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Infant Mortality Statistics From the 2009 Period Linked Birth/Infant Death Data Set

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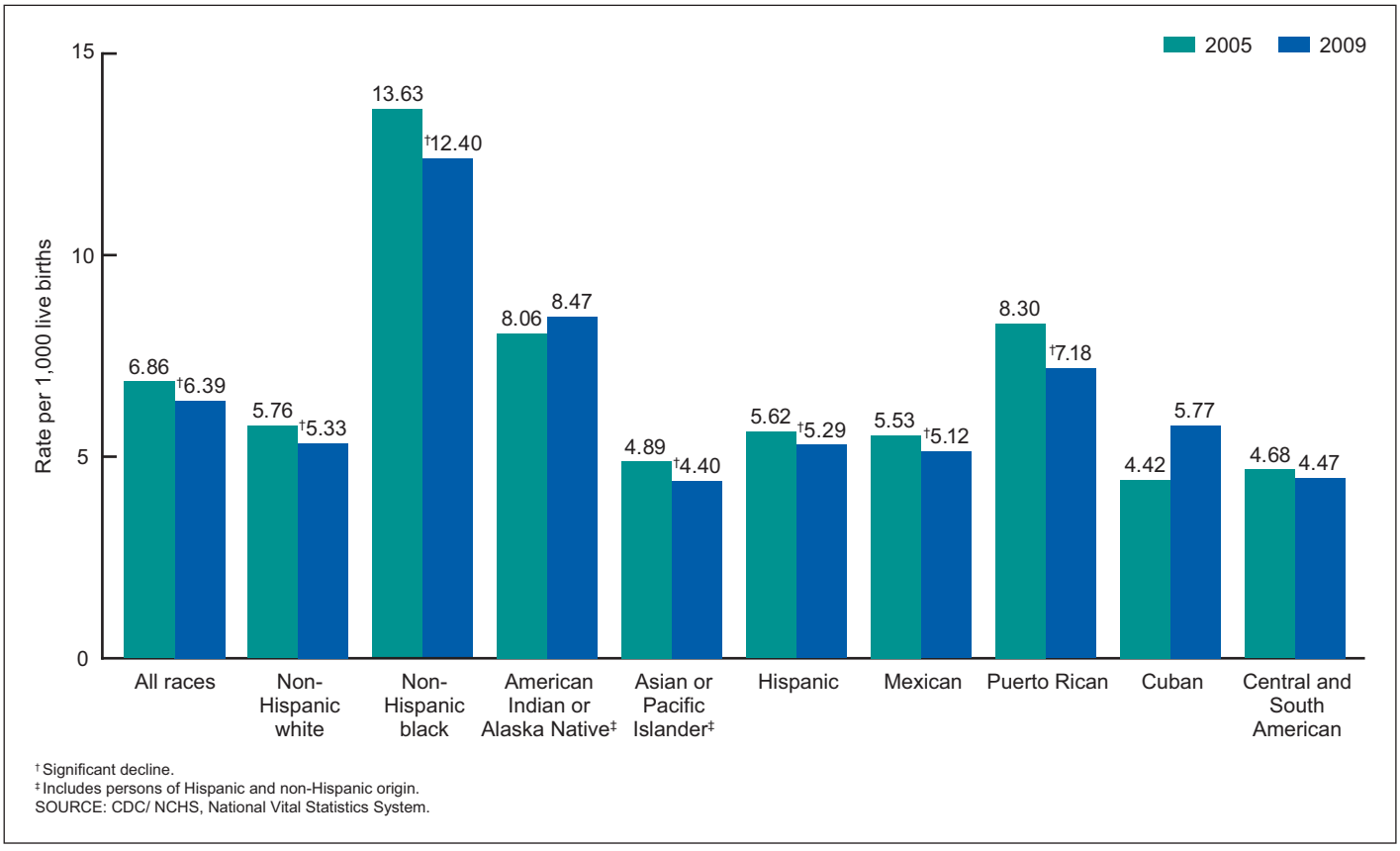

† Significant decline.
‡ Includes persons of Hispanic and non-Hispanic origin.
SOURCE: CDC/ NCHS, National Vital Statistics System.

Figure 1. Infant mortality rates, by race and ethnicity of mother: United States, 2005 and 2009

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Centers for Disease Control and Prevention
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Abstract

Objectives—This report presents 2009 period infant mortality statistics from the linked birth/infant death data set (linked file) by 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 infant mortality rate in the United States in 2009 was 6.39 infant deaths per 1,000 live births, 3% lower than the rate of 6.61 in 2008. The number of infant deaths was 28,075 in 2008 and 26,408 in 2009, a decline of 1,667 infant deaths. Infant mortality rates ranged from 4.40 per 1,000 live births for Asian or Pacific Islander mothers to 12.40 for non-Hispanic black mothers. Infant mortality was higher for male infants and infants born preterm or at low birthweight. Infant mortality rates were also higher for those infants who were born in multiple deliveries, to mothers who were unmarried, and for those whose mothers were born in the 50 states or the District of Columbia. From 2008 to 2009, the neonatal mortality rate (under age 28 days) declined 3% to 4.18 neonatal deaths per 1,000 live births, while the postneonatal mortality rate (aged 28 days to under 1 year) declined 5% to 2.21. Preterm and low birthweight infants had the highest infant mortality rates and contributed greatly to overall U.S. infant mortality. The three leading causes of infant death—congenital malformations, low birthweight, and sudden infant death syndrome—accounted for 46% of all infant deaths. In 2009, 35.4% of infant deaths were "preterm-related."

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

Introduction

This report presents infant mortality data from the 2009 period linked file. In the linked file, information from the death certificate is linked to information from the birth certificate for each infant under age 1 year who died in the 50 states, the District of Columbia (DC), Puerto Rico, the Virgin Islands, or Guam during 2009 (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 (2,3). 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 1–6 and A–D, and Figures 1–6).

Data based exclusively on the vital statistics mortality file provide further information on trends in infant mortality and on causes of infant death (4). The linked file is used to analyze and calculate 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 these differences is presented in the Technical Notes.

Methods

Data shown in this report are based on birth and infant death certificates registered in all states, DC, Puerto Rico, the Virgin Islands, and Guam. As part of the Vital Statistics Cooperative Program (VSCP), each state provides matching birth and death certificate numbers for each infant under age 1 year who died in the state during 2009 to the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS). If 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 2009, 98.6% of all infant death records were successfully linked to their corresponding birth records. These records were weighted to adjust for the 1.4% 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% of U.S. births in 2009 (2,3).

Race and Hispanic origin are reported independently on the birth certificate. In tabulations of birth data by race and Hispanic origin, data for Hispanic persons are not further classified by race, as the vast majority of women of Hispanic origin are reported as white. Data for American Indian or Alaska Native (AIAN) and for 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) (5) (see Technical Notes).

This report includes data based on the 1989 and 2003 revisions of the birth certificate. Three key data items are considered noncomparable between the 1989 and 2003 revisions: trimester of pregnancy prenatal care began, maternal educational attainment, and maternal smoking during pregnancy (2,3) (see Technical Notes).

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, teen mothers are more likely to 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 untangling 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, whereas the race information for the numerator is the race of the decedent as reported on the death certificate (2–4). Thus, standard infant mortality rates can be based on inconsistent 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 (4,6).

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 (2,3,7,8). Thirty-three states reported multiple-race data on their birth certificates for either part or all of 2009 and 30 states in 2008. To provide uniformity and comparability of the data, multiple-race data are 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 the Technical Notes. Additional information on maternal age, marital status, period of gestation, birthweight, and cause-of-death classification is also presented in the Technical Notes.

Results and Discussion

Trends in infant mortality

The infant mortality rate declined from 1995 to 2000, plateaued from 2000 to 2005, and has declined again since then (Table B). The overall 2009 infant mortality rate from the linked file was 6.39 infant deaths per 1,000 live births, 3% lower than the rate of 6.61 in 2008 and 7% lower than the rate in 2005 (6.86) (Table B). The 2009 rate from the mortality file was also 6.39 (4). From 2008 to 2009, the rate for non-Hispanic white women declined 3% and for Mexican women it declined 8% (Table B).

Several groups had declines between 2005 and 2009: Puerto Rican (13%), API (10%), non-Hispanic black (9%), and non-Hispanic white (7%) women (Table B and Figure 1).

Infant mortality by race and Hispanic origin of mother

Infant mortality rates continued to vary considerably by race and Hispanic origin of mother (9,10). In 2009, the highest rate, 12.40 per 1,000 live births, was for infants of non-Hispanic black mothers, 2.8 times greater than the lowest rate of 4.40 for infants of API mothers. Rates were also higher for infants of AIAN (8.47) and Puerto Rican (7.18) mothers. Rates were intermediate, but below the U.S. rate for infants of Cuban (5.77), non-Hispanic white (5.33), and Mexican (5.12) mothers (Tables A and B). Central and South American mothers also had a low rate (4.47). These differences are explained in part by the differences in cause-specific infant mortality rates among race and Hispanic origin groups (11,12). Disparities in the infant mortality rate between non-Hispanic black and non-Hispanic white mothers by state are described and discussed in the section, "Infant mortality by state and by race and ethnicity."

Age at death

Both neonatal and postneonatal mortality declined from 2008 to 2009. The neonatal (aged under 28 days) mortality rate declined 3% from 4.29 to 4.18 deaths per 1,000 live births (Table B). From 2008 to 2009, neonatal mortality rates declined for Mexican women. The postneonatal (aged 28 days to under 1 year) mortality rate declined 5% from 2.32 to 2.21 deaths per 1,000 live births. From 2008 to 2009, postneonatal mortality rates declined for non-Hispanic white and Central and South American women (Table B). Changes for

Table A. Infant, neonatal, and postneonatal deaths and mortality rates, by race and Hispanic origin of mother: United States, 2009 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
Total[1]	4,130,665	26,408	17,261	9,148	6.39	4.18	2.21
Non-Hispanic white	2,212,552	11,785	7,515	4,271	5.33	3.40	1.93
Non-Hispanic black	609,584	7,560	4,957	2,603	12.40	8.13	4.27
American Indian or Alaska Native	48,665	412	213	199	8.47	4.38	4.09
Asian or Pacific Islander	251,089	1,105	780	324	4.40	3.11	1.29
Hispanic	999,548	5,285	3,554	1,731	5.29	3.56	1.73
Mexican	645,297	3,302	2,223	1,080	5.12	3.44	1.67
Puerto Rican	68,486	492	326	166	7.18	4.76	2.42
Cuban	16,641	96	60	35	5.77	3.61	2.10
Central and South American	148,647	665	471	193	4.47	3.17	1.30

[1]Includes other and unknown Hispanic origin and Hispanic origin not stated, not shown separately.

NOTES: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Neonatal is under 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. Thirty-three states and the District of Columbia reported multiple-race data on the birth certificate for 2009 and 30 for 2008.The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Table B. Infant, neonatal, and postneonatal mortality rates, by race and Hispanic origin of mother: United States, 1995 and 2000–2009 linked files

Race and Hispanic origin of mother	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Percent change 2005 to 2009	Percent change 2008 to 2009
Infant mortality rate													
All races	7.57	6.89	6.84	6.95	6.84	6.78	6.86	6.68	6.75	6.61	6.39	†-6.9	†-3.3
Non-Hispanic white	6.28	5.70	5.72	5.80	5.70	5.66	5.76	5.58	5.63	5.52	5.33	†-7.5	†-3.4
Non-Hispanic black	14.65	13.59	13.46	13.89	13.60	13.60	13.63	13.35	13.31	12.67	12.40	†-9.0	-2.1
American Indian or Alaska Native	9.04	8.30	9.65	8.64	8.73	8.45	8.06	8.28	9.22	8.42	8.47	5.1	0.6
Asian or Pacific Islander	5.27	4.87	4.73	4.77	4.83	4.67	4.89	4.55	4.78	4.51	4.40	†-10.0	-2.4
Hispanic	6.27	5.59	5.44	5.62	5.65	5.55	5.62	5.41	5.51	5.59	5.29	†-5.9	†-5.4
Mexican	6.03	5.43	5.22	5.42	5.49	5.47	5.53	5.34	5.42	5.58	5.12	†-7.4	†-8.2
Puerto Rican	8.88	8.21	8.53	8.20	8.18	7.82	8.30	8.01	7.71	7.29	7.18	†-13.5	-1.5
Cuban	5.29	4.54	4.28	3.72	4.57	4.55	4.42	5.08	5.18	4.90	5.77	30.5	17.8
Central and South American	5.52	4.64	4.98	5.06	5.04	4.65	4.68	4.52	4.57	4.76	4.47	-4.5	-6.1
Neonatal mortality rate													
All races	4.92	4.62	4.54	4.67	4.63	4.52	4.54	4.46	4.42	4.29	4.18	†-7.9	†-2.6
Non-Hispanic white	4.04	3.78	3.79	3.85	3.79	3.70	3.71	3.64	3.61	3.50	3.40	†-8.4	-2.9
Non-Hispanic black	9.65	9.19	8.97	9.33	9.26	9.13	9.13	8.95	8.74	8.28	8.13	†-11.0	-1.8
American Indian or Alaska Native	3.94	4.39	4.20	4.60	4.55	4.26	4.04	4.30	4.55	4.18	4.38	8.4	4.8
Asian or Pacific Islander	3.37	3.43	3.12	3.37	3.40	3.20	3.37	3.18	3.38	3.08	3.11	-7.7	1.0
Hispanic	4.13	3.77	3.64	3.83	3.92	3.83	3.86	3.74	3.72	3.76	3.56	†-7.8	†-5.3
Mexican	3.94	3.61	3.49	3.64	3.76	3.74	3.78	3.73	3.68	3.78	3.44	†-9.0	†-9.0
Puerto Rican	6.11	5.80	5.99	5.81	5.70	5.34	5.95	5.44	5.14	4.98	4.76	†-20.0	-4.4
Cuban	3.61	3.20	2.50	3.23	3.36	2.81	3.05	3.60	3.65	3.23	3.61	18.4	11.8
Central and South American	3.65	3.26	3.36	3.45	3.65	3.43	3.23	3.12	3.14	3.19	3.17	-1.9	-0.6
Postneonatal mortality rate													
All races	2.65	2.27	2.30	2.28	2.22	2.25	2.32	2.22	2.33	2.32	2.21	†-4.7	†-4.7
Non-Hispanic white	2.23	1.92	1.93	1.95	1.91	1.96	2.05	1.94	2.02	2.02	1.93	†-5.9	†-4.5
Non-Hispanic black	5.00	4.40	4.48	4.55	4.34	4.47	4.50	4.40	4.57	4.39	4.27	-5.1	-2.7
American Indian or Alaska Native	5.10	3.94	5.45	4.04	4.18	4.19	4.02	3.98	4.67	4.24	4.09	1.7	-3.5
Asian or Pacific Islander	1.90	1.44	1.61	1.40	1.43	1.47	1.51	1.37	1.40	1.43	1.29	†-14.6	-9.8
Hispanic	2.14	1.82	1.79	1.79	1.73	1.71	1.76	1.67	1.79	1.83	1.73	-1.7	-5.5
Mexican	2.09	1.82	1.73	1.78	1.73	1.73	1.75	1.61	1.75	1.80	1.67	-4.6	-7.2
Puerto Rican	2.77	2.41	2.55	2.38	2.48	2.48	2.37	2.57	2.57	2.30	2.42	2.1	5.2
Cuban	1.68	*	1.71	*	*	1.74	1.37	1.42	1.53	1.62	2.10	53.3	29.6
Central and South American	1.86	1.38	1.61	1.60	1.39	1.22	1.46	1.41	1.43	1.57	1.30	-11.0	†-17.2

† Significant at $p < 0.05$.

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

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. Thirty-three states and the District of Columbia reported multiple-race data on the birth certificate for 2009 and 30 in 2008. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

other groups were not significant. In 2009, nearly two-thirds (65%) of all infant deaths occurred during the neonatal period (Table A).

Non-Hispanic black women had the highest neonatal mortality rate of 8.13; the rate was 2.4 times that for non-Hispanic white women (3.40). Neonatal mortality rates were also higher for Puerto Rican (4.76) and AIAN (4.38) women than for non-Hispanic white women. Neonatal mortality rates were lower for API (3.11) women than for non-Hispanic white women (Tables A and B).

Infants of non-Hispanic black (4.27) and AIAN (4.09) women had the highest postneonatal mortality rates of any group—more than twice those for non-Hispanic white women (1.93) (Tables A and B). In contrast, postneonatal mortality rates for Mexican (1.67), Central and South American (1.30), and API (1.29) women were 14%–33% lower than for non-Hispanic white women (Table A).

From 2005 to 2009, the neonatal mortality rate declined more (by 8%) than the postneonatal mortality rate (by 5%) (Table B). Declines in neonatal mortality from 2005 to 2009 were observed for non-Hispanic white, non-Hispanic black, Mexican, and Puerto Rican women (Table B), while declines in postneonatal mortality were observed for non-Hispanic white and API women.

Infant mortality by state, and by race and ethnicity

Total infant mortality rates by state for 2005 and 2009 and the number of infant deaths for 2009 are presented in Table C. Rates declined in nine states and Puerto Rico. Four of these states were in the southeastern United States. These declines ranged from 26% for South Carolina to 8% for California. California had the highest number of infant deaths (2,590) and Vermont had the fewest (38).

In order to examine variations across states in more detail and to obtain statistically reliable state-specific rates by race and Hispanic origin, 3 years of data were combined (Table 2). Across the United States, infant mortality rates are generally higher in the South and Midwest and lower elsewhere. For 2007–2009, infant mortality rates ranged from a high of 10.01 for Mississippi to a low of 4.76 for

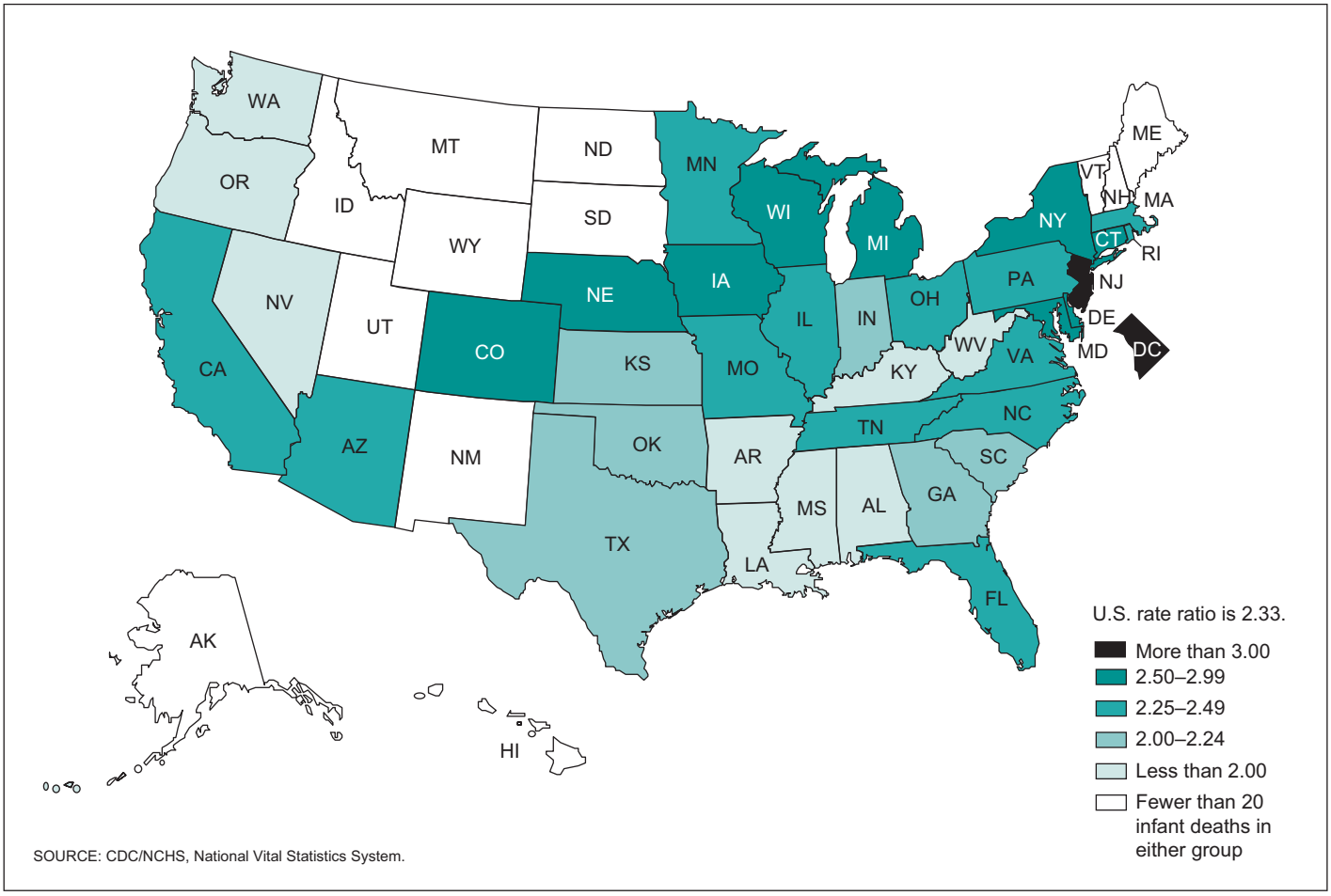


Figure 2. Infant mortality rate ratio of non-Hispanic black and non-Hispanic white populations, by state: United States, 2007–2009

New Hampshire. The highest rate noted (11.48) was for DC; however, the rate for DC is more appropriately compared with rates for other large U.S. cities because of the high concentrations of high-risk women in these areas.

Infant mortality rates differ by state among race and Hispanic origin groups. Rates for infants of non-Hispanic black mothers could be reliably computed (20 or more infant deaths) in 38 states and DC; among these states, mortality rates ranged from a high of 15.28 in Kansas to a low of 7.80 in Washington. For infants of non-Hispanic white mothers, Alabama had the highest infant mortality rate (7.53) and New Jersey had the lowest rate (3.71). Among the 42 states where infant mortality rates could be reliably computed for Hispanic mothers, Pennsylvania had the highest rate (8.32) and Louisiana had the lowest (3.84).

For infants of AIAN mothers, mortality rates could be reliably computed for only 16 states, and for API mothers, rates could only be computed for 28 states. For infants of AIAN mothers, mortality rates ranged from 15.60 in North Dakota to 5.90 in New Mexico. Infant mortality rates for infants of API mothers ranged from 6.96 in Arizona to 2.68 in New Jersey.

The data shown in Table 2 and summarized above illustrate the wide disparities that exist in infant mortality rates across states. One method for describing racial and ethnic disparities in infant mortality is to calculate the ratio between the infant mortality rates of two different racial and ethnic groups. The U.S. infant mortality rate ratio for non-Hispanic black populations relative to non-Hispanic white populations for the 3 years 2007–2009 was 2.33. It's important to keep in mind that large ratios can occur for two reasons: the infant mortality rate for non-Hispanic black women can be comparatively high or the rate for non-Hispanic white women can be relatively low. The reverse can be true when the rate ratio is low. State variation is a composition of risk factors and variation in risk factor-specific rates. Several states that lack a calculable infant mortality rate for non-Hispanic black women due to fewer than 20 infant deaths do not have a rate ratio shown here (12 states) (Figure 2).

Areas with the highest rate ratios of 2.7 or greater for 2007–2009 were DC (3.8), New Jersey (3.3), Delaware (2.8), Maryland (2.8), and Connecticut (2.7). Nine areas had ratios less than 2.0: Arkansas (1.9), Louisiana (1.9), Mississippi (1.9), Alabama (1.8), Nevada (1.8), Kentucky (1.7), Oregon (1.7), Washington (1.7), and West Virginia (1.6) (see Table 2 for rate ratios).

Sex of infant

In countries throughout the world, infant mortality rates are typically higher for male infants (13). In the United States in 2009,

Table C. Infant mortality rates, number of infant deaths, and percent change by state: United States, 2005 and 2009 linked files

[By place of residence]

State	Infant mortality rate per 1,000 live births		Percent change 2005 to 2009	Number of infant deaths in 2009
	2005	2009		
Total[1]	6.86	6.39	†-6.8	26,408
Alabama	9.53	8.28	†-13.1	517
Alaska	5.93	6.89	16.2	78
Arizona	6.85	5.97	†-12.9	554
Arkansas	7.83	7.56	-3.4	301
California	5.32	4.91	†-7.6	2,590
Colorado	6.44	6.24	-3.1	428
Connecticut	5.85	5.55	-5.1	216
Delaware	9.02	7.96	-11.7	92
District of Columbia	13.67	10.40	-23.9	94
Florida	7.24	6.90	-4.8	1,527
Georgia	8.07	7.33	†-9.2	1,036
Hawaii	6.58	5.93	-9.9	112
Idaho	5.98	5.48	-8.4	130
Illinois	7.38	6.92	-6.3	1,185
Indiana	8.04	7.82	-2.7	678
Iowa	5.44	4.61	-15.3	183
Kansas	7.37	7.10	-3.7	294
Kentucky	6.73	6.83	1.5	393
Louisiana	9.85	8.82	-10.4	573
Maine	6.87	5.72	-16.8	77
Maryland	7.30	7.22	-1.0	542
Massachusetts	5.13	5.09	-0.7	382
Michigan	7.89	7.60	-3.6	892
Minnesota	5.09	4.59	-9.8	324
Mississippi	11.46	10.09	-12.0	433
Missouri	7.52	7.07	-6.0	558
Montana	7.25	6.20	-14.5	76
Nebraska	5.66	5.38	-5.0	145
Nevada	5.66	5.82	2.8	219
New Hampshire	5.27	4.93	-6.4	66
New Jersey	5.17	5.22	1.0	576
New Mexico	6.17	5.31	-14.0	154
New York	5.82	5.36	†-7.8	1,331
North Carolina	8.81	7.92	†-10.1	1,004
North Dakota	5.96	6.33	6.2	57
Ohio	8.17	7.71	-5.7	1,116
Oklahoma	7.95	7.90	-0.7	431
Oregon	5.99	4.86	†-18.8	229
Pennsylvania	7.29	7.10	-2.6	1,040
Rhode Island	6.46	5.86	-9.3	67
South Carolina	9.46	6.98	†-26.2	423
South Dakota	6.98	6.70	-4.0	80
Tennessee	8.77	7.99	-8.9	657
Texas	6.55	5.98	†-8.6	2,403
Utah	4.52	5.27	16.6	284
Vermont	6.49	6.22	-4.1	38
Virginia	7.47	7.14	-4.4	750
Washington	5.07	4.92	-2.9	439
West Virginia	8.16	7.66	-6.1	163
Wisconsin	6.54	5.99	-8.4	424
Wyoming	6.63	5.96	-10.1	47
Puerto Rico	9.22	7.73	†-16.1	346
Virgin Islands	*	*	---	12
Guam	10.59	10.48	-1.0	36

† Significant at $p < 0.05$.

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

--- Data not available.

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

the overall infant mortality rate for male infants was 7.01 per 1,000 live births, 22% higher than the rate for female infants (5.75). Infant mortality rates were higher for male than female infants in each race and Hispanic origin group, although the difference was not significant for infants of Cuban mothers (Table 1).

Multiple births

For multiple births, the infant mortality rate in 2009 was 27.39, 5 times the rate of 5.64 for singleton births (Table 1). From 2008–2009, infant mortality rates declined by 3% for single births and declined by 5% for multiple births (14). Infant mortality rates for multiple births were higher than the rates for single births for all race and Hispanic origin groups.

The risk of infant death increases with the increasing number of infants in the pregnancy. In 2009, the infant mortality rate for twins (25.50) was nearly 5 times the rate for single births (5.64). The infant mortality rate for triplets (60.97) was 10 times, the rate for quadruplets (129.58) was 23 times, and the rate for quintuplets and higher-order births (350.00) was 62 times the rate for single births.

Multiple-pregnancy can increase maternal risks and complications associated with pregnancy (2,15–17). For example, multiple births are much more likely to be born preterm and at low birthweight than singleton births (2,15–17). The higher risk profile of multiple births has a substantial impact on overall infant mortality (16,18). For example, in 2009 multiple births accounted for 3% of all live births, but for 15% of all infant deaths in the United States (Table 1).

Period of gestation

The gestational age of an infant is perhaps the most important predictor of his or her survival and subsequent health. Infants born too small and too soon have a much greater risk of death and both short-term and long-term disability than those born at term (37–41 weeks of gestation) (19–23), and the percentage of preterm births has been linked to variations in infant mortality rates among countries (24). Because of their much greater risk of death, preterm infants have a large impact on the U.S. infant mortality rate. In 2009, two-thirds (67.0%) of all infant deaths occurred to the 12.2% of infants who were born preterm (Table D and Figure 3). Infant mortality rates are highest for very preterm (under 32 weeks) infants, and the risk decreases sharply with increasing gestational age (19,23). In 2009, the infant mortality rate for very preterm infants (172.15) was 73 times the rate of 2.36 for term infants (Table D). The infant mortality rate for infants born at 32–33 weeks of gestation was 16.07, 7 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 and disability when compared with term infants (25–28). In 2009, the infant mortality rate for late preterm infants (34–36 weeks) was 7.13, 3 times the rate for infants born at term. Even within the term period, infants born at 37–38 weeks of gestation (early term) had mortality rates that were 1.6 times higher than those born at 39–41 weeks of gestation (Table D).

From 2008 through 2009, the infant mortality rate declined significantly for gestational age groupings under 37, 32–33, 37–41, and 39–41 weeks. Infant mortality rates for other gestational age groupings were essentially unchanged from 2008–2009.

Table D. Infant mortality rates and percent distribution of infant deaths and live births, by period of gestation: United States, 2000 and 2005–2009 linked files

	All gestational ages	Preterm (under 37 weeks)					Term (37–41 weeks)			Post-term (42 weeks or over)
			Early preterm (under 34 weeks)			Late preterm		Early term		
		Total	Total	Under 32 weeks	32–33 weeks	34–36 weeks	Total	37–38 weeks	39–41 weeks	
					Infant mortality rate[1]					
2009	6.39	34.94	103.48	172.15	16.07	7.13	2.36	3.09	1.98	2.86
2008	6.61	35.76	105.71	175.45	17.58	7.40	2.44	3.13	2.08	2.69
2007	6.75	36.05	107.13	178.36	16.12	7.42	2.43	3.09	2.07	2.62
2006	6.68	35.15	105.31	175.94	16.19	7.08	2.39	3.02	2.05	2.80
2005	6.86	36.55	109.77	183.24	16.69	7.30	2.43	3.08	2.07	2.66
2000	6.89	37.88	109.75	180.95	17.37	7.96	2.59	3.38	2.24	2.91
					Percent distribution of infant deaths[2]					
2009	100.0	67.0	57.3	53.3	3.9	9.7	30.5	13.4	17.1	2.5
2008	100.0	67.2	57.3	53.1	4.2	9.9	30.4	13.3	17.2	2.3
2007	100.0	68.2	58.2	54.4	3.8	10.0	29.6	13.2	16.4	2.2
2006	100.0	68.1	58.3	54.3	4.0	9.8	29.5	13.2	16.3	2.4
2005	100.0	68.6	58.8	54.9	3.9	9.8	29.1	12.9	16.3	2.3
2000	100.0	65.6	55.8	52.0	3.7	9.4	31.2	12.3	18.9	3.2
					Percent distribution of live births[2]					
2009	100.0	12.2	3.5	2.0	1.5	8.7	82.3	27.6	54.7	5.5
2008	100.0	12.3	3.6	2.0	1.6	8.8	82.0	27.8	54.1	5.7
2007	100.0	12.7	3.6	2.0	1.6	9.0	81.7	28.6	53.1	5.6
2006	100.0	12.8	3.6	2.0	1.6	9.1	81.5	28.9	52.6	5.7
2005	100.0	12.7	3.6	2.0	1.6	9.1	81.4	28.3	53.1	5.8
2000	100.0	11.6	3.4	1.9	1.5	8.1	81.1	24.5	56.6	7.3

[1]Deaths occurring at age 1 year or under per 1,000 live births in specified group.
[2]Deaths and live births with unknown gestational age are subtracted from the total number of events used as denominators for percentage computations.

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 (14, 29–30). In 2009, the percentage of preterm births ranged from 10.8% of births to API women to 17.5% of births to non-Hispanic black women (Table 3).

Gestational age-specific infant mortality rates also varied by race and ethnicity (Table 1). Compared with non-Hispanic white women, infant mortality rates were significantly higher for non-Hispanic black women for all gestational age categories except for 32–33 weeks of gestation, and for AIAN women for all categories except under 32 weeks and 32–33 weeks of gestation. Compared with non-Hispanic white women, infant mortality rates were lower for API and Central and South American women for gestational age groupings 34–36, 37–38, 39–41, and 37–41 weeks, and for 42 weeks or over for Central and South American women. Patterns were mixed for Mexican and Puerto Rican women.

The percentage of preterm births increased 36%, from 9.4% in 1984 to a high of 12.8 in 2006 (2). However since 2006, the trend has reversed and the percentage of preterm births declined to 12.2% in 2009, a 5% decrease (Table D). The decline in the percentage of preterm births occurred during both the early (under 34 weeks) and late preterm periods. Early term (37–38 weeks) births also declined, while the percentage of births at 39–41 weeks of gestation increased (Figure 3 and Table D). Similar to the changes for births, the percentage of infant deaths that were preterm declined from 68.1% in 2006 to 67.0% in 2009, while the percentage of infant deaths that were term increased from 29.5% in 2006 to 30.5% in 2009 (2).

Birthweight

Birthweight is another important predictor of infant health. It is closely associated with, 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 2009, infant mortality rates were 24 times higher for low birthweight (less than 2,500 grams) infants (53.05 per 1,000) than for infants with birthweights of 2,500 grams or more (2.21) (Table 1). The infant mortality rate for very low birthweight (less than 1,500 grams) infants was 231.23, more than 100 times the rate for infants with birthweights of 2,500 grams or more. Among the smallest infants [less than 500 grams (1 pound, 1 ounce or less)] (Table 4), 85% were reported to have died within the first year of life. Reporting of deaths among these very small infants may be incomplete (31). Infant mortality rates were lowest at birthweights of 3,500–4,999 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% of births, but nearly one-half (47%) of all infant deaths in the United States in 2009 (Table 4). Conversely, 91.8% of infants born in the United States in 2009 weighed 2,500 grams or more,

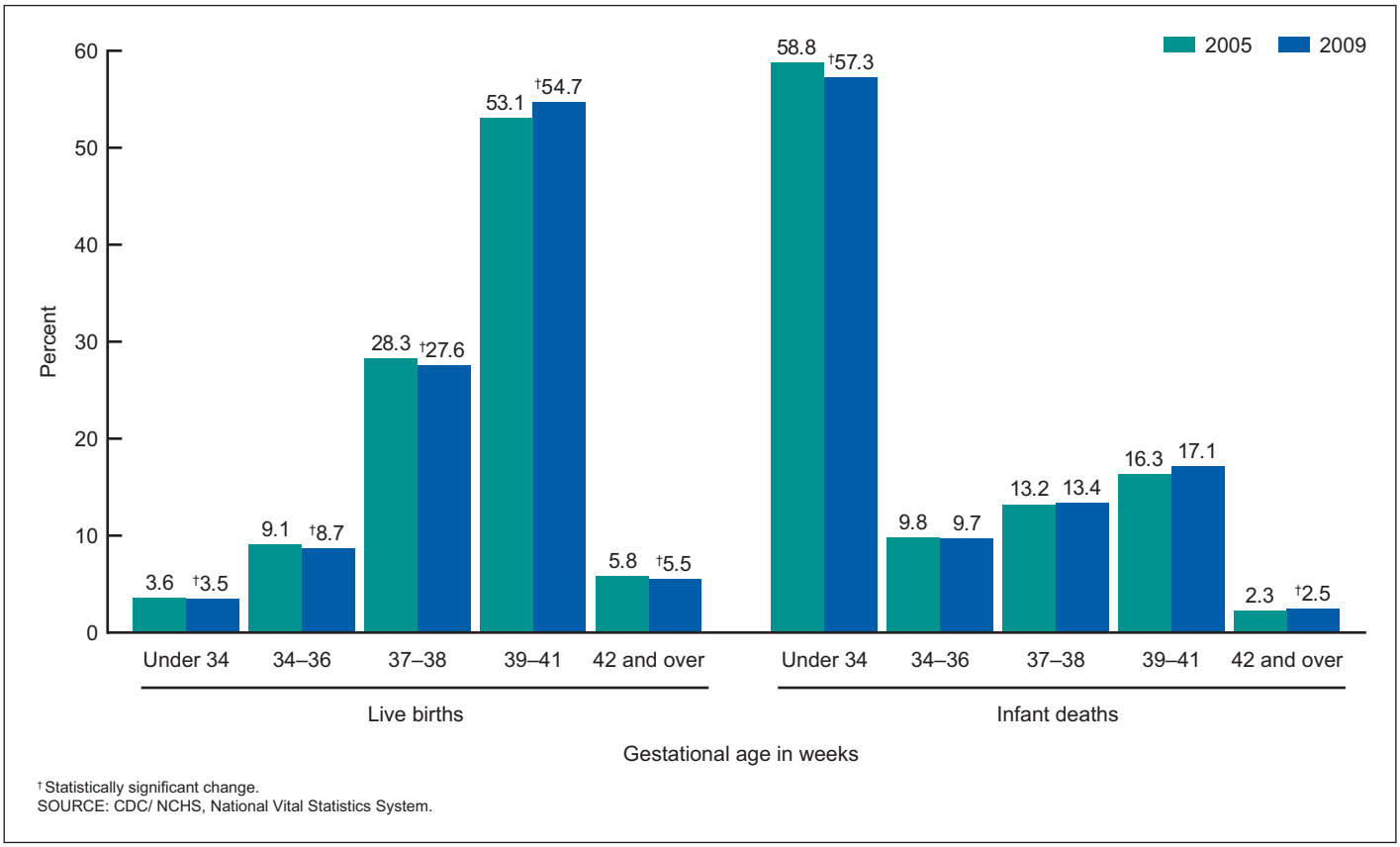


Figure 3. Percent distribution of live births and infant deaths, by gestational age: United States, 2005 and 2009

but these infants accounted for less than one-third (31.9%) of infant deaths. The large race and Hispanic-origin variations in the percentage of births at low birthweight (less than 2,500 grams) (from 6.5% for Mexican women to 13.7% for non-Hispanic black women) mean that some racial and ethnic groups are affected disproportionately by the high infant mortality rates for low birthweight infants (Table 3).

From 2005 through 2009, infant mortality rates for the total population declined for the broader birthweight categories of less than 2,500 grams, less than 1,500 grams, and 2,500 grams or more, and for detailed birthweight categories of 500–749, 2,000–2,499, and 2,500–2,999 grams (Table 4). Changes for other detailed birthweight categories were not statistically significant.

Maternal age

Infant mortality rates vary with maternal age; in 2009 infants of teenage mothers (9.05) and mothers aged 40 and over (7.90) had the highest rates. The lowest rates were for infants of mothers in their early 30s (Table 1).

In 2009, among births to teenagers, infants of the youngest mothers (under age 15) had the highest mortality rate (15.31); the rate was 14.92 in 2008. The rate for infants of mothers aged 15–17 was 9.47 in 2009, 8% lower than in 2008 (10.33); the rate for infants of mothers aged 18–19 was 8.75 in 2009 compared with 9.15 in 2008 (tabular data not shown). The rate for infants of mothers aged 35–39 was 5.82 in 2009, 6% lower than in 2008 (6.19) (14).

Infant mortality rates for births to non-Hispanic white mothers aged 20 and under were 29% higher than for mothers aged 40 and over. In contrast, for Mexican mothers, rates for births to the oldest mothers were 51% higher than rates for infants of teenagers.

Live–birth order

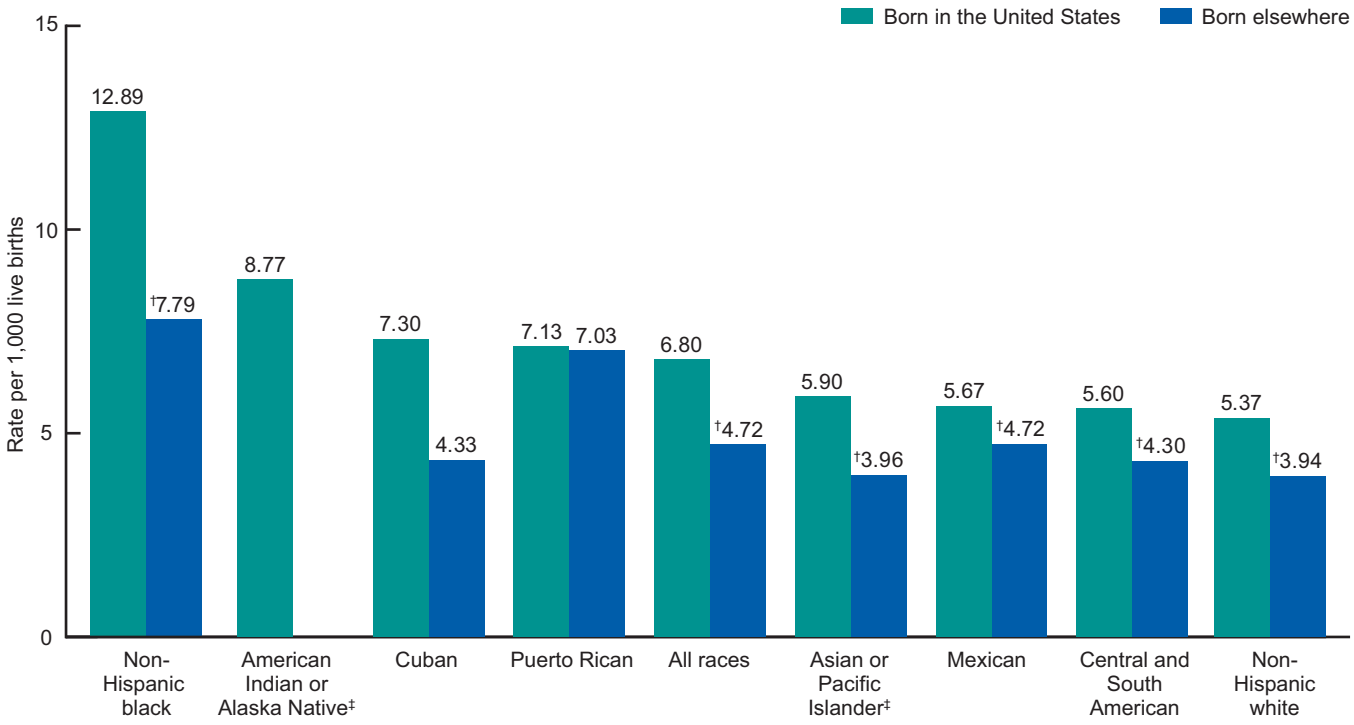
Infant mortality rates were generally higher for first births than for second births, and then generally increased as birth order increased (Table 1). In 2009, the infant mortality rate for first births (6.42) was 13% higher than for second births (5.60). The higher parities, and therefore the highest-order births (fifth child and above), are more likely to be associated with older maternal age, multiple births, and lower socioeconomic status (32).

Marital status

Marital status may be a marker for the presence or absence of social, emotional, and financial resources (33,34). Infants of mothers who are not married have been shown to be at higher risk for poor outcomes (35). In 2009, infants of unmarried mothers had an infant mortality rate of 8.58 per 1,000 live births, 76% higher than the rate for infants of married mothers (4.87) (Table 1). Within each race and Hispanic origin group, infants of unmarried mothers had higher rates of mortality, and with the exception of Cuban infants, these differences were significant.

Nativity

In 2009, the infant mortality rate for mothers born in the 50 states and DC (6.80 per 1,000) was 44% higher than the rate for



† Significant difference.
‡ Includes persons of Hispanic and non-Hispanic origin.
NOTE: "Born elsewhere" category for American Indian or Alaska Native mothers is not applicable; there are fewer than 20 infant deaths.
SOURCE: CDC/NCHS, National Vital Statistics System.

Figure 4. Infant mortality rates, by place of birth and by race and ethnicity of mother: United States, 2009

mothers born elsewhere (4.72) (Table 1). Among race and Hispanic origin groups, mothers born in the 50 states and DC had higher infant mortality rates than mothers born elsewhere for non-Hispanic black (65%), API (49%), non-Hispanic white (36%), Central and South American (30%), and Mexican mothers (20%) (Table 1 and Figure 4).

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 DC, including possible differences in migration selectivity, social support, and risk behaviors (36,37). Also, women born outside the 50 states and DC have been shown to have different characteristics than their U.S.-born counterparts with regard to socioeconomic and educational status (38).

Leading causes of infant death

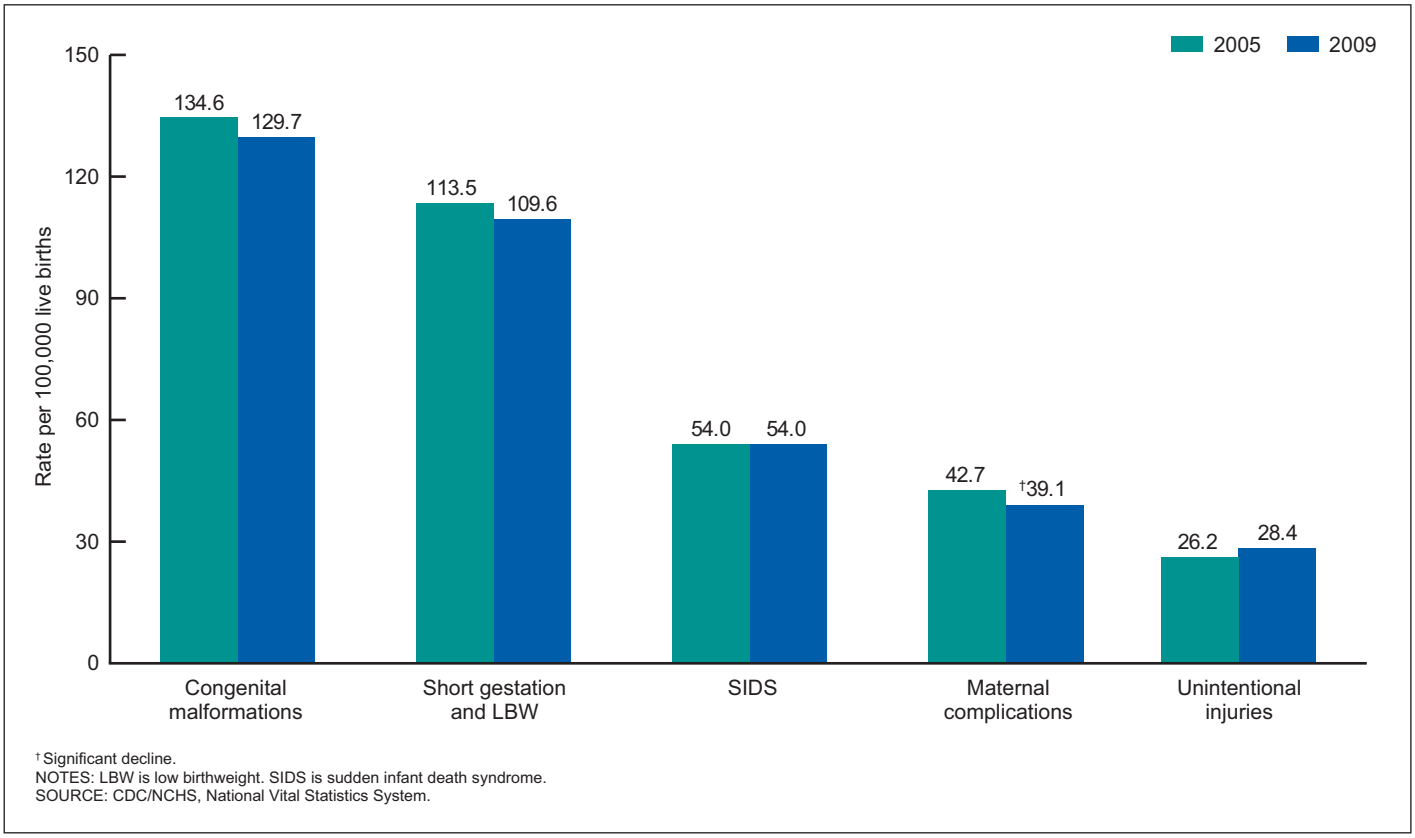
Infant mortality rates for the five leading causes of infant death are presented in Table 5 by race and Hispanic origin of mother. The leading cause of infant death in the United States in 2009 was Congenital malformations, deformations and chromosomal abnormalities (congenital malformations), accounting for 20% of all infant deaths. Disorders relating to short gestation and low birthweight, not elsewhere classified (low birthweight) was the second-leading cause, accounting for 17% of all infant deaths; followed by Sudden infant death syndrome (SIDS), accounting for 8% of infant deaths. The fourth and fifth leading causes in 2009 were Newborn affected by maternal complications of pregnancy (maternal complications) (6%), and Accidents (unintentional injuries) (4%). Together the five leading causes accounted for 56% of all infant deaths in the United States in 2009. The order of the top five leading causes was the same in 2008 and 2007. From 2005 through 2009, the infant mortality rate from maternal complications declined 8%, while changes for the other four leading causes were not statistically significant (Figure 5).

In 2009 as in previous years, 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 47% higher for AIAN women, 32% higher for non-Hispanic black women, and 23% higher for Mexican women than for non-Hispanic white women. Infant mortality rates from congenital malformations were 13% lower for API women than for non-Hispanic white women.

Infants of non-Hispanic black women had the highest mortality rates from low birthweight. The rate for non-Hispanic black women was nearly 3 times the rate for non-Hispanic white women. The rate for Puerto Rican women was more than twice the rate for non-Hispanic white women.

SIDS rates for AIAN women were more than twice those for non-Hispanic white women. SIDS rates for non-Hispanic black women



† Significant decline.
NOTES: LBW is low birthweight. SIDS is sudden infant death syndrome.
SOURCE: CDC/NCHS, National Vital Statistics System.

Figure 5. Infant mortality rates for the five leading causes of infant death: United States, 2005 and 2009

were 84% higher than for non-Hispanic white women. In contrast, SIDS rates for API, Mexican, and Central and South American women were less than one-half those for non-Hispanic white women. As most SIDS deaths occur during the postneonatal period, the high SIDS rates for infants of non-Hispanic black and AIAN women accounted for much of their elevated risk of postneonatal mortality.

For maternal complications (which include incompetent cervix, premature rupture of membranes, or multiple pregnancy, for example), infants of non-Hispanic black women had the highest mortality rates—2.7 times those for non-Hispanic white women. Non-Hispanic black women had a much higher percentage of preterm births (Table 3), which may help explain the high infant mortality rates from maternal complications, as this cause occurs predominantly among preterm infants. Infant mortality rates from maternal complications were 61% higher for Puerto Rican women than for non-Hispanic white women.

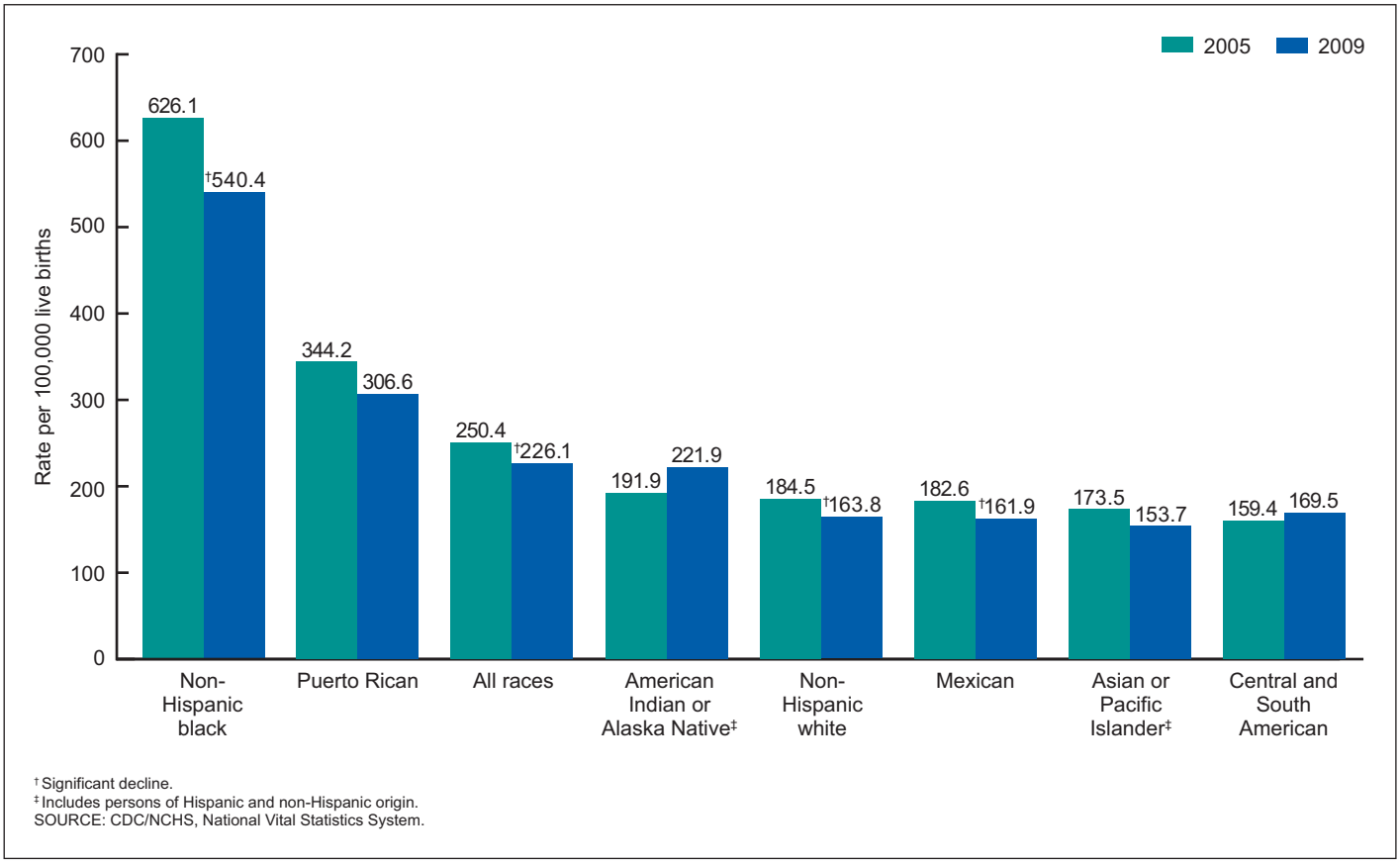
Compared with non-Hispanic white women, the infant mortality rate from unintentional injuries was 2.4 times higher for AIAN women and 2.0 times higher for non-Hispanic black women. Infant mortality rates from unintentional injuries were 34% lower for Mexican women and 62% lower for API women than for non-Hispanic white women.

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 was considered preterm-related if 75% or more of infants whose deaths were attributed to that cause were born at under 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 (39,40).

The preterm-related cause-of-death grouping includes Disorders related to short gestation and low birthweight not elsewhere classified, and most of the Maternal complications of pregnancy category from the five leading causes of death. Also included are a variety of other causes of death closely associated with prematurity, such as Respiratory distress of newborn, Bacterial sepsis of newborn, Necrotizing enterocolitis of newborn, and others. The comprehensive list of preterm-related cause-of-death categories (ICD–10 codes) is shown in Table 6. Even this comprehensive grouping likely underestimates the total impact of preterm-related infant mortality, 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 establish the etiological connection to prematurity with any degree of certainty. Preterm-related infant mortality rates shown in Table 6 and Figure 6 are computed per 100,000 live births [rather than per 1,000 live births as in previous reports (14)] to make their computation consistent with infant mortality rates for leading causes of death (Table 5).

Table 6 shows trends in preterm-related infant mortality by race and Hispanic origin of mother from 2000 through 2009. In 2009, 9,341 out of a total of 26,408 U.S. infant deaths (35.4%) were preterm-related. The percentage of infant deaths that were preterm-related increased from 34.6% in 2000 to a high of 36.9% in 2003. However, since 2003, the percentage of infant deaths that were preterm-related declined to 35.4% in 2009.



† Significant decline.
‡ Includes persons of Hispanic and non-Hispanic origin.
SOURCE: CDC/NCHS, National Vital Statistics System.

Figure 6. Preterm-related infant mortality rates, by race and Hispanic origin of mother: United States, 2005 and 2009

Preterm-related infant mortality rates varied considerably by race and ethnicity of the mother (Table 6). The preterm-related infant mortality rate was more than 3 times higher for non-Hispanic black (540.4) than for non-Hispanic white women (163.8). The preterm-related infant mortality rate was 87% higher for Puerto Rican women (306.6) and 35% higher for AIAN women (221.9) than for non-Hispanic white women. In 2009, 43%–44% of infant deaths to non-Hispanic black and Puerto Rican women were due to preterm-related causes, while the percentage was lower for other racial and ethnic groups (Table 6).

From 2005 through 2009, preterm-related infant mortality rates declined 10% for the total population, by 11% for non-Hispanic white and Mexican women, and by 14% for non-Hispanic black women (Table 6 and Figure 6). Changes for other racial and ethnic groups were not statistically significant.

Preterm-related infant mortality explains much of the higher risk of infant mortality for non-Hispanic black and Puerto Rican women, when compared with non-Hispanic white women. In 2009, 77% of the difference in the overall infant mortality rates between Puerto Rican and non-Hispanic white women was due to preterm-related causes of death. About 53% of the difference in infant mortality rates between non-Hispanic black and non-Hispanic white women was due to these causes. In contrast, preterm-related infant mortality accounted for only 18% of the difference in infant mortality rates between AIAN and non-Hispanic white women, while SIDS accounted for 21%, congenital malformations for 18%, and unintentional injuries for 12% of the difference.

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List of Detailed Tables

Table 1. Infant mortality rates, live births, and infant deaths, by selected characteristics and by race and Hispanic origin of mother: United States, 2009 linked file

Characteristic	All races and origins[1]	Non-Hispanic				Hispanic				
		White	Black	American Indian or Alaska Native[2]	Asian or Pacific Islander	Total	Mexican	Puerto Rican	Cuban	Central and South American
	Infant mortality rate per 1,000 live births in specified group									
Total	6.39	5.33	12.40	8.47	4.40	5.29	5.12	7.18	5.77	4.47
Age at death										
Total neonatal	4.18	3.40	8.13	4.38	3.11	3.56	3.44	4.76	3.61	3.17
Early neonatal (under 7 days)	3.33	2.66	6.52	3.35	2.56	2.88	2.78	3.90	2.94	2.62
Late neonatal (7–27 days)	0.85	0.74	1.61	1.03	0.55	0.68	0.66	0.86	*	0.54
Postneonatal	2.21	1.93	4.27	4.09	1.29	1.73	1.67	2.42	2.10	1.30
Sex										
Male	7.01	5.84	13.82	9.37	4.67	5.68	5.47	7.88	5.55	5.03
Female	5.75	4.78	10.93	7.53	4.10	4.88	4.75	6.48	5.88	3.88
Plurality										
Single births	5.64	4.64	10.97	8.00	3.78	4.79	4.70	6.33	4.80	3.96
Plural births	27.39	22.32	47.64	27.63	23.12	26.03	24.36	34.06	*	24.92
Birthweight										
Less than 2,500 grams	53.02	46.24	68.35	62.15	37.74	52.27	53.22	55.70	56.44	48.33
Less than 1,500 grams	231.23	212.72	253.05	243.08	214.68	231.70	235.10	230.65	248.98	225.86
1,500–2,499 grams	13.83	13.73	13.94	21.68	9.31	14.75	16.09	12.49	*	12.05
2,500 grams or more	2.21	2.13	3.46	4.23	1.36	1.76	1.77	1.99	1.56	1.35
Period of gestation										
Less than 37 weeks	34.94	29.92	52.88	34.88	27.65	29.50	29.03	38.03	32.26	26.58
Less than 32 weeks	172.15	158.22	202.20	153.33	161.44	156.14	156.36	173.53	160.66	150.94
32–33 weeks	16.07	15.80	17.31	*	14.25	15.98	17.17	*	*	13.54
34–36 weeks	7.13	7.03	8.97	12.43	5.35	5.99	6.11	6.49	*	4.85
37–41 weeks	2.36	2.26	3.65	4.15	1.45	1.94	1.96	2.25	1.61	1.43
37–38 weeks	3.09	3.12	4.34	5.33	2.00	2.38	2.44	2.98	*	1.66
39–41 weeks	1.98	1.86	3.23	3.55	1.16	1.72	1.71	1.86	*	1.32
42 weeks or more	2.86	2.53	4.72	6.35	3.30	2.38	2.52	*	*	*
Age of mother										
Under 20 years	9.05	8.94	12.60	9.14	9.40	6.43	6.20	7.96	*	5.83
20–24 years	7.43	6.64	12.53	9.67	5.64	5.16	4.81	7.13	6.06	4.89
25–29 years	5.73	4.71	12.02	6.97	3.98	4.82	4.69	7.79	5.82	4.11
30–34 years	5.07	4.09	11.83	8.11	3.80	4.69	4.61	5.77	5.64	3.56
35–39 years	5.82	4.66	13.34	*	4.24	5.62	5.67	6.25	*	4.50
40–54 years	7.90	6.31	14.26	*	5.96	9.06	9.39	*	*	8.06
Live-birth order										
1	6.42	5.19	12.66	7.39	4.38	5.85	5.80	8.06	5.40	4.58
2	5.60	4.86	11.09	8.75	3.76	4.53	4.49	5.26	4.83	4.11
3	6.20	5.50	11.79	8.87	4.93	4.46	4.15	6.89	*	4.25
4	7.58	6.71	12.93	10.94	5.53	5.73	5.44	7.73	*	4.52
5 or more	9.41	7.51	15.60	8.92	8.62	7.41	6.94	11.83	*	5.45
Marital status										
Married	4.87	4.36	10.25	6.29	4.05	4.81	4.77	6.12	5.24	3.93
Unmarried	8.58	7.68	13.20	9.62	6.10	5.71	5.45	7.75	6.26	4.96
Mother's place of birth										
Born in the 50 states and DC	6.80	5.37	12.89	8.77	5.90	5.98	5.67	7.13	7.30	5.60
Born elsewhere	4.72	3.94	7.79	*	3.96	4.73	4.72	7.03	4.33	4.30

See footnotes at end of table.

Table 1. Infant mortality rates, live births, and infant deaths, by selected characteristics and by race and Hispanic origin of mother: United States, 2009 linked file—Con.

Characteristic	All races and origins[1]	Non-Hispanic				Hispanic				
		White	Black	American Indian or Alaska Native[2]	Asian or Pacific Islander	Total	Mexican	Puerto Rican	Cuban	Central and South American
					Live births					
Total	4,130,665	2,212,552	609,584	48,665	251,089	999,548	645,297	68,486	16,641	148,647
Sex										
Male	2,113,856	1,134,654	309,751	24,752	129,526	510,477	329,299	35,134	8,476	75,932
Female	2,016,809	1,077,898	299,833	23,913	121,563	489,071	315,998	33,352	8,165	72,715
Plurality										
Single births	3,987,108	2,126,141	585,781	47,507	243,086	976,232	631,544	66,372	16,035	145,035
Plural births	143,557	86,411	23,803	1,158	8,003	23,316	13,753	2,114	606	3,612
Birthweight										
Less than 2,500 grams	337,989	159,421	83,278	3,556	20,824	69,581	41,845	6,589	1,258	9,891
Less than 1,500 grams	60,917	26,039	18,949	650	2,888	12,033	7,095	1,305	245	1,678
1,500–2,499 grams	277,072	133,382	64,329	2,906	17,936	57,548	34,750	5,284	1,013	8,213
2,500 grams or more	3,791,721	2,052,711	526,217	45,104	230,222	929,883	603,423	61,886	15,383	138,721
Not stated	955	420	89	5	43	84	29	11	*	35
Period of gestation										
Less than 37 weeks	502,306	241,301	106,316	6,537	27,200	119,507	73,996	9,414	2,201	17,796
Less than 32 weeks	81,185	34,805	23,541	1,037	3,698	17,683	10,578	1,723	361	2,511
32–33 weeks	63,776	29,620	14,326	913	3,298	15,520	9,608	1,219	262	2,289
34–36 weeks	357,345	176,876	68,449	4,587	20,204	86,304	53,810	6,472	1,578	12,996
37–41 weeks	3,394,486	1,843,476	471,889	38,753	212,371	820,908	532,427	55,059	13,644	122,074
37–38 weeks	1,138,029	590,838	177,717	13,142	71,566	282,462	181,014	19,114	5,196	41,466
39–41 weeks	2,256,457	1,252,638	294,172	25,611	140,805	538,446	351,413	35,945	8,448	80,608
42 weeks or more	228,588	125,425	30,512	3,305	11,221	57,946	38,085	3,940	789	8,581
Not stated	5,285	2,350	867	70	297	1,187	789	73	7	196
Age of mother										
Under 20 years	414,831	160,632	100,153	8,423	7,129	138,336	93,417	11,303	1,157	11,663
20–24 years	1,005,982	490,773	194,122	16,231	29,436	274,726	179,938	21,320	3,960	33,950
25–29 years	1,166,787	657,658	153,210	12,634	70,539	270,641	174,816	17,457	4,292	42,788
30–34 years	955,246	565,026	98,909	7,401	85,317	195,729	123,341	11,611	4,079	36,269
35–39 years	474,103	273,174	50,003	3,214	48,100	97,261	60,360	5,440	2,536	18,892
40–54 years	113,716	65,289	13,187	762	10,568	22,855	13,425	1,355	617	5,085
Live-birth order										
1	1,660,231	935,131	239,282	17,445	113,394	351,023	211,864	27,781	7,775	54,578
2	1,291,074	719,033	170,188	13,030	88,790	297,931	189,133	20,326	5,795	47,913
3	679,135	341,621	102,088	8,570	31,022	195,062	133,853	11,474	2,087	26,817
4	284,086	127,053	49,568	4,753	10,118	92,216	66,216	5,047	580	11,285
5 or more	189,567	78,936	41,854	4,594	6,379	57,220	40,925	3,465	290	6,792
Not stated	26,572	10,778	6,604	273	1,386	6,096	3,306	393	114	1,262
Marital status										
Married	2,437,007	1,571,300	165,540	16,853	207,832	468,103	311,277	23,847	8,978	70,764
Unmarried	1,693,658	641,252	444,044	31,812	43,257	531,445	334,020	44,639	7,663	77,883
Mother's place of birth										
Born in the 50 states and DC	3,134,234	2,073,785	527,891	45,130	52,747	423,968	258,198	50,360	8,085	20,879
Born elsewhere	982,942	133,648	77,549	3,442	196,873	573,921	386,545	17,644	8,538	127,492
Not stated	13,489	5,119	4,144	93	1,469	1,659	554	482	18	276

See footnotes at end of table.

Table 1. Infant mortality rates, live births, and infant deaths, by selected characteristics and by race and Hispanic origin of mother: United States, 2009 linked file—Con.

Characteristic	All races and origins[1]	Non-Hispanic				Hispanic				
		White	Black	American Indian or Alaska Native[2]	Asian or Pacific Islander	Total	Mexican	Puerto Rican	Cuban	Central and South American
					Infant deaths					
Total	26,408	11,785	7,560	412	1,105	5,285	3,302	492	96	665
Age at death										
Total neonatal	17,261	7,515	4,957	213	780	3,554	2,223	326	60	471
Early neonatal (under 7 days)	13,768	5,884	3,973	163	642	2,875	1,794	267	49	390
Late neonatal (7–27 days)	3,493	1,631	984	50	138	679	429	59	11	81
Postneonatal	9,148	4,271	2,603	199	324	1,731	1,080	166	35	193
Sex										
Male	14,811	6,630	4,282	232	605	2,900	1,801	277	47	382
Female	11,597	5,156	3,277	180	499	2,385	1,501	216	48	282
Plurality										
Single births	22,477	9,856	6,426	380	919	4,678	2,967	420	77	575
Plural births	3,932	1,929	1,134	32	185	607	335	72	19	90
Birthweight										
Less than 2,500 grams	17,919	7,371	5,692	221	786	3,637	2,227	367	71	478
Less than 1,500 grams	14,086	5,539	4,795	158	620	2,788	1,668	301	61	379
1,500–2,499 grams	3,833	1,832	897	63	167	849	559	66	10	99
2,500 grams or more	8,380	4,375	1,823	191	314	1,641	1,070	123	24	187
Not stated	109	40	44	1	5	7	5	2	–	–
Period of gestation										
Less than 37 weeks	17,550	7,219	5,622	228	752	3,526	2,148	358	71	473
Less than 32 weeks	13,976	5,507	4,760	159	597	2,761	1,654	299	58	379
32–33 weeks	1,025	468	248	12	47	248	165	17	5	31
34–36 weeks	2,549	1,244	614	57	108	517	329	42	8	63
37–41 weeks	7,995	4,168	1,722	161	307	1,595	1,043	124	22	175
37–38 weeks	3,521	1,843	771	70	143	671	442	57	8	69
39–41 weeks	4,474	2,325	951	91	164	924	601	67	14	106
42 weeks or more	654	317	144	21	37	138	96	7	2	16
Not stated	209	81	73	2	9	26	16	3	–	1
Age of mother										
Under 20 years	3,754	1,436	1,262	77	67	890	579	90	7	68
20–24 years	7,472	3,257	2,432	157	166	1,417	866	152	24	166
25–29 years	6,682	3,096	1,841	88	281	1,305	820	136	25	176
30–34 years	4,844	2,312	1,170	60	324	917	569	67	23	129
35–39 years	2,759	1,273	667	19	204	547	342	34	12	85
40–54 years	898	412	188	11	63	207	126	13	4	41
Live-birth order										
1	10,654	4,850	3,030	129	497	2,055	1,229	224	42	250
2	7,234	3,494	1,887	114	334	1,350	850	107	28	197
3	4,213	1,879	1,204	76	153	870	556	79	13	114
4	2,153	852	641	52	56	528	360	39	8	51
5 or more	1,784	593	653	41	55	424	284	41	–	37
Not stated	370	117	145	1	10	58	23	2	4	17
Marital status										
Married	11,877	6,858	1,697	106	841	2,253	1,484	146	47	278
Unmarried	14,531	4,928	5,862	306	264	3,032	1,819	346	48	386
Mother's place of birth										
Born in the 50 states and DC	21,318	11,142	6,804	396	311	2,537	1,465	359	59	117
Born elsewhere	4,644	526	604	13	779	2,713	1,826	124	37	548
Not stated	446	118	152	3	15	35	10	9	–	–

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

– Quantity zero.

[1]Includes other and unknown Hispanic origin not stated, not shown separately.

[2]Includes Aleut and Eskimo persons.

NOTES: DC is District of Columbia. 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. Thirty-three states and DC reported multiple-race data on the birth certificate for 2009 and 30 for 2008. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Table 2. Infant mortality rates, by race and Hispanic origin of mother: United States and each state, Puerto Rico, Virgin Islands, and Guam, 2007–2009 linked files

[By place of residence]

Area	Total	Race and Hispanic origin of mother					Ratio of rate, non-Hispanic black and non-Hispanic white
		Non-Hispanic white	Non-Hispanic black	American Indian or Alaska Native[1]	Asian or Pacific Islander	Hispanic	
	Infant mortality rate per 1,000 live births in specified group						
United States[2]	6.59	5.49	12.80	8.71	4.57	5.46	2.33
Alabama	9.24	7.53	13.33	*	*	7.30	1.77
Alaska	6.51	4.12	*	11.67	*	*	*
Arizona	6.42	5.96	14.42	8.27	6.96	5.73	2.42
Arkansas	7.59	6.60	12.59	*	*	5.11	1.91
California	5.08	4.31	10.37	6.80	4.42	4.88	2.41
Colorado	6.19	5.15	12.95	*	4.41	7.20	2.51
Connecticut	6.07	4.58	12.59	*	5.89	6.35	2.75
Delaware	7.99	5.33	14.77	*	*	6.86	2.77
District of Columbia	11.48	4.34	16.53	*	*	6.73	3.81
Florida	7.09	5.48	12.74	*	5.64	5.30	2.32
Georgia	7.78	5.71	12.31	*	3.94	4.95	2.16
Hawaii	6.07	4.89	*	*	6.54	5.73	*
Idaho	6.03	5.61	*	*	*	7.62	*
Illinois	6.97	5.51	13.64	*	5.07	5.79	2.48
Indiana	7.41	6.46	14.47	*	5.27	6.81	2.24
Iowa	5.27	4.89	12.24	*	*	6.49	2.50
Kansas	7.49	6.89	15.28	*	5.85	6.68	2.22
Kentucky	6.81	6.51	11.15	*	*	4.49	1.71
Louisiana	9.01	6.89	12.76	*	*	3.84	1.85
Maine	5.85	5.74	*	*	*	*	*
Maryland	7.74	4.82	13.29	*	4.93	5.05	2.76
Massachusetts	5.02	4.02	9.89	*	3.63	6.87	2.46
Michigan	7.65	5.92	14.86	9.36	5.35	6.88	2.51
Minnesota	5.36	4.60	11.04	8.67	5.61	4.58	2.40
Mississippi	10.01	7.23	13.38	*	*	6.25	1.85
Missouri	7.21	6.10	14.10	*	3.95	5.15	2.31
Montana	6.55	6.11	*	8.91	*	*	*
Nebraska	5.87	5.19	13.44	11.01	*	5.50	2.59
Nevada	5.83	5.48	9.88	*	4.91	5.38	1.80
New Hampshire	4.76	4.68	*	*	*	*	*
New Jersey	5.27	3.71	12.07	*	2.68	5.04	3.25
New Mexico	5.69	5.83	*	5.90	*	5.31	*
New York	5.48	4.26	11.05	*	3.16	4.92	2.59
North Carolina	8.23	5.98	14.67	15.48	5.54	6.34	2.45
North Dakota	6.57	5.37	*	15.60	*	*	*
Ohio	7.72	6.31	14.54	*	4.75	7.28	2.30
Oklahoma	7.83	7.16	14.74	8.78	*	6.07	2.06
Oregon	5.24	5.15	8.87	10.02	4.90	4.74	1.72
Pennsylvania	7.34	5.50	13.42	*	5.73	8.32	2.44
Rhode Island	6.36	4.66	10.86	*	*	5.62	2.33
South Carolina	7.86	5.88	12.14	*	*	5.51	2.06
South Dakota	7.09	5.71	*	12.43	*	*	*
Tennessee	8.15	6.38	14.90	*	4.88	6.48	2.34
Texas	6.15	5.47	11.41	7.11	4.18	5.56	2.09
Utah	4.99	4.68	*	*	6.60	5.62	*
Vermont	5.28	5.06	*	*	*	*	*
Virginia	7.26	5.57	13.07	*	4.54	6.27	2.35
Washington	5.08	4.65	7.80	9.00	4.15	5.32	1.68
West Virginia	7.57	7.46	11.59	*	*	*	1.55
Wisconsin	6.44	5.36	14.07	9.05	6.88	6.22	2.63
Wyoming	6.78	6.07	*	*	*	7.35	*
Puerto Rico	8.19	---	---	---	---	---	---
Virgin Islands	5.61	*	*	*	*	*	*
Guam	9.50	*	*	*	10.14	*	*

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

--- Data not available.

[1]Includes Aleut and Eskimo persons.

[2]Excludes data for Puerto Rico, Virgin Islands, and Guam.

NOTES: Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race. In this table, Hispanic women are classified only by place of origin; non-Hispanic women are classified by race. Thirty-three states and the District of Columbia reported multiple-race data on the birth certificate for 2009 and 30 for 2008. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Table 3. Percentage of live births with selected maternal and infant characteristics, by race and Hispanic origin of mother: United States, 2009 linked file

Characteristic	All races and origins[1]	Non-Hispanic		American Indian or Alaska Native[2]	Asian or Pacific Islander	Hispanic				
		White	Black			Total[1]	Mexican	Puerto Rican	Cuban	Central and South American
Birthweight										
Less than 1,500 grams	1.48	1.18	3.11	1.34	1.15	1.20	1.10	1.91	1.47	1.13
Less than 2,500 grams	8.2	7.2	13.7	7.3	8.3	7.0	6.5	9.6	7.6	6.7
Preterm births[3]	12.2	10.9	17.5	13.5	10.8	12.0	11.5	13.8	13.2	12.0
Births to mothers under age 20	10.0	7.3	16.4	17.3	2.8	13.8	14.5	16.5	7.0	7.8
Fourth and higher-order births	11.5	9.4	15.2	19.3	6.6	15.0	16.7	12.5	5.3	12.3
Births to unmarried mothers	41.0	29.0	72.8	65.4	17.2	53.2	51.8	65.2	46.0	52.4
Mothers born in the 50 states and DC	76.1	93.9	87.2	92.9	21.1	42.5	40.0	74.1	48.6	14.1

[1]Includes other and unknown Hispanic and origin not stated not shown separately.

[2]Includes Aleut and Eskimo persons.

[3]Born prior to 37 completed weeks of gestation.

NOTES: DC is District of Columbia. Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with 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. Thirty-three states and DC reported multiple-race data on the birth certificate for 2009 and 30 for 2008. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Table 4. Live births, infant, neonatal, and postneonatal deaths and mortality rates, by race and Hispanic origin of mother and birthweight: United States, 2009 linked file, and percent change in birthweight-specific infant mortality, 2005–2009 linked files

Race, and birthweight in grams	Number in 2009				Mortality rate per 1,000 live births in 2009			Percent change in infant mortality rate 2005–2009
	Live births	Infant deaths	Neonatal deaths	Postneonatal deaths	Infant	Neonatal	Postneonatal	
All races and origins	4,130,665	26,408	17,261	9,148	6.39	4.18	2.21	†-6.9
Less than 2,500	337,989	17,919	14,460	3,459	53.02	42.78	10.23	†-7.6
Less than 1,500	60,917	14,086	12,270	1,816	231.23	201.42	29.81	†-5.6
Less than 500	6,937	5,918	5,788	130	853.11	834.37	18.74	-0.4
500–749	11,009	4,735	3,991	744	430.10	362.52	67.58	†-8.1
750–999	11,990	1,683	1,222	461	140.37	101.92	38.45	-6.7
1,000–1,249	14,193	990	733	257	69.75	51.65	18.11	-2.1
1,250–1,499	16,788	759	535	224	45.21	31.87	13.34	-3.1
1,500–1,999	65,687	1,664	1,069	594	25.33	16.27	9.04	-5.7
2,000–2,499	211,385	2,170	1,121	1,049	10.27	5.30	4.96	†-5.7
2,500 or more	3,791,721	8,380	2,693	5,687	2.21	0.71	1.50	†-3.9
2,500–2,999	767,690	2,932	1,085	1,847	3.82	1.41	2.41	†-8.8
3,000–3,499	1,619,238	3,414	974	2,440	2.11	0.60	1.51	-1.9
3,500–3,999	1,091,173	1,579	465	1,114	1.45	0.43	1.02	-1.4
4,000–4,499	271,434	374	126	249	1.38	0.46	0.92	-4.8
4,500–4,999	37,926	53	22	30	1.40	0.58	0.79	-36.7
5,000 or more	4,260	27	20	7	6.34	4.69	*	42.5
Not stated	955	109	107	2	. . .	. . .	. . .	. . .
Non-Hispanic white	2,212,552	11,785	7,515	4,271	5.33	3.40	1.93	†-7.5
Less than 2,500	159,421	7,371	6,047	1,323	46.24	37.93	8.30	†-8.0
Less than 1,500	26,039	5,539	4,941	598	212.72	189.75	22.97	†-6.4
Less than 500	2,556	2,200	2,159	41	860.72	844.68	16.04	0.0
500–749	4,200	1,810	1,589	221	430.95	378.33	52.62	†-8.7
750–999	4,910	705	567	138	143.58	115.48	28.11	†-11.9
1,000–1,249	6,576	471	368	104	71.62	55.96	15.82	-4.3
1,250–1,499	7,797	352	258	94	45.15	33.09	12.06	2.0
1,500–1,999	31,753	789	532	257	24.85	16.75	8.09	-3.3
2,000–2,499	101,629	1,042	574	468	10.25	5.65	4.60	-7.3
2,500 or more	2,052,711	4,375	1,430	2,945	2.13	0.70	1.43	†-4.5
2,500–2,999	359,567	1,395	516	879	3.88	1.44	2.44	†-10.4
3,000–3,499	844,295	1,783	540	1,243	2.11	0.64	1.47	-3.2
3,500–3,999	647,557	906	267	639	1.40	0.41	0.99	-0.7
4,000–4,499	174,247	248	82	166	1.42	0.47	0.95	6.0
4,500–4,999	24,553	28	12	16	1.14	*	*	-38.4
5,000 or more	2,492	15	12	3	*	*	*	*
Not stated	420	40	38	2	. . .	. . .	. . .	. . .
Non-Hispanic black	609,584	7,560	4,957	2,603	12.40	8.13	4.27	†-9.0
Less than 2,500	83,278	5,692	4,452	1,240	68.35	53.46	14.89	†-8.5
Less than 1,500	18,949	4,795	4,056	739	253.05	214.05	39.00	†-4.8
Less than 500	2,585	2,184	2,135	49	844.87	825.92	18.96	-0.8
500–749	3,982	1,637	1,301	336	411.10	326.72	84.38	†-7.7
750–999	3,878	515	320	195	132.80	82.52	50.28	-1.2
1,000–1,249	3,995	268	184	84	67.08	46.06	21.03	5.7
1,250–1,499	4,509	191	116	75	42.36	25.73	16.63	-9.2
1,500–1,999	15,940	393	190	203	24.65	11.92	12.74	-8.4
2,000–2,499	48,389	505	206	298	10.44	4.26	6.16	-7.1
2,500 or more	526,217	1,823	460	1,363	3.46	0.87	2.59	-1.7
2,500–2,999	155,000	755	222	533	4.87	1.43	3.44	-3.9
3,000–3,499	236,140	735	153	582	3.11	0.65	2.46	-0.6
3,500–3,999	110,344	281	70	211	2.55	0.63	1.91	5.4
4,000–4,499	21,472	41	11	30	1.91	*	1.40	-25.7
4,500–4,999	2,885	9	3	6	*	*	*	*
5,000 or more	376	2	1	1	*	*	*	*
Not stated	89	44	44	–	. . .	. . .	. . .	. . .

See footnotes at end of table.

Table 4. Live births, infant, neonatal, and postneonatal deaths and mortality rates, by race and Hispanic origin of mother and birthweight: United States, 2009 linked file, and percent change in birthweight-specific infant mortality, 2005–2009 linked files—Con.

Race, and birthweight in grams	Number in 2009				Mortality rate per 1,000 live births in 2009			Percent change in infant mortality rate 2005–2009
	Live births	Infant deaths	Neonatal deaths	Postneonatal deaths	Infant	Neonatal	Postneonatal	
American Indian or Alaska native[1]	48,665	412	213	199	8.47	4.38	4.09	5.1
Less than 2,500	3,556	221	161	59	62.15	45.28	16.59	16.3
Less than 1,500	650	158	133	25	243.08	204.62	38.46	2.8
Less than 500	72	64	62	2	888.89	861.11	*	12.1
500–749	89	41	34	7	460.67	382.02	*	2.2
750–999	139	29	21	8	208.63	151.08	*	*
1,000–1,249	153	13	10	3	*	*	*	*
1,250–1,499	197	11	6	5	*	*	*	*
1,500–1,999	696	24	16	8	34.48	*	*	12.2
2,000–2,499	2,210	39	12	26	17.65	*	11.76	29.3
2,500 or more	45,104	191	51	140	4.23	1.13	3.10	-4.5
2,500–2,999	8,192	55	17	38	6.71	*	4.64	-6.4
3,000–3,499	18,494	84	18	66	4.54	*	3.57	9.7
3,500–3,999	13,679	40	11	28	2.92	*	2.05	-9.0
4,000–4,499	3,943	11	3	8	*	*	*	*
4,500–4,999	679	–	–	–	*	*	*	*
5,000 or more	117	1	1	–	*	*	*	*
Not stated	5	1	1	–	. . .	. . .	. . .	. . .
Asian or Pacific Islander	251,089	1,105	780	324	4.40	3.11	1.29	-10.0
Less than 2,500	20,824	786	649	137	37.74	31.17	6.58	-14.5
Less than 1,500	2,888	620	541	79	214.68	187.33	27.35	-9.7
Less than 500	294	265	259	6	901.36	880.95	*	6.0
500–749	459	204	170	33	444.44	370.37	71.90	-12.1
750–999	586	75	56	19	127.99	95.56	*	-11.3
1,000–1,249	655	34	24	10	51.91	36.64	*	-29.1
1,250–1,499	894	41	31	10	45.86	34.68	*	-5.2
1,500–1,999	3,756	80	60	20	21.30	15.97	5.32	-19.5
2,000–2,499	14,180	86	48	38	6.06	3.39	2.68	-15.4
2,500 or more	230,222	314	127	187	1.36	0.55	0.81	-5.6
2,500–2,999	58,788	120	60	60	2.04	1.02	1.02	-17.4
3,000–3,499	105,765	136	49	87	1.29	0.46	0.82	2.4
3,500–3,999	54,062	47	13	33	0.87	*	0.61	3.6
4,000–4,499	10,108	10	3	7	*	*	*	*
4,500–4,999	1,318	–	–	–	*	*	*	*
5,000 or more	181	1	1	–	*	*	*	*
Not stated	43	5	5	–	. . .	. . .	. . .	. . .
Hispanic	999,548	5,285	3,554	1,731	5.29	3.56	1.73	†-5.9
Less than 2,500	69,581	3,637	2,945	692	52.27	42.32	9.95	†-6.2
Less than 1,500	12,033	2,788	2,414	374	231.70	200.61	31.08	-5.5
Less than 500	1,317	1,100	1,069	31	835.23	811.69	23.54	-2.5
500–749	2,195	982	834	148	447.38	379.95	67.43	-6.9
750–999	2,434	348	248	99	142.97	101.89	40.67	-4.5
1,000–1,249	2,780	199	145	55	71.58	52.16	19.78	0.8
1,250–1,499	3,307	158	118	40	47.78	35.68	12.10	-5.9
1,500–1,999	13,265	367	263	104	27.67	19.83	7.84	-8.3
2,000–2,499	44,283	482	268	214	10.88	6.05	4.83	-0.4
2,500 or more	929,883	1,641	602	1,039	1.76	0.65	1.12	-6.4
2,500–2,999	184,387	591	263	328	3.21	1.43	1.78	-10.3
3,000–3,499	411,660	672	203	469	1.63	0.49	1.14	-0.6
3,500–3,999	263,321	301	101	200	1.14	0.38	0.76	-8.8
4,000–4,499	61,045	57	24	33	0.93	0.39	0.54	-25.0
4,500–4,999	8,383	13	7	6	*	*	*	*
5,000 or more	1,087	7	4	3	*	*	*	*
Not stated	84	7	7	–	. . .	. . .	. . .	. . .

† Not 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.

[1]Includes Aleut and Eskimo persons.

NOTES: Infant deaths are weighted so numbers may not exactly add to totals due to rounding. Neonatal is under 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.Thirty-three states and the District of Columbia reported multiple-race data on the birth certificate for 2009 and 30 for 2008.The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Table 5. Infant deaths and mortality rates for the five leading causes of infant death, by race and Hispanic origin of mother: United States, 2009 linked file

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

Cause of death (based on *International Classification of Diseases, Tenth Revision,* 1992)	All races			Non-Hispanic white			Non-Hispanic black			American Indian or Alaska Native			Asian or Pacific Islander[1]		
	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate
All causes	. . .	26,408	639.3	. . .	11,785	532.6	. . .	7,560	1,240.2	. . .	412	846.6	. . .	1,105	440.1
Congenital malformations, deformations, and chromosomal abnormalities (Q00–Q99)	1	5,358	129.7	1	2,638	119.2	2	960	157.5	1	85	174.7	1	260	103.5
Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	2	4,528	109.6	2	1,629	73.6	1	1,734	284.5	3	45	92.5	2	189	75.3
Sudden infant death syndrome (R95)	3	2,231	54.0	3	1,213	54.8	3	614	100.7	2	58	119.2	4	51	20.3
Newborn affected by maternal complications of pregnancy (P01)	4	1,614	39.1	4	682	30.8	4	515	84.5	5	21	43.2	3	74	29.5
Accidents (unintentional injuries) (V01–X59)	5	1,172	28.4	5	602	27.2	5	338	55.4	4	32	65.8	9	26	10.4

Cause of death (based on *International Classification of Diseases, Tenth Revision*, 1992)	Total Hispanic[2]			Mexican[3]			Puerto Rican[4]			Central and South American[5]		
	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate	Rank	Number	Rate
All causes	. . .	5,285	528.7	. . .	3,302	511.7	. . .	492	718.4	. . .	665	447.4
Congenital malformations, deformations, and chromosomal abnormalities (Q00–Q99)	1	1,374	137.5	1	949	147.1	2	69	100.8	1	174	117.1
Disorders related to short gestation and low birth weight, not elsewhere classified (P07)	2	848	84.8	2	474	73.5	1	113	165.0	2	119	80.1
Sudden infant death syndrome (R95)	3	285	28.5	4	166	25.7	3	35	51.1	4	31	20.9
Newborn affected by maternal complications of pregnancy (P01)	4	282	28.2	3	173	26.8	4	34	49.6	3	34	22.9
Accidents (unintentional injuries) (V01–X59)	6	172	17.2	6	116	18.0	7	15	*	13	11	*

. . . Category not applicable.

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

[1]For Asian or Pacific Islander persons, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 49 deaths and a rate of 19.5.

[2]For Hispanic persons, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 214 deaths and a rate of 21.4.

[3]For Mexican persons, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 136 deaths and a rate of 21.1.

[4]For Puerto Ricans persons, Respiratory distress of newborn (P22) was the fifth leading cause of death with 22 deaths and a rate of 32.1.

[5]For Central and South American persons, Newborn affected by complications of placenta, cord and membranes (P02) was the fifth leading cause of death with 27 deaths and a rate of 18.2.

NOTES: Reliable cause-specific infant mortality rates cannot be computed for Cuban persons because of the small number of infant deaths (96). 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. Thirty-three states and the District of Columbia reported multiple-race data on the birth certificate for 2009. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Table 6. Number of and percentage of preterm-related infant deaths and preterm-related infant mortality rates, by race and Hispanic origin of mother: United States, 2000–2009 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 infant deaths					
2009	9,341	3,624	3,294	108	386	1,781	1,045	210	252
2008	9,952	3,843	3,466	97	418	2,009	1,303	222	229
2007	10,498	4,104	3,755	111	430	1,956	1,276	208	269
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					
2009	35.4	30.8	43.6	26.2	34.9	33.7	31.6	42.7	37.9
2008	35.4	30.7	43.9	23.3	36.6	34.5	34.1	44.1	30.9
2007	36.0	31.6	45.0	24.3	35.4	33.4	32.6	39.4	34.6
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
				Infant mortality rate[2]					
2009	226.1	163.8	540.4	221.9	153.7	178.2	161.9	306.6	169.5
2008	234.3	169.5	556.3	195.8	165.1	192.9	190.3	321.7	147.2
2007	243.2	177.6	598.7	224.5	169.0	184.0	176.7	303.7	158.4
2006	241.5	179.1	600.9	209.6	148.5	179.8	171.1	330.2	152.4
2005	250.4	184.5	626.1	191.9	173.5	190.8	182.6	344.2	159.4
2004	247.6	181.6	629.1	188.9	165.0	185.1	175.9	318.5	165.8
2003	252.6	187.7	627.6	211.4	164.6	193.0	177.7	342.5	188.8
2002	247.8	188.9	619.2	212.4	152.2	175.7	162.2	330.6	152.4
2001	242.6	184.3	603.6	188.7	139.8	168.6	155.6	340.5	155.7
2000	238.3	175.2	593.3	230.4	148.6	172.9	159.6	325.2	150.0

[1]Includes Cuban and other and unknown Hispanic. Cuban data were not shown separately because of small numbers of infant deaths.
[2]Rate per 100,000 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, and P77. 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. Thirty-three states and the District of Columbia reported multiple-race data on the birth certificate for 2009 and 30 for 2008. The multiple-race data for these states were bridged to the single-race categories of the 1977 standards for comparability with other states; see references 2 and 3.

Technical Notes

Differences between period and cohort data

From 1983 through 1991, the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) produced linked files in a birth cohort format (41). Beginning with 1995 data, linked files are produced first using a period format and then subsequently using a birth cohort format. The 2009 period linked file contains a numerator file that consists of all infant deaths occurring in 2009 that have been linked to their corresponding birth certificates, whether the birth occurred in 2008 or in 2009. In contrast, the 2009 birth cohort linked file will contain a numerator file that consists of all infant deaths to babies born in 2009 whether the death occurred in 2009 or 2010. Beginning with 1995 data, the period linked file is the basis for all official NCHS linked file statistics.

Weighting

In 2009 a record weight was added to the linked file to compensate for the 1.4% 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 95.3% to 100.0% with all but four areas —California, Louisiana, New Mexico, and Texas at 97.5% or higher) (Table I). The number of infant deaths in the linked file for the 50 states and the District of Columbia (DC) was weighted to equal the sum of the linked plus unlinked infant deaths by state of occurrence of birth and age of death (under 7 days, 7–27 days, and 28 days to under age 1 year). The addition of the weight reduced the potential for bias in comparing infant mortality rates by characteristics.

The 2009 linked file started with 26,437 infant death records. Of these 26,437 records, 26,076 were linked; 361 were unlinked because corresponding birth certificates could not be identified. The 26,437 linked and unlinked records contained 29 records of infants whose mothers' usual place of residence was outside of the United States. These 29 records were excluded to derive a weighted total of 26,408 infant deaths for 2009.

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

The overall infant mortality rate from the 2009 period linked file of 6.39 deaths per 1,000 live births is the same as the 2009 vital statistics mortality file (4). The number of infant deaths in the linked file (26,408) differs slightly from the number in the mortality file (26,412) (4). 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 DC are included regardless of the place of birth of the infant. In contrast, to be included in the U.S. linked file, both the birth and death must occur in the 50 states and DC (the territory linked file is a separate file). Also, weighting of the linked file may

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, 2009 linked file

State	Percent linked by state of occurrence of death
United States[1]	98.6
Alabama	100.0
Alaska	100.0
Arizona	97.6
Arkansas	100.0
California	96.7
Colorado	100.0
Connecticut	98.1
Delaware	100.0
District of Columbia	99.5
Florida	99.9
Georgia	99.2
Hawaii	100.0
Idaho	100.0
Illinois	98.0
Indiana	99.2
Iowa	100.0
Kansas	99.6
Kentucky	97.8
Louisiana	97.4
Maine	98.7
Maryland	100.0
Massachusetts	99.5
Michigan	99.8
Minnesota	99.7
Mississippi	99.7
Missouri	99.5
Montana	100.0
Nebraska	100.0
Nevada	99.5
New Hampshire	100.0
New Jersey	97.7
New Mexico	96.3
New York State	98.9
New York City	99.7
North Carolina	99.7
North Dakota	100.0
Ohio	97.7
Oklahoma	98.8
Oregon	100.0
Pennsylvania	99.5
Rhode Island	98.9
South Carolina	100.0
South Dakota	100.0
Tennessee	100.0
Texas	95.3
Utah	99.3
Vermont	100.0
Virginia	99.9
Washington	99.8
West Virginia	100.0
Wisconsin	100.0
Wyoming	100.0
Puerto Rico	98.0
Virgin Islands	90.9
Guam	100.0

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

contribute to small differences in numbers and rates by specific variables between these two data sets.

The 1989 and 2003 revisions of the U.S. Standard Certificates of Live Birth

This report includes 2009 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) (3). The 2003 revision is described in detail elsewhere (42–44).

Maternal education, prenatal care, and smoking during pregnancy

Data for educational attainment, prenatal care, and tobacco use, although collected on both the revised and unrevised birth certificates, are not considered comparable between revisions. Because the 2009 linked file has birth records from both 2008 and 2009, the reporting areas of these three items from the 2003 revised certificate are those that were revised by January 1, 2008. Twenty-seven states—California, Colorado, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Michigan, Montana, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Washington, and Wyoming—had implemented the revised birth certificate by January 1, 2008. Data for Florida, Georgia, and Michigan are excluded in the smoking results because each state's birth certificate question on smoking is either not comparable with the 2003 revision or the information was not collected (3). Results for these three items from the limited reporting area are not generalizable to the country as a whole (2,3). The 27 revised states represent 65% of all births in 2008 (53% for the 24 states with smoking data, which exclude Florida, Georgia, and Michigan).

However, maternal education, prenatal care, and smoking during pregnancy continue to have important relationships with infant mortality rates for those with less than a high school education, those with late or no prenatal care, and smokers (Table II). Analyses of these important variables will be expanded when all states adopt the 2003 revision.

Table II. Infant mortality rates for 2009, by trimester when pregnancy prenatal care began, smoking status during pregnancy, and education of mother: 27-state reporting area as of January 1, 2008

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

Characteristic	Rate
Prenatal care	
Prenatal care beginning in the 1st trimester	5.24
Prenatal care beginning after the 1st trimester or no care	7.36
Prenatal care beginning in the 2nd trimester	6.19
Prenatal care beginning in the 3rd trimester	5.21
No prenatal care	26.93
Smoking status	
Smoker	9.73
Nonsmoker	5.50
Educational attainment	
Less than high school diploma	7.65
High school diploma	7.15
Some college or technical school	5.82
Bachelor's degree or higher	3.73

NOTES: Includes data from California, Colorado, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Michigan, Montana, Nebraska, New Hampshire, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Washington, and Wyoming. These states are those that revised their birth certificates as of January 1, 2008. Information on smoking status excludes data for Florida, Georgia, and Michigan; see Methods and Technical Notes.

Marital status

National estimates of births to unmarried women are based on two methods of determining marital status. In 2009, marital status was based on a direct question in 49 states and DC. New York used inferential procedures to compile birth statistics by marital status; a birth is categorized as nonmarital if either of these factors, listed in priority-of-use order, is present: a paternity acknowledgment was received or the father's name is missing (3).

Multiple race

For the birth certificates in the 2009 data year, multiple race was reported by 33 states and DC (both revised and nonrevised): California, Colorado, Delaware, District of Columbia (for births after January 31), Florida, Georgia, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Montana, Nebraska, Nevada (for births after May 31), New Hampshire, New Mexico, New York, North Dakota, Ohio, Oklahoma (for births after March 31), Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, and Wyoming (3,45). Data from the vital records of the remaining states followed the 1977 Office of Management and Budget standards in which a single race is reported (46,47). In addition, these unrevised areas also 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 (3).

To provide uniformity and comparability of the data during the transition period, before multiple-race data are available for all reporting areas, it is necessary to bridge the responses of those who reported more than one race to a single race. Multiple race is imputed to a single race (one of the following: American Indian or Alaska Native, Asian or Pacific Islander, black, or white) according to the combination of races, Hispanic origin, sex, and age indicated on the birth certificate using methods described elsewhere (3,8,48).

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. This measure 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. When the LMP date was not reported or was inconsistent with birthweight, the "obstetric estimate of gestation" was used (6% of births) (2,3).

Birthweight

For the linked file, birthweight not stated was imputed for 3,077 records or 0.07% of the birth records in 2009 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, then the not-stated value for birthweight was retained. This imputation was done to improve the accuracy of birthweight-specific infant mortality rates, because the percentage of records with not-stated birthweight was higher for infant deaths (3.27% before imputation) than for live births (0.10% before imputation). The imputation reduced the percentage of not-stated records to 0.41% for infant deaths and to 0.02% for births. The not-stated birthweight cases in the natality/birth file, as distinct from the linked file, are not imputed (3).

Cause-of-death classification

The mortality statistics presented in this report were compiled in accordance with 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 Manuals* (49,50).

In this report tabulations of cause-of-death statistics are based solely on the underlying cause of death. The underlying cause is defined by WHO as "the disease or injury which initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" (5). The underlying cause is selected from the conditions entered by the physician in the cause-of-death section of the death certificate. When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection 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 (51,52).

About every 10–20 years the ICD is revised to take into account advances in medical knowledge. Effective with deaths occurring in 1999, the United States began using the Tenth Revision (ICD–10) (5); during the period 1979–1998, causes were coded and classified according to the Ninth Revision (ICD–9) (53).

Changes in classification of causes of death due to these revisions may result in discontinuities in cause-of-death trends. Measures of this discontinuity are essential to the interpretation of mortality trends, and are discussed in detail in other NCHS publications (4,54,55).

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* (56). Briefly, category titles that begin with the words "Other" and "All other" are not ranked to determine the leading causes of death. When one of the titles that represents a subtotal is ranked [for example, Influenza and pneumonia (J10–J18)], its component parts are not ranked [in this case, Influenza (J10–J11) and Pneumonia (J12–J18)].

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% 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 (39). The cause-of-death categories included in this grouping are shown in Table 6. Causes that are incidental to preterm birth (for example, a Motor vehicle accident to a preterm infant) are not included. This grouping of preterm-related causes likely 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 establish the etiological connection to prematurity with any degree of certainty. Further details on the development of this cause-of-death grouping are available in related publications (39,40).

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, rates 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 comparing these two files), the rates will often differ for specific variables (particularly for race and ethnicity). Infant mortality rates in the linked file 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 age 1 year as the denominator.

For all variables, not-stated responses were shown in tables of frequencies, but were subtracted 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 an additional decimal for rates per 100,000 live births does not increase precision as it does for rates per 1,000 live births.

As stated previously, infant death records for the 50 states and DC 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 represent complete counts of such events. As such, they are not subject to sampling error, although they are subject to nonsampling error in the registration process. However, when the figures are used for analytic purposes, such as the comparison of rates over time, for different areas or among different subgroups, the number of events that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances (57). 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 (RSE) is usually small. When the number of events is small (perhaps less than 100) and the probability of such an event is small, considerable caution must be observed in interpreting the data. Such infrequent events may be assumed to follow a Poisson probability distribution (3,4). Estimates of RSEs and 95% confidence intervals are shown below.

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

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

where D is the number of deaths, and

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

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.

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

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

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

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

The RSE of the IMR for the example above

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

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

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

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

Thus, for Group A:

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

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

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 less than 100 the confidence interval for the rate can be estimated based on the Poisson distribution using the values in Table III.

$$\text{Lower: IMR} \bullet L(0.95, D_{adj})$$

$$\text{Upper: IMR} \bullet U(0.95, D_{adj}),$$

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

$$D_{adj} = \frac{D \bullet B}{D + B}.$$

$L(0.95, D_{adj})$ and $U(0.95, D_{adj})$ 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.

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

Therefore, the 95% confidence interval (using the formula in Table III for 1–99 infant deaths) is:

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

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

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 determine whether they overlap. If so, the difference is not statistically significant at the 95% level. If they do not overlap, the difference is statistically significant. If both of the rates (R_1 and R_2)to be compared are based on 100 or more deaths, the following z test may be used to define a significance test statistic:

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

Availability of linked file data

Linked file data are available for download at: http://www.cdc.gov/nchs/data_access/VitalStatsOnline.htm. Beginning with 2005, the public-use file no longer includes geographic detail; such files are available upon special request (see http://www.cdc.gov/nchs/nvss/dvs_data_release.htm). Data are also available in issues of Vital and Health Statistics, Series 20, National Vital Statistics Reports, and Data Briefs from http://www.cdc.gov/nchs.

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			

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