	4,616	157	616
Late neonatal (7–27 days)	3,893	2,533	1,161	49	151
Postneonatal	9,468	6,130	2,818	190	331
Sex					
Male	15,973	10,384	4,726	232	632
Female	12,536	8,039	3,869	163	465
Plurality					
Single births	24,190	15,588	7,310	365	927
Plural births	4,319	2,834	1,285	31	170
Birthweight					
Less than 2,500 grams	19,576	11,989	6,634	197	756
Less than 1,500 grams	15,498	9,212	5,574	142	570
1,500–2,499 grams	4,078	2,776	1,060	56	186
2,500 grams or more	8,779	6,331	1,918	198	333
Not stated	154	103	44	–	8
Period of gestation					
Less than 32 weeks	15,227	9,047	5,480	141	559
32–33 weeks	1,110	764	276	14	56
34–36 weeks	2,746	1,890	708	47	102
37–41 weeks	8,272	5,888	1,871	181	332
37–39 weeks	5,937	4,198	1,385	117	237
40–41 weeks	2,335	1,690	485	65	95
42 weeks or more	674	505	134	11	24
Not stated	481	329	127	1	24
Age of mother					
Under 20 years	4,320	2,588	1,584	74	75
20–24 years	8,156	5,124	2,721	139	172
25–29 years	7,036	4,669	1,992	101	274
30–34 years	5,058	3,376	1,349	52	281
35–39 years	3,039	2,053	741	21	224
40–54 years	901	613	209	8	71
Live-birth order					
1	11,345	7,359	3,387	131	469
2	7,977	5,417	2,116	89	355
3	4,583	2,949	1,418	68	148
4	2,248	1,393	740	49	67
5 or more	1,874	1,033	738	57	46
Not stated	482	271	197	2	12
Marital status					
Married	13,419	10,330	2,127	123	840
Unmarried	15,091	8,093	6,468	272	257
Mother's place of birth					
Born in the 50 states and D.C.	22,450	14,397	7,417	373	263
Born elsewhere	5,389	3,643	914	17	815
Not stated	671	383	265	5	18

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

– Quantity zero.

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. In this table, all women (including Hispanic women) are classified only according to their race. See reference 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

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, 2006 linked file

Characteristic	All origins ¹	Hispanic						Non-Hispanic		
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total ²	White	Black
Infant mortality rates per 1,000 live births in specified group										
Total	6.68	5.41	5.34	8.01	5.08	4.52	5.78	7.04	5.58	13.35
Age at death										
Total neonatal	4.46	3.74	3.73	5.44	3.60	3.12	3.68	4.64	3.64	8.95
Early neonatal (less than 7 days)	3.55	2.98	3.00	4.36	2.95	2.44	2.79	3.67	2.87	7.15
Late neonatal (7–27 days)	0.91	0.76	0.74	1.08	*	0.68	0.89	0.97	0.78	1.80
Postneonatal	2.22	1.67	1.61	2.57	1.42	1.41	2.10	2.40	1.94	4.40
Sex										
Male	7.31	5.86	5.80	9.13	4.97	4.60	6.53	7.72	6.19	14.36
Female	6.02	4.94	4.87	6.86	5.07	4.45	4.98	6.32	4.94	12.30
Plurality										
Single births	5.87	4.89	4.84	7.09	4.20	4.12	5.20	6.14	4.82	11.78
Plural births	30.07	28.06	28.69	37.27	*	20.90	26.65	30.26	24.69	53.30
Birthweight										
Less than 2,500 grams	55.38	53.16	54.79	58.85	51.20	47.42	45.28	55.41	48.17	73.44
Less than 1,500 grams	240.44	236.88	241.91	250.19	251.14	215.60	215.57	239.05	221.13	269.78
1,500–2,499 grams	14.11	14.67	15.63	13.64	*	13.42	12.21	13.90	13.56	15.13
2,500 grams or more	2.24	1.79	1.83	2.25	1.46	1.37	2.06	2.40	2.18	3.47
Period of gestation										
Less than 32 weeks	175.94	155.60	154.60	187.18	177.05	145.01	142.86	179.67	162.74	209.63
32–33 weeks	16.19	14.53	14.93	15.16	*	13.27	*	16.71	16.38	17.31
34–36 weeks	7.08	6.12	6.43	5.94	*	5.30	5.63	7.36	6.78	9.32
37–41 weeks	2.39	1.96	2.02	2.51	*	1.44	2.30	2.53	2.26	3.83
37–39 weeks	2.58	2.13	2.20	2.73	*	1.53	2.41	2.72	2.43	4.10
40–41 weeks	2.02	1.66	1.69	2.07	*	1.27	2.07	2.15	1.92	3.24
42 weeks or more	2.80	2.35	2.39	*	*	2.02	*	2.98	2.81	3.97
Age of mother										
Under 20 years	9.78	6.85	6.63	10.38	*	6.09	6.01	11.22	9.48	14.30
20–24 years	7.55	5.30	5.10	7.52	5.94	4.57	6.34	8.40	6.77	13.18
25–29 years	5.95	4.78	4.74	6.92	*	3.97	5.34	6.26	5.02	12.36
30–34 years	5.32	4.85	4.89	8.18	*	3.94	4.90	5.38	4.28	13.47
35–39 years	6.09	5.82	6.03	7.48	*	4.85	5.47	6.04	4.81	14.28
40–54 years	8.01	8.78	9.21	*	*	8.16	*	7.79	6.35	15.53
Live-birth order										
1	6.69	5.45	5.50	8.12	4.94	4.18	5.58	6.99	5.64	13.67
2	5.89	5.11	5.09	6.26	4.40	4.37	6.20	6.11	5.06	11.54
3	6.39	4.86	4.70	8.12	*	4.20	4.81	6.98	5.41	12.80
4	7.78	5.65	5.27	9.92	*	5.82	6.28	8.71	6.65	14.32
5 or more	10.13	7.83	7.61	13.14	*	7.23	7.04	10.97	7.69	17.31
Marital status										
Married	5.11	4.92	5.05	5.80	3.99	4.19	4.83	5.13	4.58	11.16
Unmarried	9.19	5.91	5.66	9.34	6.60	4.84	6.76	10.62	8.35	14.26
Mother's place of birth										
Born in the 50 states and D.C	7.03	6.00	5.92	7.56	5.30	4.99	5.61	7.17	5.59	13.54
Born elsewhere	5.09	4.99	4.98	8.70	4.76	4.43	5.48	5.22	4.04	10.01

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, 2006 linked file—Con.

Characteristic	All origins ¹	Hispanic						Non-Hispanic			
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total ²	White	Black	Not stated
Live births											
Total	4,265,593	1,039,079	718,148	66,932	16,936	165,321	71,742	3,196,111	2,308,654	617,260	30,403
Sex											
Male	2,184,260	530,875	366,632	34,288	8,659	84,860	36,436	1,637,893	1,184,310	314,607	15,492
Female	2,081,333	508,204	351,516	32,644	8,277	80,461	35,306	1,558,218	1,124,344	302,653	14,911
Plurality											
Single births	4,121,964	1,015,594	703,125	64,866	16,425	161,350	69,828	3,077,248	2,220,739	593,977	29,122
Plural births	143,629	23,485	15,023	2,066	511	3,971	1,914	118,863	87,915	23,283	1,281
Birthweight											
Less than 2,500 grams	353,460	72,795	47,343	6,797	1,211	11,283	6,161	277,872	169,517	86,588	2,793
Less than 1,500 grams	64,456	12,610	8,193	1,299	219	1,897	1,002	51,227	28,260	19,827	619
1,500–2,499 grams	289,004	60,185	39,150	5,498	992	9,386	5,159	226,645	141,257	66,761	2,174
2,500 grams or more	3,911,038	965,881	670,461	60,127	15,723	154,008	65,562	2,917,768	2,138,863	530,536	27,389
Not stated	1,095	403	344	8	2	30	19	471	274	136	221
Period of gestation											
Less than 32 weeks	86,547	18,477	12,102	1,731	305	2,855	1,484	67,323	38,115	25,063	747
32–33 weeks	68,579	16,453	11,055	1,319	286	2,487	1,306	51,655	32,542	15,247	471
34–36 weeks	387,791	90,804	60,810	6,571	1,624	14,516	7,283	294,343	198,612	73,138	2,644
37–41 weeks	3,456,424	837,354	579,187	53,069	13,806	134,432	56,860	2,595,142	1,902,205	469,239	23,928
37–39 weeks	2,303,021	548,532	376,953	35,170	9,641	87,320	39,448	1,738,927	1,263,875	324,318	15,562
40–41 weeks	1,153,403	288,822	202,234	17,899	4,165	47,112	17,412	856,215	638,330	144,921	8,366
42 weeks or more	240,589	63,499	44,408	4,074	878	9,885	4,254	175,409	129,674	31,980	1,681
Not stated	25,663	12,492	10,586	168	37	1,146	555	12,239	7,506	2,593	932
Age of mother											
Under 20 years	441,834	148,125	107,982	11,852	1,352	14,785	12,154	291,004	170,997	106,188	2,705
20–24 years	1,080,451	303,455	216,372	20,998	3,703	40,297	22,085	770,249	528,360	198,740	6,747
25–29 years	1,181,909	280,615	193,311	17,051	4,151	48,120	17,982	893,307	665,484	153,615	7,987
30–34 years	950,267	194,595	129,902	10,385	4,745	37,306	12,257	748,467	566,712	95,782	7,205
35–39 years	498,620	91,568	58,200	5,347	2,385	19,787	5,849	402,599	309,033	49,929	4,453
40–54 years	112,512	20,721	12,381	1,299	600	5,026	1,415	90,485	68,068	13,006	1,306
Live-birth order											
1	1,697,000	370,192	243,208	26,719	7,691	64,776	27,798	1,314,988	957,389	237,839	11,820
2	1,354,418	315,284	214,039	20,448	6,138	52,874	21,785	1,030,204	763,217	175,187	8,930
3	716,673	203,278	147,738	11,447	2,180	29,021	12,892	508,665	366,962	106,505	4,730
4	288,771	91,519	69,059	4,841	557	11,333	5,729	195,232	132,304	50,144	2,020
5 or more	185,022	55,926	42,550	3,197	273	6,638	3,268	127,443	76,718	41,191	1,653
Not stated	23,709	2,880	1,554	280	97	679	270	19,579	12,064	6,394	1,250
Marital status											
Married	2,623,623	520,953	368,900	25,164	10,268	80,208	36,413	2,083,551	1,694,125	181,022	19,119
Unmarried	1,641,970	518,126	349,248	41,768	6,668	85,113	35,329	1,112,560	614,529	436,238	11,284
Mother's place of birth											
Born in the 50 states and D.C	3,191,345	389,002	257,356	45,926	8,309	22,652	54,759	2,780,477	2,164,913	534,924	21,866
Born elsewhere	1,058,707	648,344	460,089	20,584	8,611	142,451	16,609	403,281	137,287	77,391	7,082
Not stated	15,541	1,733	703	422	16	218	374	12,353	6,454	4,945	1,455

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, 2006 linked file—Con.

Characteristic	All origins ¹	Hispanic						Non-Hispanic			Not stated
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total ²	White	Black	
Infant deaths											
Total	28,509	5,622	3,837	536	86	748	415	22,493	12,884	8,241	395
Age at death											
Total neonatal	19,041	3,883	2,679	364	61	515	264	14,820	8,410	5,525	338
Early neonatal (less than 7 days)	15,148	3,096	2,151	292	50	403	200	11,735	6,620	4,414	317
Late neonatal (7–27 days)	3,893	787	528	72	11	112	64	3,085	1,790	1,111	21
Postneonatal	9,468	1,739	1,158	172	24	233	151	7,673	4,474	2,716	57
Sex											
Male	15,973	3,110	2,125	313	43	390	238	12,640	7,328	4,518	224
Female	12,536	2,512	1,712	224	42	358	176	9,853	5,556	3,723	171
Plurality											
Single births	24,190	4,963	3,406	460	69	665	363	18,896	10,713	7,000	332
Plural births	4,319	659	431	77	17	83	51	3,597	2,171	1,241	63
Birthweight											
Less than 2,500 grams	19,576	3,870	2,594	400	62	535	279	15,396	8,165	6,359	310
Less than 1,500 grams	15,498	2,987	1,982	325	55	409	216	12,246	6,249	5,349	265
1,500–2,499 grams	4,078	883	612	75	7	126	63	3,150	1,916	1,010	45
2,500 grams or more	8,779	1,729	1,224	135	23	211	135	6,997	4,666	1,842	53
Not stated	154	23	19	2	–	2	–	99	53	40	32
Period of gestation											
Less than 32 weeks	15,227	2,875	1,871	324	54	414	212	12,096	6,203	5,254	255
32–33 weeks	1,110	239	165	20	5	33	16	863	533	264	7
34–36 weeks	2,746	556	391	39	8	77	41	2,165	1,347	682	26
37–41 weeks	8,272	1,645	1,171	133	16	194	131	6,576	4,300	1,799	51
37–39 weeks	5,937	1,166	829	96	12	134	95	4,734	3,076	1,329	37
40–41 weeks	2,335	479	342	37	4	60	36	1,842	1,224	470	14
42 weeks or more	674	149	106	13	1	20	8	522	364	127	4
Not stated	481	158	133	7	1	10	6	271	137	114	52
Age of mother											
Under 20 years	4,320	1,015	716	123	12	90	73	3,265	1,621	1,519	41
20–24 years	8,156	1,609	1,104	158	22	184	140	6,473	3,578	2,619	74
25–29 years	7,036	1,340	917	118	19	191	96	5,589	3,339	1,898	107
30–34 years	5,058	944	635	85	17	147	60	4,028	2,428	1,290	86
35–39 years	3,039	533	351	40	14	96	32	2,432	1,485	713	74
40–54 years	901	182	114	12	1	41	14	705	432	202	13
Live-birth order											
1	11,345	2,019	1,338	217	38	271	155	9,195	5,395	3,251	131
2	7,977	1,612	1,090	128	27	231	135	6,290	3,863	2,021	75
3	4,583	987	695	93	15	122	62	3,551	1,984	1,363	46
4	2,248	517	364	48	4	66	36	1,701	880	718	29
5 or more	1,874	438	324	42	–	48	23	1,398	590	713	38
Not stated	482	50	26	8	1	11	3	357	171	173	76
Marital status											
Married	13,419	2,561	1,862	146	41	336	176	10,682	7,754	2,020	176
Unmarried	15,091	3,061	1,975	390	44	412	239	11,811	5,130	6,221	219
Mother's place of birth											
Born in the 50 states and D.C.	22,450	2,335	1,523	347	44	113	307	19,928	12,107	7,242	187
Born elsewhere	5,389	3,233	2,289	179	41	631	91	2,104	554	775	52
Not stated	671	54	25	10	–	3	16	461	223	224	156

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

– Quantity zero.

¹Includes origin not stated.²Includes races other than black or white.

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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Table 3. Infant mortality rates, by race and Hispanic origin of mother: United States and each state, Puerto Rico, Virgin Islands, and Guam, 2004–2006 linked files

[By place of residence]

State	Total	Race and Hispanic origin of mother						
		Race				Hispanic origin		
		White	Black	American Indian or Alaska Native	Asian or Pacific Islander	Hispanic	Non-Hispanic white	Non-Hispanic black
Infant mortality rates per 1,000 live births in specified group								
United States ¹	6.77	5.65	13.13	8.26	4.70	5.52	5.67	13.52
Alabama	9.07	7.02	13.85	*	*	7.43	6.98	13.76
Alaska	6.51	4.68	*	9.84	*	*	5.01	*
Arizona	6.64	6.41	11.30	7.19	5.96	6.72	6.05	12.30
Arkansas	8.23	6.90	13.94	*	*	6.28	6.96	13.99
California	5.17	4.87	11.31	6.30	4.12	4.91	4.67	11.40
Colorado	6.14	5.80	13.69	*	5.62	7.01	5.18	13.97
Connecticut	5.82	4.78	13.41	*	3.19	7.76	3.97	13.38
Delaware	8.57	6.23	15.18	*	*	5.54	6.31	15.02
District of Columbia	12.57	3.99	16.54	*	*	*	3.22	18.46
Florida	7.18	5.60	12.09	*	5.47	5.07	5.86	12.76
Georgia	8.22	5.92	12.99	*	5.91	5.15	6.07	12.95
Hawaii	6.07	4.11	18.55	*	6.36	6.11	3.66	20.85
Idaho	6.31	6.21	*	*	*	7.32	5.97	*
Illinois	7.40	5.97	14.42	*	5.12	6.21	5.88	14.39
Indiana	7.94	6.96	15.99	*	*	6.74	6.99	16.07
Iowa	5.21	4.97	8.25	*	8.64	5.01	4.96	8.18
Kansas	7.28	6.64	14.45	*	6.43	6.43	6.77	14.46
Kentucky	7.03	6.50	12.53	*	*	7.35	6.48	12.54
Louisiana	10.04	6.96	14.66	*	6.32	5.65	7.00	14.69
Maine	6.28	6.26	*	*	*	*	6.16	*
Maryland	7.90	5.59	12.30	*	4.55	5.26	5.55	12.94
Massachusetts	4.93	4.41	9.33	*	3.56	6.38	3.99	10.31
Michigan	7.60	5.90	15.67	*	4.86	7.32	5.74	15.66
Minnesota	4.97	4.45	8.77	9.48	4.06	4.27	4.36	9.62
Mississippi	10.63	6.75	15.38	*	*	5.74	6.80	15.40
Missouri	7.48	6.45	13.70	*	5.49	6.23	6.45	13.79
Montana	5.95	5.32	*	9.94	*	*	5.03	*
Nebraska	5.91	5.46	11.59	*	*	5.84	5.25	12.15
Nevada	6.18	5.44	13.95	*	5.57	5.10	5.53	14.33
New Hampshire	5.60	5.43	*	*	*	*	5.33	*
New Jersey	5.39	4.15	10.92	*	4.68	5.14	3.68	11.76
New Mexico	6.12	5.84	*	7.61	*	5.41	6.75	*
New York	5.87	4.78	10.27	*	3.80	5.29	4.61	11.46
North Carolina	8.54	6.32	15.66	10.61	6.11	6.17	6.37	15.66
North Dakota	5.91	5.38	*	9.79	*	*	5.37	*
Ohio	7.82	6.35	15.56	*	4.36	5.61	6.35	15.92
Oklahoma	7.95	7.35	12.94	8.31	6.30	5.38	7.68	13.07
Oregon	5.61	5.49	8.99	8.32	5.18	5.37	5.54	9.42
Pennsylvania	7.40	6.13	14.00	*	5.63	7.71	5.84	13.82
Rhode Island	6.02	5.43	10.87	*	*	7.95	3.97	11.42
South Carolina	9.00	6.30	14.02	*	6.12	7.37	6.28	14.34
South Dakota	7.26	6.15	*	12.28	*	*	6.20	*
Tennessee	8.68	6.82	15.23	*	7.43	6.50	6.87	15.87
Texas	6.34	5.67	11.88	*	4.21	5.54	5.83	12.11
Utah	4.96	4.80	*	*	7.68	5.31	4.74	*
Vermont	5.57	5.53	*	*	*	*	5.64	*
Virginia	7.30	5.65	13.57	*	4.00	5.28	5.69	13.79
Washington	5.09	4.88	7.52	9.25	4.43	4.82	4.49	8.12
West Virginia	7.61	7.39	15.39	*	*	*	7.33	15.09
Wisconsin	6.29	5.09	16.87	8.09	5.64	5.73	5.01	16.94
Wyoming	7.37	7.20	*	*	*	*	7.33	*
Puerto Rico	8.59	8.57	8.76	---	---	---	---	---
Virgin Islands	6.78	*	8.07	*	*	*	*	6.76
Guam	11.91	*	*	*	12.33	*	*	*

* Figure does not meet standards of reliability or precision; based on fewer than 20 deaths in the numerator. --- Data not available. ¹Excludes 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 2 in this report. Multiple-race data on the birth certificate were reported for 15 states in 2004, 19 in 2005, and 23 in 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Table 4. Percentage of live births with selected maternal and infant characteristics, by race of mother: United States, 2006 linked file

Characteristic	All races	White	Black	American Indian or Alaska Native	Asian or Pacific Islander
Birthweight:					
Less than 1,500 grams	1.51	1.22	3.11	1.31	1.14
Less than 2,500 grams	8.3	7.2	13.6	7.5	8.1
Preterm births ¹	12.8	11.9	18.1	14.2	10.9
Births to mothers under 20 years	10.4	9.4	17.0	17.6	3.3
Fourth and higher order births	11.2	10.7	14.7	19.1	6.5
Births to unmarried mothers	38.5	33.3	70.2	64.6	16.5
Mothers born in the 50 states and D.C.	75.1	77.1	84.0	93.8	19.0

¹Born prior to 37 completed weeks of gestation.

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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Table 5. Percentage 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, 2006 linked file

Characteristic	All origins ¹	Hispanic						Non-Hispanic		
		Total	Mexican	Puerto Rican	Cuban	Central and South American	Other and unknown Hispanic	Total ²	White	Black
Birthweight:										
Less than 1,500 grams	1.51	1.21	1.14	1.94	1.29	1.15	1.40	1.61	1.22	3.21
Less than 2,500 grams	8.3	7.0	6.6	10.2	7.2	6.8	8.6	8.7	7.3	14.0
Preterm births ³	12.8	12.2	11.9	14.4	13.1	12.1	14.2	13.0	11.7	18.5
Births to mothers under 20 years	10.4	14.3	15.0	17.7	8.0	8.9	16.9	9.1	7.4	17.2
Fourth and higher order births	11.2	14.2	15.6	12.1	4.9	10.9	12.6	10.2	9.1	15.0
Births to unmarried mothers	38.5	49.9	48.6	62.4	39.4	51.5	49.2	34.8	26.6	70.7
Mothers born in the 50 states and D.C.	75.1	37.5	35.9	69.1	49.1	13.7	76.7	87.2	94.0	87.4

¹Includes origin not stated.

²Includes races other than black or white.

³Born prior to 37 completed weeks of gestation.

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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Table 6. Live births and infant, neonatal, and postneonatal deaths and mortality rates, by race and Hispanic origin of mother and birthweight: United States, 2006 linked file, and percent change in birthweight-specific infant mortality, 2000–2006 linked files

Race and Hispanic origin and birthweight	Number in 2006				Mortality rate per 1,000 live births in 2006			Percent change in infant mortality rate 2000–2006
	Live births	Infant deaths	Neonatal deaths	Postneonatal deaths	Infant	Neonatal	Postneonatal	
All races ¹	4,265,593	28,509	19,041	9,468	6.68	4.46	2.22	**–3.0
Less than 2,500 grams	353,460	19,576	15,897	3,679	55.38	44.98	10.41	**–6.8
Less than 1,500 grams	64,456	15,498	13,465	2,033	240.44	208.90	31.54	–1.6
Less than 500 grams	7,294	6,177	6,017	160	846.86	824.92	21.94	0.1
500–749 grams	11,782	5,507	4,654	853	467.41	395.01	72.40	–1.9
750–999 grams	12,737	1,916	1,414	501	150.43	111.02	39.33	–3.5
1,000–1,249 grams	14,910	1,040	756	285	69.75	50.70	19.11	**–9.8
1,250–1,499 grams	17,733	857	624	233	48.33	35.19	13.14	6.0
1,500–1,999 grams	69,555	1,810	1,210	600	26.02	17.40	8.63	**–8.0
2,000–2,499 grams	219,449	2,268	1,222	1,046	10.33	5.57	4.77	**–12.0
2,500 grams or more	3,911,038	8,779	2,997	5,782	2.24	0.77	1.48	**–9.3
2,500–2,999 grams	786,117	3,153	1,225	1,928	4.01	1.56	2.45	**–12.3
3,000–3,499 grams	1,657,170	3,499	1,100	2,399	2.11	0.66	1.45	**–11.3
3,500–3,999 grams	1,134,511	1,636	477	1,160	1.44	0.42	1.02	**–13.8
4,000–4,499 grams	287,710	390	143	247	1.36	0.50	0.86	–7.5
4,500–4,999 grams	40,972	76	32	43	1.85	0.78	1.05	–9.8
5,000 grams or more	4,558	25	19	5	5.48	*	*	–10.5
Not stated	1,095	154	147	7	...	...	...	...
White	3,310,331	18,422	12,292	6,130	5.57	3.71	1.85	**–2.5
Less than 2,500 grams	239,310	11,989	9,909	2,080	50.10	41.41	8.69	**–7.3
Less than 1,500 grams	40,366	9,212	8,150	1,062	228.21	201.90	26.31	–1.9
Less than 500 grams	4,020	3,429	3,376	53	852.99	839.80	13.18	0.2
500–749 grams	6,874	3,324	2,898	425	483.56	421.59	61.83	–1.1
750–999 grams	7,898	1,216	936	281	153.96	118.51	35.58	–4.3
1,000–1,249 grams	9,691	678	516	162	69.96	53.25	16.72	**–12.6
1,250–1,499 grams	11,883	565	424	141	47.55	35.68	11.87	7.2
1,500–1,999 grams	47,385	1,237	876	361	26.11	18.49	7.62	**–8.2
2,000–2,499 grams	151,559	1,540	883	657	10.16	5.83	4.33	**–15.2
2,500 grams or more	3,070,169	6,331	2,286	4,045	2.06	0.74	1.32	**–8.0
2,500–2,999 grams	556,908	2,145	900	1,246	3.85	1.62	2.24	**–12.3
3,000–3,499 grams	1,282,104	2,507	848	1,659	1.96	0.66	1.29	**–10.5
3,500–3,999 grams	943,506	1,278	378	900	1.35	0.40	0.95	**–10.6
4,000–4,499 grams	248,421	328	123	206	1.32	0.50	0.83	–2.2
4,500–4,999 grams	35,400	55	24	30	1.55	0.68	0.85	–12.9
5,000 grams or more	3,830	17	13	4	*	*	*	...
Not stated	852	103	98	5	...	...	...	...
Black	666,494	8,595	5,778	2,818	12.90	8.67	4.23	**–4.3
Less than 2,500 grams	90,940	6,634	5,198	1,436	72.95	57.16	15.79	**–3.7
Less than 1,500 grams	20,710	5,574	4,681	893	269.15	226.03	43.12	0.9
Less than 500 grams	2,948	2,486	2,384	102	843.28	808.68	34.60	0.8
500–749 grams	4,364	1,946	1,540	406	445.92	352.89	93.03	–2.7
750–999 grams	4,177	599	403	196	143.40	96.48	46.92	1.2
1,000–1,249 grams	4,409	314	203	111	71.22	46.04	25.18	–0.6
1,250–1,499 grams	4,812	230	151	79	47.80	31.38	16.42	6.6
1,500–1,999 grams	17,825	461	257	205	25.86	14.42	11.50	–7.1
2,000–2,499 grams	52,405	598	261	337	11.41	4.98	6.43	–2.1
2,500 grams or more	575,385	1,918	538	1,380	3.33	0.94	2.40	**–14.8
2,500–2,999 grams	165,410	835	259	576	5.05	1.57	3.48	**–10.5
3,000–3,499 grams	255,831	764	189	575	2.99	0.74	2.25	**–17.2
3,500–3,999 grams	125,072	262	67	195	2.09	0.54	1.56	**–26.1
4,000–4,499 grams	25,101	35	11	24	1.39	*	0.96	–42.1
4,500–4,999 grams	3,499	15	7	8	*	*	*	...
5,000 grams or more	472	6	5	1	*	*	*	...
Not stated	169	44	42	2	...	...	...	...

See footnotes at end of table.

Table 6. Live births and infant, neonatal, and postneonatal deaths and mortality rates, by race and Hispanic origin of mother and birthweight: United States, 2006 linked file, and percent change in birthweight-specific infant mortality, 2000–2006 linked files—Con.

Race and Hispanic origin and birthweight	Number in 2006				Mortality rate per 1,000 live births in 2006			Percent change in infant mortality rate 2000–2006
	Live births	Infant deaths	Neonatal deaths	Postneonatal deaths	Infant	Neonatal	Postneonatal	
American Indian or Alaska Native	47,720	395	205	190	8.28	4.30	3.98	-0.2
Less than 2,500 grams	3,601	197	156	42	54.71	43.32	11.66	-12.2
Less than 1,500 grams	624	142	128	14	227.56	205.13	*	-14.8
Less than 500 grams	63	55	53	2	873.02	841.27	*	-2.8
500–749 grams	97	44	40	3	453.61	412.37	*	-0.2
750–999 grams	133	23	18	5	172.93	*	*	-39.5
1,000–1,249 grams	150	10	9	1	*	*	*	...
1,250–1,499 grams	181	10	7	3	*	*	*	...
1,500–1,999 grams	729	18	9	9	*	*	*	...
2,000–2,499 grams	2,248	37	19	18	16.46	*	*	5.2
2,500 grams or more	44,111	198	50	148	4.49	1.13	3.36	4.9
2,500–2,999 grams	8,077	58	19	38	7.18	*	4.70	16.7
3,000–3,499 grams	17,799	77	17	60	4.33	*	3.37	-8.8
3,500–3,999 grams	13,575	44	10	34	3.24	*	2.50	7.3
4,000–4,499 grams	3,857	13	2	11	*	*	*	...
4,500–4,999 grams	712	5	-	5	*	*	*	...
5,000 grams or more	91	1	1	-	*	*	*	...
Not stated	8	-	-	-	...	...	...	...
Asian or Pacific Islander	241,048	1,097	766	331	4.55	3.18	1.37	-6.6
Less than 2,500 grams	19,609	756	634	122	38.55	32.33	6.22	** -13.2
Less than 1,500 grams	2,756	570	506	63	206.82	183.60	22.86	-11.7
Less than 500 grams	263	208	205	3	790.87	779.47	*	-8.7
500–749 grams	447	194	175	19	434.00	391.50	*	-5.2
750–999 grams	529	77	57	20	145.56	107.75	37.81	-14.0
1,000–1,249 grams	660	39	28	11	59.09	42.42	*	-13.9
1,250–1,499 grams	857	52	42	10	60.68	49.01	*	-14.3
1,500–1,999 grams	3,616	94	69	25	26.00	19.08	6.91	-6.1
2,000–2,499 grams	13,237	92	59	33	6.95	4.46	2.49	-15.8
2,500 grams or more	221,373	333	124	209	1.50	0.56	0.94	-8.5
2,500–2,999 grams	55,722	115	48	68	2.06	0.86	1.22	-22.6
3,000–3,499 grams	101,436	151	47	104	1.49	0.46	1.03	22.1
3,500–3,999 grams	52,358	53	21	31	1.01	0.40	0.59	-24.1
4,000–4,499 grams	10,331	13	7	6	*	*	*	...
4,500–4,999 grams	1,361	1	1	-	*	*	*	...
5,000 grams or more	165	-	-	-	*	*	*	...
Not stated	66	8	8	-	...	...	...	...
Hispanic	1,039,079	5,622	3,883	1,739	5.41	3.74	1.67	-3.2
Less than 2,500 grams	72,795	3,870	3,191	679	53.16	43.84	9.33	** -5.3
Less than 1,500 grams	12,610	2,987	2,620	367	236.88	207.77	29.10	0.5
Less than 500 grams	1,292	1,062	1,038	23	821.98	803.41	17.80	-0.1
500–749 grams	2,368	1,143	1,009	134	482.69	426.10	56.59	1.1
750–999 grams	2,510	379	278	101	151.00	110.76	40.24	-7.7
1,000–1,249 grams	2,961	226	168	58	76.33	56.74	19.59	1.1
1,250–1,499 grams	3,479	177	127	50	50.88	36.50	14.37	3.6
1,500–1,999 grams	13,737	405	292	113	29.48	21.26	8.23	-10.1
2,000–2,499 grams	46,448	478	279	200	10.29	6.01	4.31	-11.1
2,500 grams or more	965,881	1,729	671	1,059	1.79	0.69	1.10	** -13.5
2,500–2,999 grams	189,101	607	283	325	3.21	1.50	1.72	** -16.0
3,000–3,499 grams	422,972	720	251	469	1.70	0.59	1.11	** -12.4
3,500–3,999 grams	277,047	310	94	217	1.12	0.34	0.78	** -24.3
4,000–4,499 grams	66,121	71	29	42	1.07	0.44	0.64	-14.4
4,500–4,999 grams	9,477	11	7	4	*	*	*	...
5,000 grams or more	1,163	9	7	2	*	*	*	...
Not stated	403	23	22	1	...	...	...	...

See footnotes at end of table.

Table 6. Live births and infant, neonatal, and postneonatal deaths and mortality rates, by race and Hispanic origin of mother and birthweight: United States, 2006 linked file, and percent change in birthweight-specific infant mortality, 2000–2006 linked files—Con.

Race and Hispanic origin and birthweight	Number in 2006				Mortality rate per 1,000 live births in 2006			Percent change in infant mortality rate 2000–2006
	Live births	Infant deaths	Neonatal deaths	Postneonatal deaths	Infant	Neonatal	Postneonatal	
NonHispanic white	2,308,654	12,884	8,410	4,474	5.58	3.64	1.94	-2.1
Less than 2,500 grams	169,517	8,165	6,727	1,438	48.17	39.68	8.48	**-8.8
Less than 1,500 grams	28,260	6,249	5,535	714	221.13	195.86	25.27	-3.7
Less than 500 grams	2,708	2,344	2,308	35	865.58	852.29	12.92	0.7
500–749 grams	4,608	2,210	1,911	299	479.60	414.71	64.89	-2.5
750–999 grams	5,525	855	674	182	154.75	121.99	32.94	-2.7
1,000–1,249 grams	6,864	451	345	106	65.71	50.26	15.44	**-18.7
1,250–1,499 grams	8,555	389	297	92	45.47	34.72	10.75	5.2
1,500–1,999 grams	34,223	837	581	256	24.46	16.98	7.48	-9.1
2,000–2,499 grams	107,034	1,078	611	467	10.07	5.71	4.36	**-15.7
2,500 grams or more	2,138,863	4,666	1,633	3,033	2.18	0.76	1.42	**-4.8
2,500–2,999 grams	375,743	1,564	623	942	4.16	1.66	2.51	**-10.0
3,000–3,499 grams	874,868	1,821	608	1,213	2.08	0.69	1.39	**-8.8
3,500–3,999 grams	675,294	970	284	686	1.44	0.42	1.02	-5.9
4,000–4,499 grams	184,103	259	95	164	1.41	0.52	0.89	3.7
4,500–4,999 grams	26,156	43	17	26	1.64	*	0.99	-7.3
5,000 grams or more	2,699	8	6	2	*	*	*	...
Not stated	274	53	50	3	...	...	...	...
Non-Hispanic black	617,260	8,241	5,525	2,716	13.35	8.95	4.40	-1.8
Less than 2,500 grams	86,588	6,359	4,973	1,386	73.44	57.43	16.01	-2.8
Less than 1,500 grams	19,827	5,349	4,481	868	269.78	226.00	43.78	1.5
Less than 500 grams	2,830	2,387	2,292	96	843.46	809.89	33.92	0.8
500–749 grams	4,190	1,870	1,477	393	446.30	352.51	93.79	-2.0
750–999 grams	3,999	572	379	193	143.04	94.77	48.26	1.7
1,000–1,249 grams	4,221	302	194	108	71.55	45.96	25.59	-0.9
1,250–1,499 grams	4,587	219	140	79	47.74	30.52	17.22	7.4
1,500–1,999 grams	16,989	434	243	191	25.55	14.30	11.24	-8.3
2,000–2,499 grams	49,772	576	249	327	11.57	5.00	6.57	-1.6
2,500 grams or more	530,536	1,842	515	1,328	3.47	0.97	2.50	**-12.2
2,500–2,999 grams	155,608	799	248	551	5.13	1.59	3.54	**-9.5
3,000–3,499 grams	236,163	733	178	555	3.10	0.75	2.35	**-15.1
3,500–3,999 grams	112,951	258	67	191	2.28	0.59	1.69	**-20.3
4,000–4,499 grams	22,280	31	10	21	1.39	*	0.94	-42.1
4,500–4,999 grams	3,103	15	7	8	*	*	*	...
5,000 grams or more	431	6	5	1	*	*	*	...
Not stated	136	40	38	2	...	...	...	...

** Significant at $p < 0.05$.

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

... Category not applicable.

- Quantity zero.

¹Includes 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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Table 7. Infant deaths and mortality rates for the five leading causes of infant death, by race and Hispanic origin of mother: United States, 2006 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 ¹			American Indian or Alaska Native ²			Asian or Pacific Islander ³		
	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate
All causes . . . . .	...	28,509	668.3	...	12,884	558.1	...	8,241	1,335.1	...	395	827.7	...	1,097	455.1
Congenital malformations, deformations, and chromosomal abnormalities. (Q00-Q99)	1	5,850	137.1	1	2,922	126.6	2	1,078	174.6	1	73	153.0	1	263	109.1
Disorders related to short gestation and low birthweight, not elsewhere classified . . . (P07)	2	4,843	113.5	2	1,774	76.8	1	1,863	301.8	3	47	98.5	2	184	76.3
Sudden infant death syndrome (R95)	3	2,327	54.6	3	1,283	55.6	3	641	103.8	2	57	119.4	4	55	22.8
Newborn affected by maternal complications of pregnancy. (P01)	4	1,676	39.3	4	731	31.7	4	552	89.4	6	13	*	3	57	23.6
Accidents (unintentional injuries) . . . (V01-X59)	5	1,143	26.8	5	597	25.9	6	326	52.8	4	37	77.5	6	31	12.9

Cause of death (based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total Hispanic ⁴			Mexican ⁵			Puerto Rican ⁶			Central and South American ⁷		
	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate
All causes . . . . .	...	5,622	541.1	...	3,837	534.3	...	536	800.8	...	748	452.5
Congenital malformations, deformations, and chromosomal abnormalities. (Q00-Q99)	1	1,476	142.0	1	1,087	151.4	2	82	122.5	1	194	117.3
Disorders related to short gestation and low birthweight, not elsewhere classified . . . (P07)	2	887	85.4	2	586	81.6	1	111	165.8	2	115	69.6
Sudden infant death syndrome (R95)	4	282	27.1	4	183	25.5	3	37	55.3	5	25	15.1
Newborn affected by maternal complications of pregnancy. (P01)	3	290	27.9	3	203	28.3	3	37	55.3	5	25	15.1
Accidents (unintentional injuries) . . . (V01-X59)	8	154	14.8	7	99	13.8	6	19	*	9	19	*

. . . Category not applicable.

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

¹For Non-Hispanic black women, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 356 deaths and a rate of 57.7.²For American Indian or Alaska native women, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 19 deaths.³For Asian or Pacific Islander women, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 44 deaths and a rate of 18.3.⁴For Hispanic women, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 221 deaths and a rate of 21.3.⁵For Mexican women, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 161 deaths and a rate of 22.4.⁶For Puerto Rican women, Respiratory distress of newborn (P22) was the fifth leading cause of death with 25 deaths and a rate of 37.4.⁷For Central and South American women, Respiratory distress of newborn (P22) was the third leading cause with 27 deaths and a rate of 16.3. Newborn affected by complications of placenta, cord and membranes (P02) was the fourth leading cause with 26 deaths and a rate of 15.7.

NOTES: Reliable cause-specific infant mortality rates cannot be computed for Cuban women because of the small number of infant deaths (86). 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 2 in this report. Twenty-three states reported multiple-race data on the birth certificate for 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Table 8. Number and percent of preterm-related infant deaths and preterm-related infant mortality rates, by race and Hispanic origin of mother: United States, 2000–2006 linked files

Year	All races and origins	Non-Hispanic white	Non-Hispanic black	American Indian or Alaska Native	Asian or Pacific Islander	Total Hispanic ¹	Mexican	Puerto Rican	Central and South American
Number of preterm-related infant deaths									
2006	10,303	4,134	3,709	100	358	1,868	1,229	221	252
2005	10,364	4,206	3,655	86	401	1,880	1,266	218	241
2004	10,180	4,171	3,641	83	378	1,752	1,192	195	238
2003	10,331	4,358	3,615	91	364	1,761	1,163	200	256
2002	9,965	4,342	3,581	90	321	1,540	1,018	190	192
2001	9,767	4,289	3,561	79	280	1,436	951	196	189
2000	9,673	4,141	3,586	96	298	1,411	929	189	170
Percent of total infant deaths that are preterm-related									
2006	36.1	32.1	45.0	25.3	32.6	33.2	32.0	41.2	33.7
2005	36.5	32.0	45.9	23.8	35.5	34.0	33.0	41.4	34.0
2004	36.5	32.1	46.3	22.4	35.3	33.4	32.2	40.7	35.7
2003	36.9	32.9	46.1	24.2	34.1	34.2	32.4	41.8	37.4
2002	35.6	32.6	44.6	24.6	31.9	31.3	29.9	40.3	30.1
2001	35.5	32.2	44.9	19.6	29.6	31.0	29.8	39.9	31.3
2000	34.6	30.8	43.7	27.7	30.5	30.9	29.4	39.6	32.3
Preterm-related infant mortality rate ²									
2006	2.42	1.79	6.01	2.10	1.49	1.80	1.71	3.30	1.52
2005	2.50	1.84	6.26	1.92	1.74	1.91	1.83	3.44	1.59
2004	2.48	1.82	6.29	1.89	1.65	1.85	1.76	3.19	1.66
2003	2.53	1.88	6.28	2.11	1.65	1.93	1.78	3.42	1.89
2002	2.48	1.89	6.19	2.12	1.52	1.76	1.62	3.31	1.52
2001	2.43	1.84	6.04	1.89	1.40	1.69	1.56	3.40	1.56
2000	2.38	1.75	5.93	2.30	1.49	1.73	1.60	3.25	1.50

¹Includes Cuban and other and unknown Hispanic. Cuban data were not shown separately because of small numbers of infant deaths.

²Rate per 1,000 live births in specified group.

NOTES: Preterm-related deaths are those where the infant was born preterm (before 37 completed weeks of gestation) with the underlying cause of death assigned to one of the following ICD-10 categories: K550, P000, P010, P011, P015, P020, P021, P027, P070–P073, P102, P220–229, P250–279, P280, P281, P360–369, P520–523, P77. Twenty-three states reported multiple-race data on the birth certificate for all of 2006. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see reference 2 in this report.

Technical Notes

Differences between period and cohort data

From 1983–1991, the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) produced linked files in a birth cohort format (49). Beginning with 1995 data, linked files are produced first using a period format and then using a birth cohort format. The 2006 period linked file contains a numerator file consisting of all infant deaths occurring in 2006 that have been linked to their corresponding birth certificates, whether the birth occurred in 2005 or in 2006. In contrast, the 2006 birth cohort linked file will contain a numerator file that consists of all infant deaths to infants born in 2006, whether the death occurred in 2006 or 2007. Beginning with 1995 data, the period linked file is the basis for all official NCHS linked file statistics.

For the 2006 file, NCHS accepted birth records that could be linked to infant deaths even if registered after the closure of the 2006 birth file (fewer than 100 cases). This improved the infant birth/death linkage and made the denominator file distinctly, but slightly, different from the official 2006 birth file.

Weighting

In 2006, a record weight was added to the linked file to compensate for the 1.3 percent 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 were not weighted. The percentage of records linked varied by registration area (from 93.3 to 100.0 percent, with all but four areas—Alaska, California, Louisiana, 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 reduced the potential for bias in comparing infant mortality rates by characteristics.

The 2006 linked file started with 28,540 infant death records. Of these records, 28,174 were linked and 366 were unlinked because corresponding birth certificates could not be identified. The 28,540 linked and unlinked records contained 31 records of infants whose mother's usual place of residence was outside of the United States. These 31 records were excluded to derive a weighted total of 28,509 infant deaths for 2006.

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

The overall infant mortality rate of 6.68 from the 2006 period linked file is nearly the same as the 6.69 rate from the 2006 vital statistics mortality file (3). The number of infant deaths differs slightly from the 28,527 infant deaths in the mortality file (3). Differences in numbers of infant deaths between the two data sources are primarily due to geographic coverage differences. For the vital statistics mortality file, all deaths occurring in the 50 states and the District of Columbia are included regardless of the infant's place of birth. In contrast, to be included in the U.S. linked file, both the birth and death must occur in the 50 states and the District of Columbia (the

Table I. Percentage of infant death records that were linked to their corresponding birth records: United States and each state, Puerto Rico, Virgin Islands, and Guam, 2006 linked file

State	Percent linked by state of occurrence of death
United States ¹	98.7
Alabama	99.8
Alaska	95.8
Arizona	99.4
Arkansas	99.7
California	96.3
Colorado	99.5
Connecticut	100.0
Delaware	99.0
District of Columbia	100.0
Florida	99.3
Georgia	99.8
Hawaii	100.0
Idaho	100.0
Illinois	99.0
Indiana	99.1
Iowa	99.5
Kansas	100.0
Kentucky	98.9
Louisiana	93.3
Maine	100.0
Maryland	100.0
Massachusetts	100.0
Michigan	100.0
Minnesota	100.0
Mississippi	99.5
Missouri	99.6
Montana	100.0
Nebraska	99.4
Nevada	99.6
New Hampshire	100.0
New Jersey	98.9
New Mexico	97.9
New York State	98.4
New York City	99.7
North Carolina	99.8
North Dakota	100.0
Ohio	97.9
Oklahoma	100.0
Oregon	99.7
Pennsylvania	98.9
Rhode Island	100.0
South Carolina	99.0
South Dakota	100.0
Tennessee	100.0
Texas	96.5
Utah	99.0
Vermont	100.0
Virginia	100.0
Washington	100.0
West Virginia	100.0
Wisconsin	100.0
Wyoming	100.0
Puerto Rico	99.8
Virgin Islands	100.0
Guam	100.0

¹Excludes data for Puerto Rico, Virgin Islands, and Guam.

territory linked file is a separate file). Weighting of the linked file also may contribute to small differences in numbers and rates by specific variables between these two data sets.

1989 and 2003 revisions of U.S. Standard Certificate of Live Birth

This report includes 2006 data on items that are collected on both the 1989 Revision of the U.S. Standard Certificate of Live Birth (unrevised) and the 2003 Revision of the U.S. Standard Certificate of Live Birth (revised) (2). The 2003 revision is described in detail elsewhere (50–52).

Data for educational attainment, prenatal care, and tobacco use, although collected on both the revised and unrevised certificates, are not considered comparable between revisions. Since the 2006 linked file has birth records from both 2005 and 2006, the reporting of the three items from the 2003 revised certificate is from the 12 states that had revised the certificate by January 1, 2005: Florida, Idaho, Kansas, Kentucky, Nebraska, New Hampshire, New York (excluding New York City), Pennsylvania, South Carolina, Tennessee, Texas, and Washington. Data for Florida are excluded from the smoking results because the state's birth certificate question on smoking is not comparable to the 2003 revision (2).

Marital status

National estimates of births to unmarried women are based on two methods of determining marital status. In 2006, marital status was based on a direct question in 48 states and the District of Columbia. In the two states that used inferential procedures to compile birth statistics by marital status (Michigan and New York), a birth is inferred as nonmarital if either of the following 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, see "Technical Notes" in *National Vital Statistics Reports*, Volume 57 Number 7, "Births: Final Data for 2006" (2).

Multiple race

For the birth certificates in the 2006 data year, multiple race was reported by 23 states (both revised and unrevised): California, Delaware, Florida, Hawaii, Idaho, Kansas, Kentucky, Michigan (for births at selected facilities only), Minnesota, Nebraska, New Hampshire, New York (excluding New York City), North Dakota, Ohio, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont (for births occurring from July 1, 2005, only), Washington, and Wyoming (2). Data from the vital records of the remaining states, the District of Columbia, and New York City followed the 1977 Office of Management and Budget standards in which a single race is reported (53,54). In addition, these areas report the minimum set of four races as stipulated in the 1977 standards, compared with the minimum of five races mandated by the 1997 standards (2).

To provide uniformity and comparability of the data during the transition period before multiple-race data are available for all reporting areas, the responses of those who reported more than one race are bridged to a single race. Multiple race is imputed to a single race (AIAN, API, black, or white) according to the combination of races, Hispanic origin, sex, and age indicated on the birth certificate using methods described elsewhere (2,7,55).

Period of gestation

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 may occur more frequently among some subpopulations and among births with shorter gestations (56,57).

The U.S. Standard Certificate of Live Birth contains the clinical or obstetric 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 5.6 percent of the births in 2006 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 the birthweight was reclassified as "not stated." This was necessary for about 0.06 percent of all birth records in 2006 (2).

Birthweight

For the linked file, not-stated birthweight was imputed for 3,635 records, or 0.09 percent of the birth records in 2006 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, since the percentage of records with not-stated birthweight was higher for infant deaths (3.10 percent before imputation) than for live births (0.11 percent before imputation). The imputation reduced the percentage of not-stated records to 0.54 percent for infant deaths and 0.03 percent for births. The not-stated birthweight cases in the natality/birth file, as distinct from the linked file, are not imputed (2).

Cause-of-death classification

The mortality statistics presented in this report were compiled in accordance with World Health Organization (WHO) regulations, which specify that member nations classify and code causes of death in accordance with the current revision of the *International 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* (58,59).

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 chain 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, ICD provisions, and associated selection and modification rules. 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 (60,61).

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 ICD’s Tenth Revision (ICD–10) (4); during the 1979–1998 period, causes were coded and classified according to the Ninth Revision (ICD–9) (62).

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 interpreting mortality trends and are discussed in detail in other NCHS publications (3,63,64).

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* (65). 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 (ICD codes J10–J18)], its component parts are not ranked [in this case, Influenza (J10–J11) and Pneumonia (J12–18)].

Preterm-related causes of death

Preterm-related causes of death are those causes that have a direct etiological connection to preterm birth. For an underlying cause of death to be considered preterm related, 75 percent or more of infants whose deaths were attributed to that cause had to be born preterm, and the cause of death had to be a direct consequence of preterm birth based on a clinical evaluation and review of the literature (47). The cause-of-death categories included in this grouping are shown in the [Table 8](#) footnote. Causes that are incidental to preterm birth (for example, a motor vehicle accident involving a preterm infant) are not included. This grouping of preterm-related causes probably underestimates the total impact of preterm-related infant death, as some ICD categories (notably those beginning with the words “other” and “all other”) had a high

percentage of preterm infant deaths but lacked sufficient specificity to be able to establish the etiologic connection to prematurity with any degree of certainty. Further details on the development of this cause-of-death grouping are available in related publications (47,48).

Computation of rates

Infant mortality rates are the most commonly used index for measuring the risk of dying during the first year of life. For the linked birth/infant death data set, they are calculated by dividing the number of infant deaths in a calendar year by the number of live births registered for the same period and are presented as rates per 1,000 or per 100,000 live births. Both the mortality file and the linked birth/infant death file use this computation method, but due to unique numbers of infant deaths (as explained in the section above on the comparison of these two files), the rates will often differ for specific variables, particularly for race and ethnicity. Infant mortality rates use the number of live births in the denominator to approximate the population at risk of dying before the first birthday. In contrast to the infant mortality rates based on live births, infant death rates, used only in age-specific death rates with the mortality file, use the estimated population of persons under 1 year of age as the denominator.

For all variables, not-stated responses were shown in tables of frequencies but were dropped before rates were computed. Rates per 1,000 live births display two digits after the decimal place to provide a more precise and sensitive measurement. For rates per 100,000 live births (by cause of death), the infant mortality rate is shown for one decimal place. Adding a 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 U.S. 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 represents 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 (66). 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 normal distribution. When the number of events is large, the relative standard error is usually small. When the number of events is small (perhaps fewer 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 (2,3). Estimates of relative standard errors (RSEs) and 95 percent confidence intervals are shown below.

Table II. Infant mortality rates for 2006, by trimester of pregnancy prenatal care began, smoking status during pregnancy, and education of mother: 12-state reporting area, as of January 1, 2005

Characteristic	Rate
Prenatal care	
Prenatal care beginning in the 1st trimester	5.49
Prenatal care beginning after the 1st trimester or no care	7.94
Prenatal care beginning in the 2nd or 3rd trimester	6.47
No prenatal care	26.67
Smoking status	
Smoker	9.52
Nonsmoker	6.00
Educational attainment	
Less than high school diploma	8.28
High school diploma	7.65
Some college or technical school	5.76
Bachelor's degree or higher	3.78

NOTES: Includes data from Florida, Idaho, Kansas, Kentucky, Nebraska, New Hampshire, New York (excluding New York City), Pennsylvania, South Carolina, Tennessee, Texas, and Washington. Information on smoking status excludes data for Florida. These states are those that revised as of January 1, 2005. See "Methods" and "Technical Notes."

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

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

where D is the number of deaths, and

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

where B is the number of births.

For example, suppose that for group A, the number of infant deaths was 497, while the number of live births was 81,555, yielding an infant mortality rate of 6.09 infant deaths per 1,000 live births.

$$\text{The RSE of the deaths} = 100 \cdot \sqrt{\frac{1}{497}} = 4.49,$$

$$\text{whereas the RSE of the births} = 100 \cdot \sqrt{\frac{1}{81,555}} = 0.35.$$

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

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

The RSE of the IMR for the example above

$$= 100 \cdot \sqrt{\frac{1}{497} + \frac{1}{81,555}} = 4.50.$$

Normal distribution—When the number of events is greater than 100, the normal distribution is used to estimate the 95 percent confidence intervals as follows:

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

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

Thus, for Group A:

$$\text{Lower: } 6.09 - \left(1.96 \cdot 6.09 \cdot \frac{4.50}{100} \right) = 5.55.$$

$$\text{Upper: } 6.09 + \left(1.96 \cdot 6.09 \cdot \frac{4.50}{100} \right) = 6.63.$$

Thus, the chances are 95 out of 100 that the true IMR for Group A lies somewhere in the 5.55–6.63 interval.

Poisson distribution—When the number of events in the numerator is fewer than 100, the confidence interval for the rate can be estimated based on the Poisson distribution using the values in [Table III](#).

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

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

where D_{adj} is the adjusted number of infant deaths (rounded to the nearest integer) used to take into account the RSE of the number of infant deaths and live births. It 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 III](#) corresponding to the value of D_{adj} .

For example, suppose that for Group B, the number of infant deaths was 53, the number of live births was 9,241, and the infant mortality rate was 5.74:

$$D_{adj} = \frac{53 \cdot 9,241}{53 + 9,241} = 53.$$

Therefore the 95 percent confidence interval (using the formula in [Table III](#) for 1 to 99 infant deaths) is:

$$\text{Lower: } 5.74 \cdot 0.74907 = 4.30.$$

$$\text{Upper: } 5.74 \cdot 1.30802 = 7.51.$$

Comparison of two infant mortality rates—If either of the two rates to be compared is based on fewer 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 to be compared (R_1 and R_2) are based on 100 or more deaths, the following z-test may be used to define a significance test statistic:

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

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

Table III. 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

N	L	U	N	L	U
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			

Availability of linked file data

Beginning with 2005, the public-use file no longer includes geographic detail; such files are available upon special request. Linked file data are available for download from: http://www.cdc.gov/nchs/data_access/VitalStatsOnline.htm. Prebuilt tables and table creation are available at VitalStats from: <http://www.cdc.gov/nchs/VitalStats.htm>. Data are also available in issues of Vital and Health Statistics, Series 20, and the *National Vital Statistics Reports* from the NCHS website: <http://www.cdc.gov/nchs>.

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