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Infant Mortality by Birthweight and Other Characteristics: United States, 1985 Birth Cohort

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U.S. infant mortality is analyzed for the 1985 birth cohort by birthweight, mother's age, prenatal care, and other characteristics. The effect of cohort and period on race-specific infant mortality rates is analyzed. The report also discusses the history of linked birth and infant death files in the Public Health Service and provides a detailed description of the methodology for creating linked files at the National Center for Health Statistics.

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Symbols

- - - Data not available
 - . . . Category not applicable
 - Quantity zero
 - 0.0 Quantity more than zero but less than 0.05
 - * Figure does not meet standard of reliability or precision
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Infant Mortality by Birthweight and Other Characteristics: United States, 1985 Birth Cohort

by Kate Prager, Sc.D.

Introduction

This report presents information from the national linked birth and infant death data set for the birth cohort of 1985, a new National Center for Health Statistics (NCHS) resource for studying infant mortality. In the linked file, birth certificates for infants born in 1985 who died before their first birthday are linked to death certificates for the same infants, thereby making available for analysis of infant mortality a large number of variables from the birth certificate that are relevant to the infant's death. Previous national linked files were developed by the Division of Reproductive Health, Center for Chronic Disease Prevention and Health Promotion (CCDPHP), Centers for Disease Control and Prevention (CDC) for the 1980 birth cohort (1), and by NCHS for the 1960 birth cohort (2).

This report is in four parts:

- The first part includes a brief history of linked birth and infant death record projects in the Public Health Service (PHS) and a description of the methodology by which linked files were created in the present project.
- The second part presents a descriptive analysis of infant mortality for selected variables by race for the 1985 birth cohort.
- The third part examines infant mortality rates for detailed race groups, comparing cohort and period rates.
- The final section provides detailed tables of live births and infant deaths and mortality rates for selected variables by race of child and age at death.

In this report, detailed tables present data for the birth cohort of 1985 for selected infant and maternal characteristics by race of child and age at death for singleton and multiple births combined. The following major demographic and health variables are included: birthweight; gestational age; sex; maternal age; live-birth order; marital status; educational attainment; prenatal care; and detailed race groups, such as American Indian and Alaskan native, Chinese, Japanese, Hawaiian, and Filipino, in addition to white and black. Cause-of-death information from the linked file is not included. The analysis is based on data from the 1985 birth cohort except for the analysis of detailed races, which is based on 3 years of data for the 1983–85 birth cohorts, to achieve more stability among rates for smaller minority race groups. Data are analyzed using percent distributions, birth cohort infant mortality rates, and mortality race ratios.

The analysis of infant mortality using birth cohort data in this report represents a departure from the more commonly used approach to analyzing infant mortality, which is usually in terms of period data. In period infant mortality rates, the numerator of the rate (deaths of infants under 1 year of age) and the denominator (live births) represent events that occur in the same period, or calendar year. In contrast, in birth cohort infant mortality rates, the numerator is comprised of deaths in the first year of life that occur in the year of birth or the following year to infants born in a specified calendar year; and the denominator is comprised of all live born infants in the specified year. Thus, the denominators for both the 1985 period and 1985 birth cohort rates are the same, all infants born alive in 1985. However the numerator for the period rate is comprised of infant deaths that occurred in 1985; whereas, the numerator for the birth cohort rate is comprised of infant deaths that occurred in 1985 and 1986 to infants who were born in 1985.

Birth cohort data in which the death record for the infant that died is linked to the birth record for the same infant present a special opportunity to measure race differentials in infant mortality more accurately than is possible with period data. The advantage of linked data for race-specific infant mortality rates derives in part from the consistent source of race information, the birth certificate, for both the numerator and denominator of the rate. The race variable for infant deaths in the numerator comes from the birth certificate that is linked to the infant's death certificate and is therefore consistent with the source of the race variable for live births in the denominator. In contrast, for period rates, race information for

NOTE: This report was prepared in the Division of Vital Statistics, under the general direction of Harry M. Rosenberg, Ph.D., Chief, Mortality Statistics Branch. The author gratefully acknowledges the assistance of the following people: The linked birth and infant death data system was designed and programmed by David P. Johnson of the Systems and Programming Branch. The detailed tables were programmed by David P. Johnson and Gail Parr. Consultation to State vital statistical offices regarding collection of linked birth and infant death data on which this report is based was provided by Wilma Latta of the Technical Services Branch. Content review was provided by Thomas D. Dunn of the Statistical Resources Branch. The report was edited by Gail V. Johnson and typeset by Annette F. Facemire of the Publications Branch, Division of Data Services. Appreciation is expressed to John E. Patterson, former Director of the Division of Vital Statistics, for his support of the Linked Birth and Infant Death project and for his helpful suggestions on the report.

the denominator comes from the birth certificate, whereas race information for the numerator comes from a different source document—the infant’s death certificate. Especially for smaller minority races, some inconsistencies in reporting race on the birth and death certificates may lead to understated period infant mortality rates for these groups.

Furthermore, the reporting of race information on the birth certificate is more accurate than on the death certificate (3). Accuracy of race reporting is better because on the birth certificate, race of each parent is usually reported by the mother at the time of delivery, whereas on the death certifi-

cate, race of the deceased infant is reported by the funeral director based on information provided by an informant or on observation.

The linked record data sets for the 1983–85 birth cohorts resulted from a joint endeavor of NCHS, the States, and the Association of Vital Records and Health Statistics (AVRHS). Their development was supported with evaluation funds provided by the Assistant Secretary for Planning and Evaluation (ASPE), U.S. Department of Health and Human Services (DHHS).

Highlights

This report presents statistical results from the national linked birth and infant death data set for the birth cohort of 1985, a new NCHS resource for studying infant mortality. The report reviews the history and background of linked files in the PHS and describes the methodology by which linked files were created at NCHS. The linked file is comprised of birth certificates for the cohort of infants born in 1985 who died before their first birthday linked to death certificates for the same infants. An advantage of using the linked file to analyze infant mortality is the availability of a large number of variables from the birth certificate that are relevant to the infant's death. In addition, race-specific infant mortality rates based on the linked file are more accurate, especially for smaller race groups, than period infant mortality rates published in *Vital Statistics of the United States, Volume II, Mortality*.

For infants born in 1985, the cohort infant mortality rate was 10.4 deaths per 1,000 live births. Mortality before the end of the first year of life was strongly and inversely associated with the infant's weight at birth, that is, infants of low birthweight were at much higher risk of death than heavier babies. Except at lower birthweights, black infants had higher mortality than white infants. Infant mortality also decreased markedly with increasing gestational age, with mortality higher for black than white infants, except among preterm births. Male infants had higher mortality than female infants.

Maternal age was associated with infant mortality. The youngest and oldest mothers had higher infant mortality rates

than mothers of intermediate ages. Infant mortality was lowest for first- and second-order births and increased for higher-order births. Out-of-wedlock childbearing was associated with elevated risk of infant death with a more pronounced effect among white than black mothers.

Educational attainment of mother was inversely correlated with infant mortality. Rates for college graduates were less than half those for women who completed fewer than 8 years of school. While the absence of prenatal care was associated with high neonatal and postneonatal mortality, only postneonatal mortality was directly related to trimester prenatal care began.

Race-specific cohort infant mortality rates based on the national linked data set are more precise than period rates based on routinely available vital statistics data, especially for smaller race groups, because race information for both the numerator (infant deaths) and denominator (live births) of cohort rates is from the same source document, the birth certificate; and race is more accurately reported on the birth than death certificate. In contrast, race information for period rates is from two different source documents, the death certificate for the numerator and the birth certificate for the denominator. Based on linked file data for the birth cohorts of 1983-85 combined, cohort infant mortality rates for the white population were about 3 percent lower and for the black population 2 percent higher than period rates. Cohort infant mortality rates for other minority races ranged from 19 to 80 percent higher than period rates.

History of national linked files in the Public Health Service

NCHS undertook its first major effort to create a national file of linked birth and infant death records for the birth cohort of 1960 (2). The file was constructed by collecting actual copies of linked birth and death certificates from each of the 50 States and preparing punched cards for each pair of certificates. Of the nearly 110,000 infant deaths to the 1960 birth cohort, certificates for 97.4 percent were matched to the corresponding live birth certificates. The infant mortality rate based on the 1960 birth cohort linked file was 25.1 per 1,000 live births.

The next national file was created for the birth cohort of 1980 by the Division of Reproductive Health, CCDPHP, CDC, in a project called National Infant Mortality Surveillance (NIMS) (1). NIMS provided not only valuable data but also the occasion for an important forum, the NIMS Conference, held on May 1, 1986, in Atlanta, Georgia. This conference brought together for the first time representatives from State maternal and child health programs and State vital statistics offices to exchange information on data needed to monitor the effectiveness and efficiency of maternal and child health programs.

In 1985, NCHS initiated a two-stage evaluation project to determine the feasibility of creating linked birth and infant death files on a routine, annual basis as part of the Vital

Statistics Cooperative Program (VSCP) of NCHS and the States. In stage 1, a linked file was produced with a match rate of 96.7 percent for the 1982 birth cohort of infant deaths that occurred in a nine-State area (4). Stage 1 demonstrated both the feasibility of using a new methodology for creating the linked file on a routine basis, as well as the importance of followup to link birth and death certificates that were not linked initially. Followup linking not only increased the overall match rate but also reduced geographic and demographic biases in the linked file before followup.

In stage 2 of the evaluation project, State and national linked files for each of the birth cohorts of 1983-86 were formally evaluated at two evaluation meetings. In March 1988, at the first evaluation meeting in San Diego, California, quality and completeness of the 1983 birth cohort national linked file were evaluated, and a variety of technical and methodological issues were considered. In addition, State linking and registration procedures that contributed to more complete and high quality State and national linked files were identified. In November 1989, at the second evaluation meeting in Houston, Texas, trends in quality and completeness of linked files were evaluated (5). The meeting also focused on use and interpretation of linked data at the State and national levels.

Methods

The national file of linked birth and infant death records was created in two stages. First, State vital statistics offices provided NCHS with certificate numbers from State linked files that identified linked birth and death records for deceased infants. With these identifying certificate numbers, NCHS created an initial file by accessing records identified by the State-provided certificate numbers in the NCHS natality and mortality statistical files. Second, a final file was processed in which additional records linked during followup added to the initial file.

Thus, the national linked birth and infant death file was created by taking advantage of two existing data sources that will be described in detail.

1. State linked files that provide certificate numbers to identify linked birth and death certificates for deceased infants;
2. NCHS natality and mortality statistical files that provide coded information from birth and death certificates.

Virtually all States routinely link death certificates for infants to birth certificates corresponding to the same infants for legal and statistical purposes. Most States, therefore, can fairly readily generate files of linked birth and death events for infants, particularly when both the birth and infant death occur in the same State. When the birth and death of an infant occur in different States, linking the two certificates that are filed in different jurisdictions requires State vital statistics offices to cooperate in the exchange of vital records. In accordance with the terms of the "Association for Vital Records and Health Statistics Agreement for Administering the Vital Records Exchange System," copies of vital records are exchanged by the State of death and State of birth to effect a link. In addition, if a third State is identified as the State of residence at the time of birth or death, that State is also sent a copy of the appropriate certificate by the State where the birth or death occurred. These existing State linked files greatly facilitated the development of national linked files.

The NCHS statistical files include data from birth and death certificates provided to NCHS by States under the VSCP. The data have been coded according to uniform coding specifications, have met NCHS quality control standards, have been edited and reviewed, and are the basis for official U.S. natality and mortality statistics (6). The NCHS statistical files are the source of live birth and infant death computer records from which the national linked file is created. For the 1985 birth cohort linked file, statistical records of live births that occurred in 1985 in the United States were linked to statistical

records of deaths to these same infants who died in 1985 or 1986 before their first birthday.

Initial linked file

To create the initial file, NCHS obtained linked files on magnetic tape from those States that had them and extracted only birth and death certificate numbers for linked records and State and year of occurrence. Five States without computerized linked files—Alaska, Arizona, Delaware, Indiana, and Nevada—posted certificate numbers for linking birth certificates on a computer-generated list of infant death certificate numbers that was produced by NCHS. Using certificate numbers provided by the States, NCHS selected and linked birth and death records from NCHS natality and mortality statistical files and created a single statistical record containing coded information from two previously separate records. These new statistical records comprised the initial national file of linked birth and infant death records.

Followup to link unlinked records

NCHS then followed up with State vital statistics offices to link infant death certificates not linked in the initial file; and to review linked records with inconsistent data. To link unlinked death certificates, NCHS returned copies or computer lists of unlinked infant death certificates to States of death. If the birth occurred in a State different from the State of death, the State of birth identified on the death certificate was contacted to obtain the linked birth certificate. Some records in State linked files were not linked in the NCHS initial file because the birth record had been renumbered or had been filed in the State after NCHS closed its statistical files. If the linked birth certificate from another State had been renumbered, the State of death requested the original certificate number from the State of birth. If the linked birth certificate had been filed after NCHS closed its statistical files, the State provided NCHS with a copy of the late-filed birth certificate so it could be added to the linked file data set.

Followup to review accuracy of linking

Linked records with inconsistent data were reviewed to ensure that the birth and death records were linked correctly. Accuracy of linking was determined by measuring consistency between the following four statistical items common to both

the birth and death records: date of birth, sex, State of birth, and race. A list of linked records failing the consistency check as well as unlinked death records were returned to States for review. In the 1985 initial file, of the 707 records that failed the consistency check, 91 were found to be mismatched and were corrected.

Final linked file

Upon the completion of followup, NCHS processed the linked file by correcting linked records that were mismatched in the initial file and by adding late-filed birth certificates to the linked file data set. Certificates that were added to the data set were coded, keyed, and processed before they were added to the denominator or birth cohort file. Then they were linked to infant death records and added to the numerator or linked file. The addition of late-filed birth records to the linked file data set results in a denominator file that is not identical to the NCHS natality statistical file.

Birth cohort

A birth cohort of infant deaths is comprised of deaths under 1 year of age that occur in the year of birth or the following year to infants born in a specified calendar year. The 1985 birth cohort national linked birth and infant death data set includes all infants born in 1985 in the United States who died in 1985 or 1986 (also in the United States) before their first birthday.

Residence

While the national linked file includes linked statistical records for births and deaths that occurred in the United States to U.S. residents and nonresidents, with one exception, only data for U.S. residents are analyzed and presented in this report. The one exception is the analysis of file completeness, which is based on all infant death occurrences, as shown in table A.

Table A. Live births and infant deaths to the birth cohort and infant death records linked and not linked, by race and age at death: United States, 1983-85 birth cohorts

Linked status of infant death records	Birth cohort		
	1983	1984	1985
	Number		
Live births	3,643,001	3,673,693	3,765,336
Infant deaths	40,349	39,167	39,943
Linked	39,704	38,314	39,170
Not linked	645	853	773
	Percent		
Linked	98.4	97.8	98.1
White	98.5	98.0	98.2
Black	98.0	97.5	97.8
Neonatal	98.2	97.9	98.1
Postneonatal	98.6	97.7	98.0
Not linked	1.6	2.2	1.9

NOTE: Includes live births and infant deaths that occurred in the United States, regardless of residence.

Residence is determined by the mother's usual place of residence at the time of the infant's birth. Excluded from the linked file are deaths that occurred outside the United States to infants born in the United States, deaths that occurred in the United States to foreign-born infants, and births and deaths that occurred outside the United States to U.S. residents.

File completeness

File completeness is based on the percent of records for infant deaths to the birth cohort that were linked to birth records for the same infants. The percent is based on all infant deaths to the birth cohort that occurred in the United States, regardless of residence at birth, because birth residence is unknown for unlinked infant death records. Deaths to infants known to be born outside the United States are not included in the calculation of percent linked.

The percent of infant death records linked with their corresponding birth records was 98.1 percent for the 1985 birth cohort (table A). A slightly larger percent was linked for white than black infants, 98.2 and 97.8 percent, respectively. The difference in percent linked for neonatal and postneonatal deaths was very small, 98.1 and 98.0 percent, respectively. Because the analysis is based on linked infant death records and does not include unlinked records for infant deaths, rates are understated by 1.9 percent, on the average.

Unlinked infant death records

In the 1985 birth cohort, 773 records for infant deaths were not linked (table A). Deaths to foreign-born infants were not counted among the not linked, regardless of mother's country of residence. An analysis of the characteristics of unlinked records revealed that distributions by race and age at death were similar to those of linked records; but that a larger proportion of the unlinked compared with the linked records represented events in which the birth and death occurred in different States.

Infant mortality rates

Infant mortality rates in this report are calculated by dividing the number of infant deaths to the birth cohort by the number of live births in that cohort. Such measures are called "cohort" infant mortality rates.

In contrast, "period" rates published annually in *Vital Statistics of the United States, Volume II, Mortality* are calculated by relating the aggregate number of infant deaths in a calendar year to the number of live births in the same year. Period rates approximate the risk of infant death in populations in which the number of births is not changing rapidly from year to year (7,8). Because period mortality rates are based on natality and mortality data from a single calendar year, they can be produced on a more timely basis than cohort rates.

Cohort rates more accurately measure infant mortality risk than period rates because the denominator includes the total population of infants at risk; every child whose death is counted in the numerator is also included in the denominator. Cohort rates are also more accurate than period rates because

information for both the numerator and denominator comes from the same source record, the birth certificate; and race is better reported on the birth than death certificate. Thus, cohort rates are not subject to inconsistencies between the numerator and denominator that can affect period rates.

Results

A total of 3,760,833 U.S. resident infants were born in 1985. (NOTE: NCHS previously published a total of 3,760,561 infants born in 1985 in the United States (9). In creating the national birth cohort linked data set, birth records were added for infants registered after the NCHS natality statistics file was closed—see Methods section.) Of the infants born in 1985, 39,145 died before their first birthday, resulting in an infant mortality rate for the 1985 birth cohort of 10.4 infant deaths per 1,000 live births. This was the same rate as for the 1984 birth cohort and 5 percent below the rate of 10.9 for the 1983 birth cohort. For white infants born in 1985, the rate was 8.9 compared with a rate of 18.3 for black infants. For the birth cohorts of 1983 and 1984, rates for white infants were 9.3 and 8.9, and for black infants, 18.9 and 17.9, respectively.

The 1985 birth cohort infant mortality rate of 10.4 deaths per 1,000 live births compares with a period infant mortality rate of 10.6 in 1985, reflecting infant deaths and live births occurring in the same calendar year. The cohort rate is 1.9 percent less than the period rate, corresponding to 1.9 percent of the infant deaths to the cohort that were not linked.

Birthweight

For the 1985 birth cohort, 93.2 percent of all live births and 38.9 percent of all infant deaths were of normal birth-

weight (weighing at least 2,500 grams or 5 pounds 8 ounces at birth) (table B). In contrast, low birthweight babies (weighing less than 2,500 grams at birth) comprised only 6.8 percent of all live births but 61.1 percent of all infant deaths. Thus, the majority of infant deaths occurred to a very small proportion of all live births, those weighing less than 2,500 grams at birth. While comprising only 1.2 percent of all live births, infants of very low birthweight (weighing less than 1,500 grams or 3 pounds 4 ounces at birth) accounted for almost one-half, 45.8 percent, of the infant deaths. Among white infants, low birthweight characterized 5.6 percent of the births and 57.9 percent of the deaths; and among black infants, low birthweight characterized 12.4 percent of the births and 69.4 percent of the deaths.

The percent distribution of all live births by birthweight is unimodal, with a peak at 3,000–3,499 grams or 6 pounds 10 ounces–7 pounds 11 ounces for all races combined as well as for the two major race groups, white and black (figure 1). For black infants the birthweight distribution is shifted toward lower birthweights than the corresponding distribution for white infants, illustrating the higher percent of low birthweight births among the black than white population.

In contrast, the distribution of infant deaths by birthweight is bimodal, with a primary peak at birthweights of

Table B. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to birthweight; and mortality race ratios by birthweight: United States, 1985 birth cohort

Birthweight	Live births			Infant deaths			Infant mortality			Race ratio black:white
	All races	White	Black	All races	White	Black	All races	White	Black	
	Percent distribution						Rate per 1,000 live births			
All birthweights	100.0	100.0	100.0	100.0	100.0	100.0	10.4	8.9	18.3	2.06
Less than 2,500 grams	6.8	5.6	12.4	61.1	57.9	69.4	94.5	91.5	102.7	1.12
Less than 500 grams	0.1	0.1	0.3	11.4	9.5	16.2	896.9	900.3	890.7	0.99
500–999 grams	0.5	0.4	1.1	25.8	23.6	31.8	561.5	582.7	526.7	0.90
1,000–1,499 grams	0.6	0.5	1.2	8.6	9.1	7.5	145.5	162.1	110.0	0.68
1,500–1,999 grams	1.3	1.1	2.4	6.7	7.0	6.0	53.9	57.8	45.3	0.78
2,000–2,499 grams	4.2	3.6	7.4	8.5	8.8	7.8	20.8	21.4	19.3	0.90
2,500 grams or more	93.2	94.4	87.6	38.9	42.1	30.6	4.3	3.9	6.3	1.62
2,500–2,999 grams	15.9	14.1	23.6	12.0	12.2	11.4	7.8	7.6	8.7	1.14
3,000–3,499 grams	36.7	36.1	38.3	15.1	16.2	12.0	4.2	3.9	5.6	1.44
3,500–3,999 grams	29.6	31.7	20.3	8.4	9.6	5.2	2.9	2.7	4.6	1.70
4,000–4,499 grams	9.2	10.3	4.5	2.5	3.0	1.3	2.8	2.6	5.4	2.08
4,500–4,999 grams	1.7	1.9	0.7	0.6	0.7	0.3	3.8	3.4	8.1	2.38
5,000 grams or more	0.2	0.2	0.1	0.3	0.3	0.3	14.8	11.5	56.5	4.91

NOTE: Figures may not add to total due to rounding.

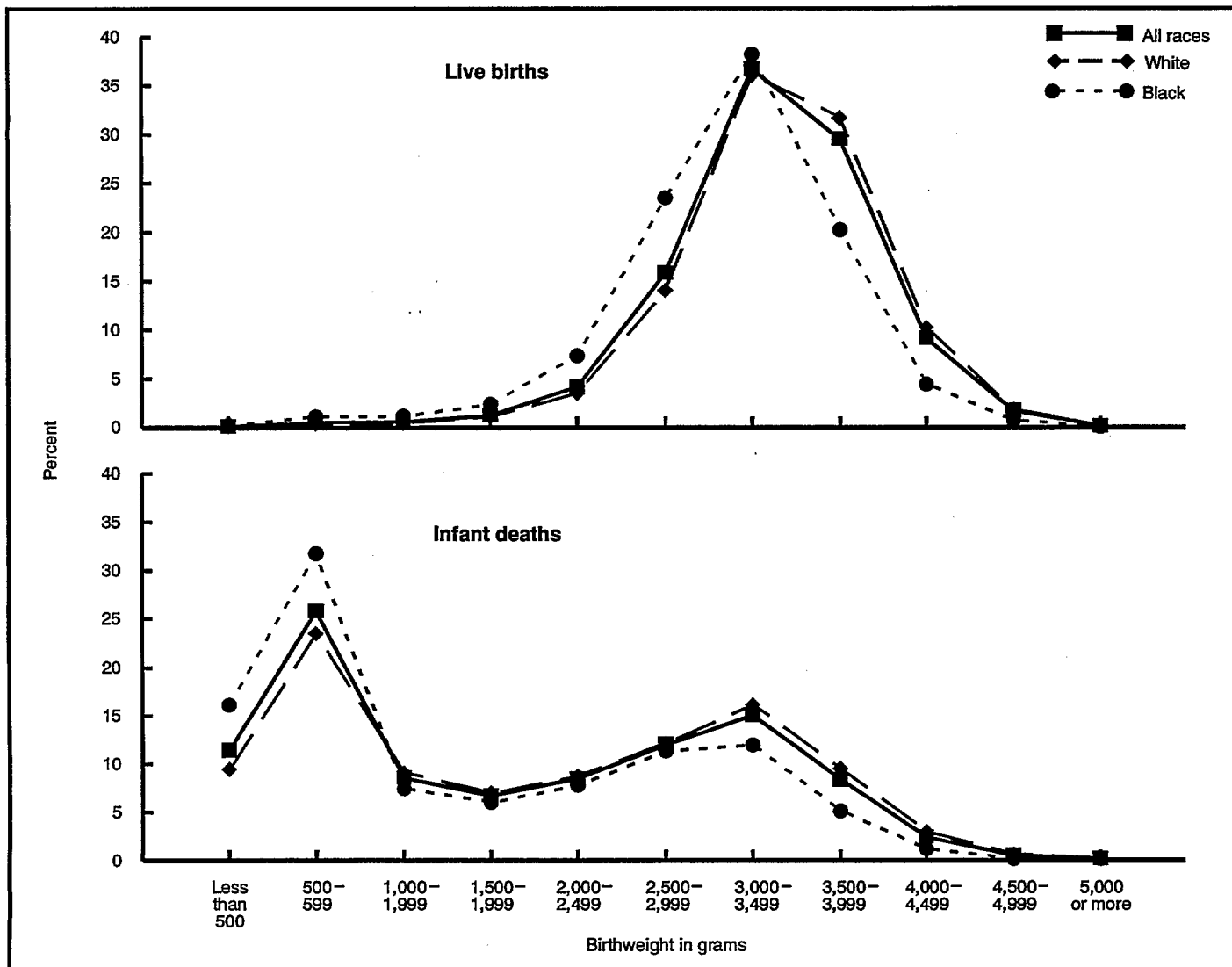


Figure 1. Percent distribution of live births and infant deaths by birthweight and race: United States, 1985 birth cohort

500–999 grams or 1 pound 2 ounces–2 pounds 3 ounces and a secondary peak at 3,000–3,499 grams, the latter peak corresponding to the peak in the live birth distribution (figure 1). A larger proportion of black deaths than white deaths were to infants weighing less than 1,500 grams, 55.5 and 42.2 percent, respectively.

As age at death increases, the birthweight distribution of the deaths shifts from the lower peak at 500–999 grams to the higher peak at 3,000–3,499 grams (figure 2). Deaths in the early neonatal period, 0–6 days, are concentrated in the lower peak; deaths in the postneonatal period, 28 days–11 months, are concentrated in the higher peak; and late neonatal deaths in the intermediate period, 7–27 days, are distributed between both peaks.

Birthweight-specific infant mortality

Infant mortality rates are inversely related to birthweight, that is, rates decrease as birthweight increases, up to 4,500 grams or 9 pounds 14 ounces for infants of all races combined (figure 3 and table B). At birthweights greater than 4,500

grams, rates increase somewhat. For the 1985 birth cohort for all races combined, the mortality rate for infants of low birthweight (less than 2,500 grams or 5 pounds 8 ounces) was 94.5 deaths per 1,000 live births, 22 times the rate of 4.3 for normal weight infants (2,500 grams or more). The rate for infants of very low birthweight (less than 1,500 grams or 3 pounds 4 ounces) was 390.0 per 1,000 (rate computed from data in table 1), 90 times the rate for normal weight infants. The lowest infant mortality rate for all races combined was 2.8 deaths per 1,000 infants weighing 4,000–4,499 grams or 8 pounds 14 ounces–9 pounds 14 ounces at birth.

Mortality among black infants, 18.3 deaths per 1,000 live births, was more than two times that of white infants, 8.9, as indicated by a mortality race ratio (ratio of black to white infant mortality rates) of 2.06 (table B). However, at birthweights below 2,500 grams where the risk of death is greater, mortality race ratios of less than 1.00 indicate that black infants have a mortality advantage relative to white infants. For example, at birthweights of 1,000–1,499 grams, mortality for black infants (110.2 infant deaths per 1,000 live births) was 32 percent lower than that for white infants (162.1). The

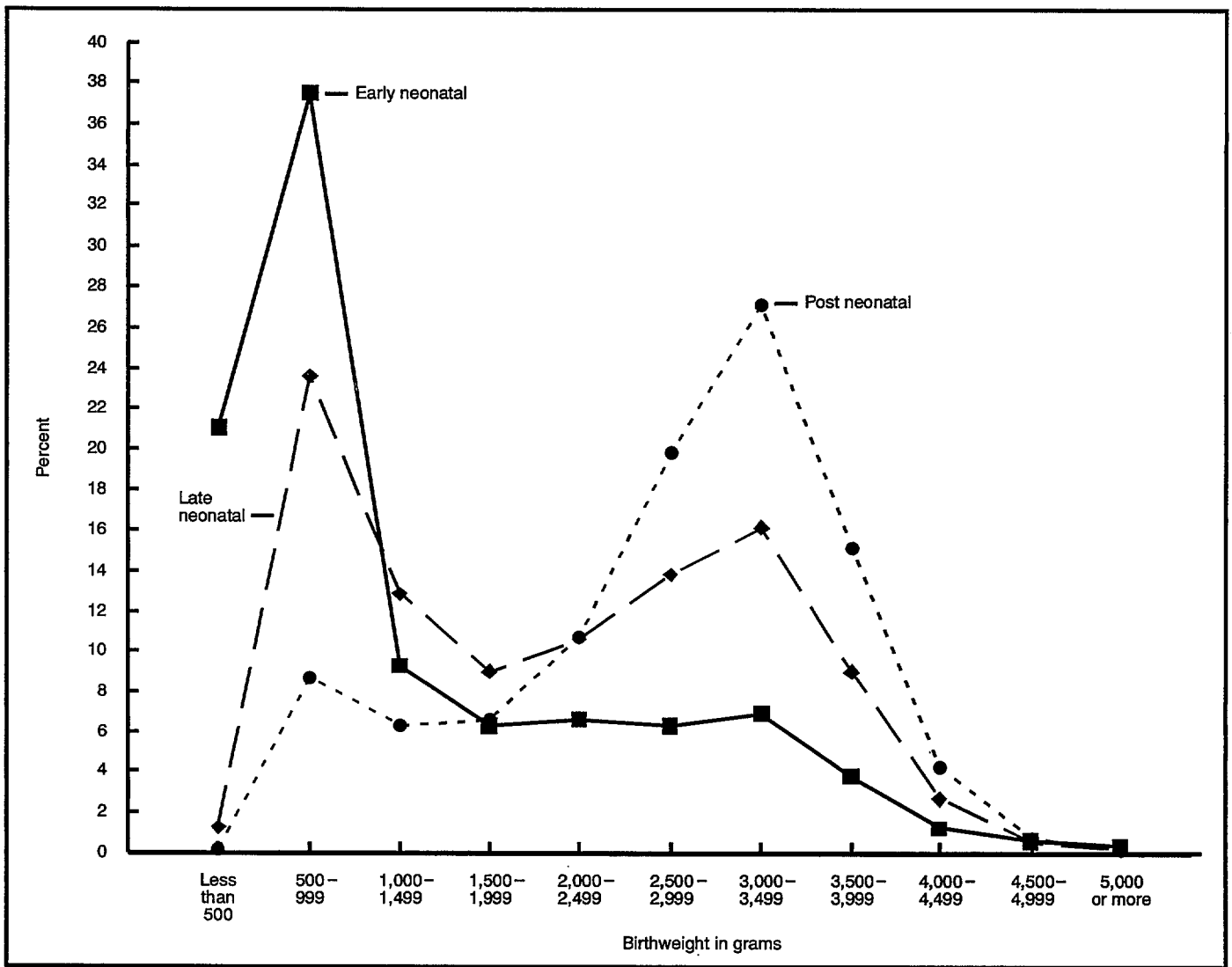


Figure 2. Percent distribution of infant deaths by birthweight and age at death: United States, 1985 birth cohort

mortality differential by race narrowed from 0.68 to 0.90 as the corresponding birthweights increased from 1,000–1,499 to 2,000–2,499 grams, respectively.

At birthweights of 2,500 grams and over where the risk of death is lower, mortality rate ratios of greater than 1.00 indicate that black infants had a mortality disadvantage relative to white infants that steadily increased as birthweight increased (table B). A mortality rate ratio of 1.14 for infants weighing 2,500–2,999 grams or 5 pounds 9 ounces–6 pounds 9 ounces indicates that mortality was 14 percent greater among black than white infants. The mortality rate ratio increases to a maximum of 4.91 for infants weighing 5,000 grams or 11 pounds 1 ounce or more.

The foregoing analysis of birthweight-specific infant mortality does not take into account that live births to the white population and live births to the black population have unique birthweight distributions and mean birthweights specific for the race (see figure 1 and table B). In another type of analysis pioneered by Wilcox and Russell (10), the population mean birthweight is assumed to be an important parameter when comparing infant mortality between races. In the Wilcox and

Russell model, infant mortality for the black race and white race is compared for babies whose weight at birth deviates from the population mean birthweight by standard amounts called standard deviations from the mean. In contrast, in the previous analysis, birthweight-specific infant mortality rates were compared for black infants and white infants of the same absolute birthweight and showed a relative survival advantage for black infants weighing less than 2,500 grams at birth. According to Wilcox and Russell, when birthweight distributions are standardized, the relative survival advantage of lower birthweight black infants disappears.

Gestational age

In the 1985 birth cohort, 90.2 percent of all live births and 42.3 percent of all infant deaths were full term, that is, born at 37 or more completed weeks of gestation (table C). In contrast, preterm babies (born before 37 weeks of gestation) comprised only 9.8 percent of all live births but 57.7 percent of all infant deaths. Thus, the majority of infant deaths occurred to a small proportion of all live births, namely, those born preterm.

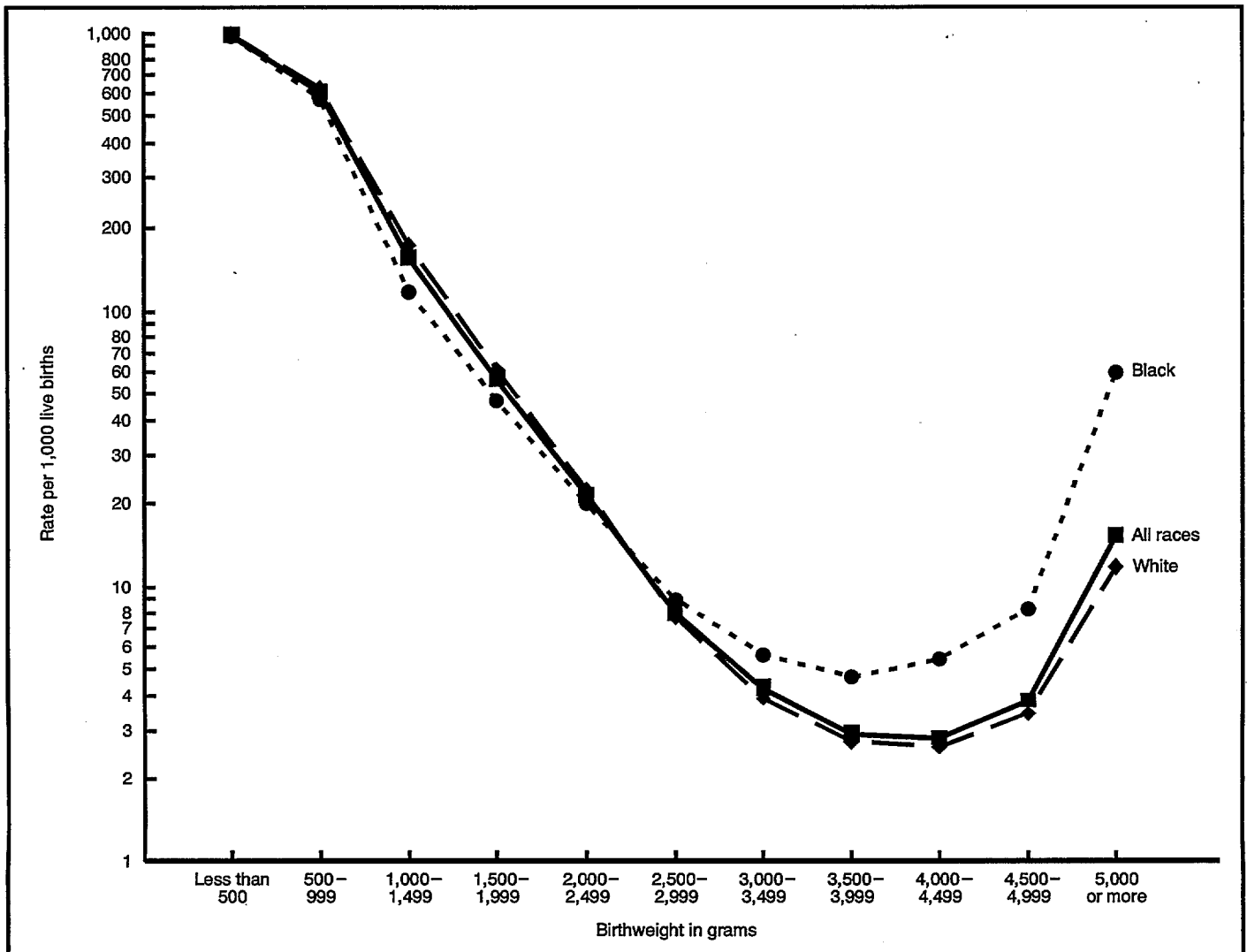


Figure 3. Infant mortality rates by birthweight and race of child: United States, 1985 birth cohort

The proportion of preterm live births and infant deaths differed for the two major race groups. More than twice the proportion of black births (17.6 percent) as white births (8.2 percent) was preterm. The proportion preterm among infant deaths was also larger for the black than the white population, 66.2 percent compared with 54.6 percent, respectively.

Preterm birth was associated with a higher risk of death than full-term birth. Infant mortality rates were inversely related to gestational age, that is, rates decreased as gestational age increased, up to 40 weeks gestation for infants of all races combined (table C and figure 4). For infants of gestations longer than 41 weeks, mortality increased somewhat. For the 1985 birth cohort for all races combined, mortality decreased steadily from 435.4 infant deaths per 1,000 preterm births of less than 28 weeks to 4.1 for infants of 40 and 41 weeks gestation.

Although mortality among black infants was more than twice that among white infants for babies born prior to 36 completed weeks of gestation, mortality rates for black infants were lower than for white infants as indicated by mortality race ratios of less than 1.00 (table C). Thus, at short gestations

where the risk of death was higher, black infants had a mortality advantage relative to white infants. For example, at gestational ages of 28–31 weeks, the mortality race ratio of 0.72 indicates that mortality for black infants (75.0 deaths per 1,000 live births) was nearly 30 percent less than the corresponding rate for white infants (104.2).

At gestations of at least 36 completed weeks where the risk of death was lower, mortality race ratios greater than 1.00 indicate that black infants have a mortality disadvantage relative to white infants. For example, a mortality race ratio of 1.97 for infants born after 40 completed weeks of gestation indicates that mortality for black infants (7.1 deaths per 1,000 live births) was nearly twice that for white infants (3.6).

Sex

In the 1985 birth cohort, the sex ratio was 1,052 males per 1,000 females, 1,056 for the white population and 1,030 for the black population (table D). The sex ratio for infant deaths of all races combined was considerably higher than that for live births, 1,347; the ratio was 1,394 and 1,237 for the white

Table C. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to gestational age; and mortality race ratios by gestational age: United States, 1985 birth cohort

Gestational age	Live births			Infant deaths			Infant mortality			Race ratio black:white
	All races	White	Black	All races	White	Black	All races	White	Black	
	Percent distribution						Rate per 1,000 live births			
All births	100.0	100.0	100.0	100.0	100.0	100.0	10.4	8.9	18.3	2.06
Less than 28 weeks	0.8	0.6	2.0	33.8	30.0	43.8	435.4	455.4	408.2	0.90
28-31 weeks	1.1	0.9	2.4	10.1	10.2	9.9	93.5	104.2	75.0	0.72
32-35 weeks	4.7	3.9	8.4	10.1	10.5	9.0	22.6	24.0	19.7	0.82
36 weeks	3.2	2.9	4.8	3.7	3.8	3.5	11.9	11.6	13.1	1.13
37-39 weeks	38.7	37.9	41.4	20.1	21.2	17.1	5.4	5.0	7.5	1.50
40 weeks	22.1	22.9	17.9	8.6	9.2	7.0	4.1	3.6	7.1	1.97
41 weeks	15.2	16.2	11.0	6.0	6.7	4.3	4.1	3.7	7.1	1.92
42 weeks and over	14.2	14.7	12.1	7.5	8.3	5.5	5.5	5.0	8.4	1.68

NOTE: Figures may not add to total due to rounding.

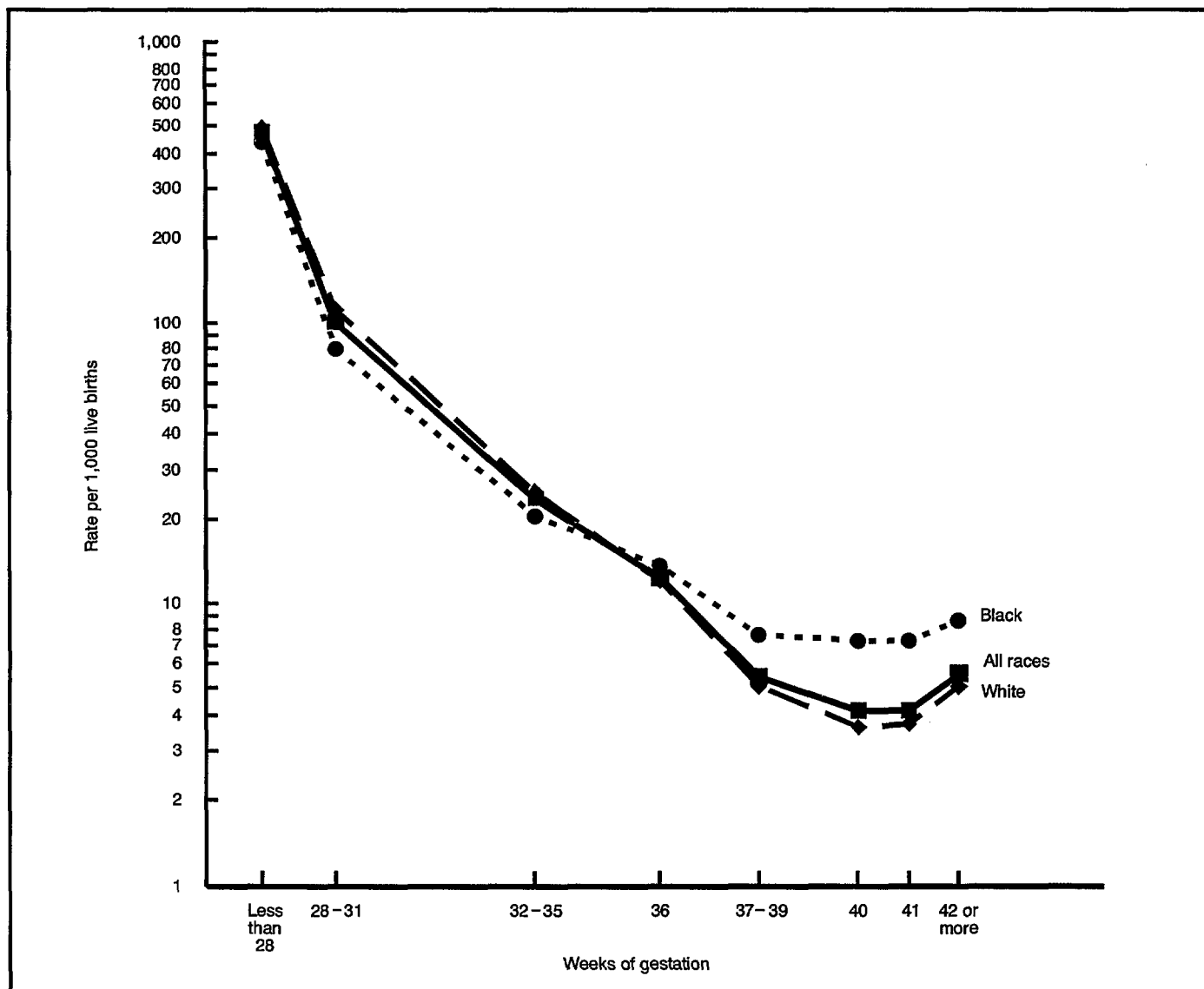


Figure 4. Infant mortality rates by gestational age and race of child: United States, 1985 birth cohort

and black populations, respectively. Infant mortality rates were consistently higher for males than females, as indicated by mortality sex ratios greater than 1.00 (table D). For all races

combined, rates for males (11.7 infant deaths per 1,000 live births) were 29 percent higher than rates for females (9.1). For the white and black populations, infant mortality rates for

Table D. Sex ratios for live births and infant deaths by race and age at death, infant mortality rates by race and sex, and sex ratios of infant mortality rates by race: United States, 1985 birth cohort

<i>Age and sex</i>	<i>All races</i>	<i>White</i>	<i>Black</i>
Males per 1,000 females			
Live births	1,052	1,056	1,030
Infant deaths	1,347	1,394	1,237
Neonatal	1,331	1,369	1,242
Postneonatal	1,377	1,443	1,229
Deaths per 1,000 live births			
Both sexes	10.4	8.9	18.3
Male	11.7	10.1	20.0
Female	9.1	7.6	16.6
Ratio of infant mortality rates			
Male:female	1.29	1.33	1.20

males exceeded those for females by 33 and 20 percent, respectively.

Maternal age

In the 1985 birth cohort, the distributions of live births and infant deaths by maternal age were similar. However, mothers whose babies died in the first year of life tended to be younger than all mothers giving birth in 1985 (table E). While over one-half (51.3 percent) of the infant deaths were to mothers under 25 years of age, only 43.0 percent of all births were to mothers of that age.

The youngest and oldest mothers showed the highest risk of infant mortality while mothers in the age groups 25–29 and 30–34 years showed the lowest risk. Infant mortality rates for the birth cohort of 1985 for all races combined decreased as mother's age increased to 30–34 years. Rates increased for infants of mothers age 35 years and over (table E and figure 5). For mothers under 15 years, the rate was 22.0 deaths per 1,000 live births, decreasing to a low of 8.6 for mothers 30–34 years and increasing for older mothers to a high of 23.2 for mothers 45–49 years.

The same U-shaped pattern of infant mortality by maternal age applied to both white and black mothers. But black mothers were more likely than white mothers to experience infant death as indicated by mortality race ratios that exceeded 1.00 at every age (table E and figure 5). The differential in infant mortality by race was greatest for the low risk maternal age groups of 25–29 and 30–34 years, as indicated by mortality race ratios of 2.31 and 2.29, respectively.

Live-birth order

In the 1985 birth cohort, the distributions of live births and infant deaths by live-birth order were similar. Three-fourths (74.8 percent) of all live births and 71.1 percent of all infant deaths were first- or second-order births (table F). Infant mortality experienced by mothers of all ages and races combined was lowest for first- and second-order births, 10.0 and 9.8 deaths per 1,000 live births, respectively, and increased to 10.9 and 13.6 for third- and fourth- and higher-order births, respectively (table F and figure 6).

Mortality patterns by live-birth order differed substantially for mothers of different ages. At younger ages, risks increased with birth order while at older ages, risks showed a U-shaped pattern of association with live-birth order. For example, among the youngest mothers, those under 20 years of age, mortality increased steeply with increasing live-birth order. Mortality among fourth- and higher-order births (33.0 infant deaths per 1,000 live births) was 2.5 times that among first-order births (13.2). Among mothers in the prime child-bearing ages of 20–34 years, mortality for first-order births (8.9 deaths per 1,000) did not differ substantially from mortality for second-order births (9.0). Mortality increased to 14.0 infant deaths per 1,000 live births for fourth- and higher-order births (table F and figure 6). Among older mothers 35–49 years, mortality for first-order births (11.4 infant deaths per 1,000 live births) was elevated relative to second- and third-order births (8.9 and 9.5, respectively) and similar to that for fourth- and higher-order births (11.5).

At every live-birth order, infant mortality for black mothers was twice that for white mothers (table F). For high risk

Table E. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to mother's age; and mortality race ratios by mother's age: United States, 1985 birth cohort

<i>Mother's age</i>	<i>Live births</i>			<i>Infant deaths</i>			<i>Infant mortality</i>			<i>Race ratio black:white</i>
	<i>All races</i>	<i>White</i>	<i>Black</i>	<i>All races</i>	<i>White</i>	<i>Black</i>	<i>All races</i>	<i>White</i>	<i>Black</i>	
	Percent distribution						Rate per 1,000 live births			
All ages	100.0	100.0	100.0	100.0	100.0	100.0	10.4	8.9	18.3	2.06
Under 20 years	12.7	10.8	23.0	18.5	16.0	25.1	15.1	13.1	19.9	1.52
Under 15 years	0.3	0.1	1.0	0.6	0.3	1.2	22.0	20.7	23.7	1.14
15–19 years	12.4	10.7	22.1	17.9	15.6	23.8	15.0	13.0	19.7	1.52
20–24 years	30.3	29.9	34.1	32.8	32.5	34.1	11.3	9.6	18.3	1.91
25–29 years	31.9	33.3	25.0	27.0	28.4	23.7	8.8	7.5	17.3	2.31
30–34 years	18.5	19.4	12.8	15.3	16.5	12.0	8.6	7.5	17.2	2.29
35–39 years	5.7	5.8	4.3	5.4	5.7	4.3	9.9	8.8	18.4	2.09
40–44 years	0.8	0.7	0.6	0.9	0.9	0.7	12.4	10.8	19.8	1.83
45–49 years	0.0	0.0	0.0	0.1	*	*	23.2	*	*	*

NOTE: Figures may not add to total due to rounding.

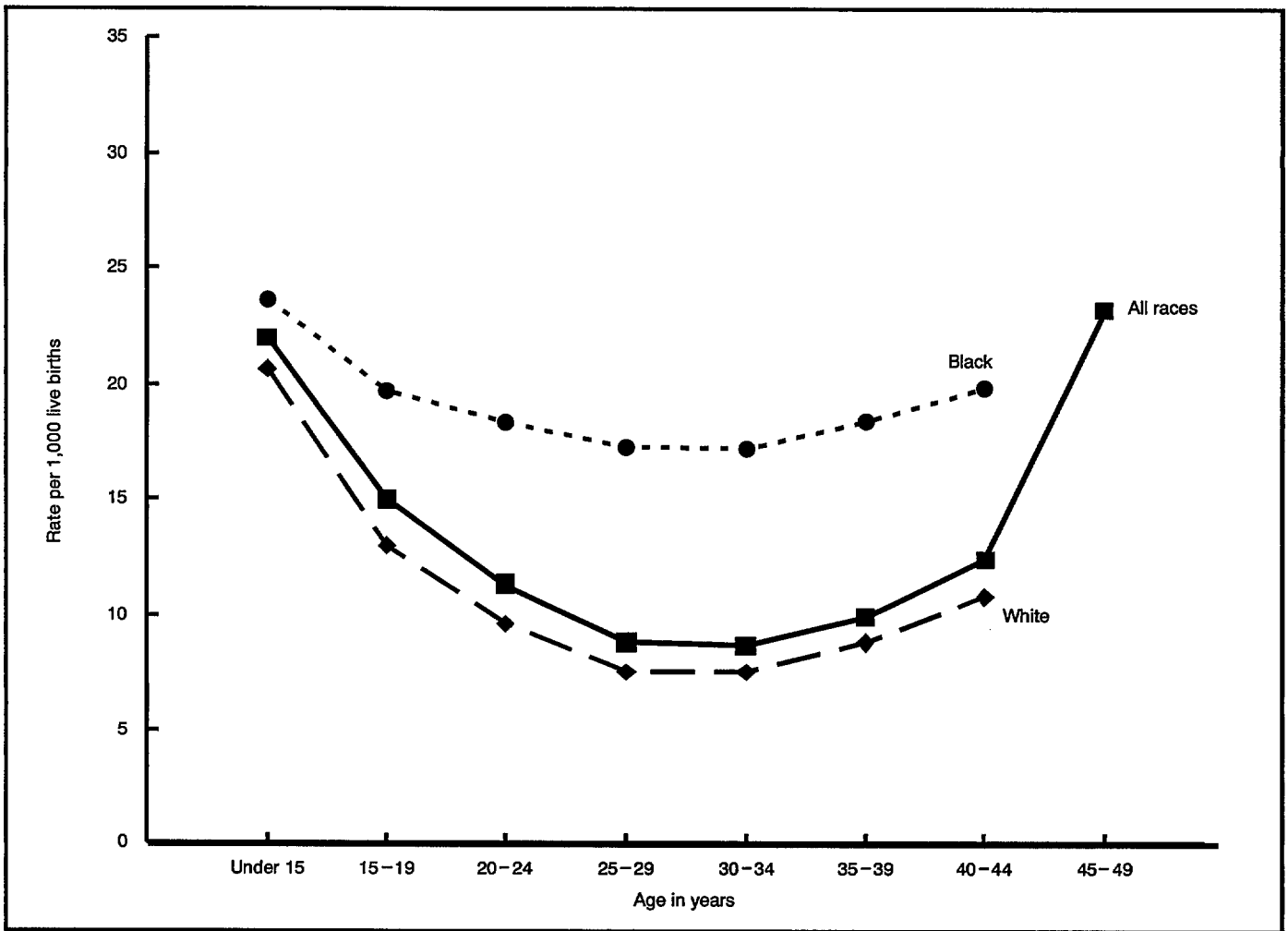


Figure. 5 Infant mortality rates by mother's age and race of child: United States, 1985 birth cohort

Table F. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to mother's age and live-birth order; and mortality race ratios by mother's age and live-birth order: United States, 1985 birth cohort

Mother's age and live-birth order	Live births			Infant deaths			Infant mortality			Race ratio black:white
	All races	White	Black	All races	White	Black	All races	White	Black	
	Percent distribution						Rate per 1,000 live births			
All mothers	100.0	100.0	100.0	100.0	100.0	100.0	10.4	8.9	18.3	2.06
First child	41.6	42.1	39.4	39.9	41.1	37.6	10.0	8.7	17.5	2.01
Second child	33.2	34.0	29.8	31.2	32.7	28.1	9.8	8.5	17.3	2.04
Third child	15.6	15.4	17.0	16.4	15.8	17.7	10.9	9.1	19.1	2.10
Fourth child and over	9.5	8.5	13.8	12.4	10.5	16.6	13.6	10.9	22.0	2.02
Mothers under 20 years	100.0	100.0	100.0	100.0	100.0	100.0	15.1	13.1	19.9	1.52
First child	77.8	80.1	72.7	68.0	71.3	63.5	13.2	11.7	17.4	1.49
Second child	18.4	17.1	21.3	25.0	23.9	26.3	20.5	18.3	24.5	1.34
Third child	3.3	2.5	5.0	5.9	4.3	8.1	27.2	22.6	32.1	1.42
Fourth child and over	0.5	0.3	1.0	1.1	0.5	2.1	33.0	22.5	42.1	1.87
Mothers 20-34 years	100.0	100.0	100.0	100.0	100.0	100.0	9.7	8.3	17.8	2.14
First child	37.8	39.0	30.6	34.7	36.7	29.6	8.9	7.8	17.2	2.21
Second child	36.0	36.7	33.1	33.4	35.0	29.5	9.0	7.9	15.9	2.01
Third child	17.0	16.4	20.4	18.6	17.6	21.0	10.6	8.9	18.2	2.04
Fourth child and over	9.1	7.8	15.9	13.2	10.6	19.9	14.0	11.2	22.2	1.98
Mothers 35-49 years	100.0	100.0	100.0	100.0	100.0	100.0	10.3	9.0	18.7	2.08
First child	17.9	18.6	12.9	19.8	20.2	18.7	11.4	9.8	27.0	2.76
Second child	27.1	27.8	21.5	23.4	25.4	17.6	8.9	8.3	15.2	1.83
Third child	22.9	23.2	21.8	21.1	21.5	20.4	9.5	8.4	17.5	2.08
Fourth child and over	32.1	30.4	43.7	35.7	32.9	43.3	11.5	9.8	18.5	1.89

NOTE: Figures may not add to total due to rounding.

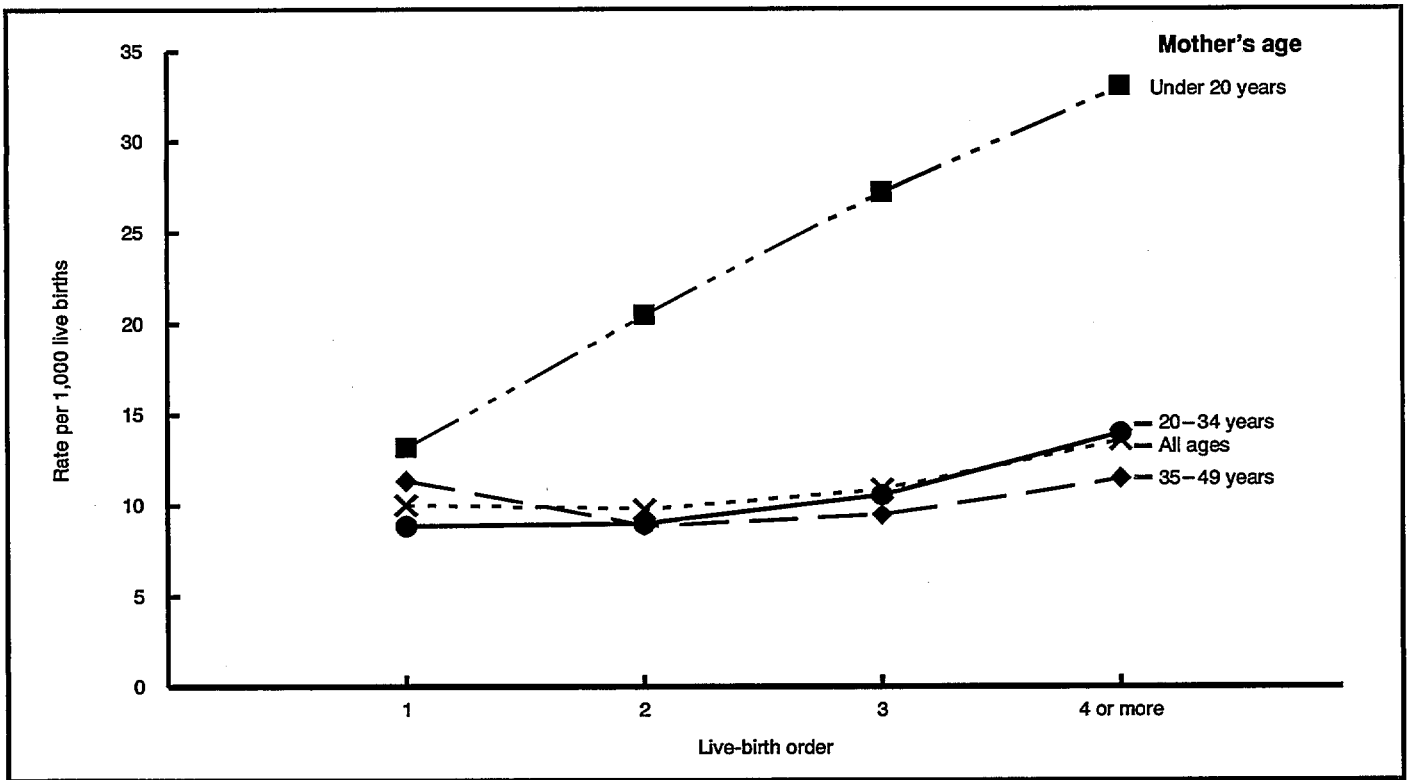


Figure 6. Infant mortality rates by live-birth order and mother's age: United States, 1985 birth cohort

mothers under 20 years of age, mortality race ratios were generally smaller at every birth order than for older mothers.

Mother's marital status

For the 1985 birth cohort, 22.0 percent of all live births and 35.3 percent of all infant deaths were to unmarried mothers (table G). The distributions of live births and infant deaths by marital status differed substantially between the two major race groups. For the black population, 60.1 percent of live births and 67.1 percent of the infant deaths were to unmarried mothers compared with only 14.5 percent live births and 22.4 percent infant deaths for the white population.

Births to unmarried women were associated with elevated risk of infant death. For all races combined, the infant mortality rate for unmarried mothers (16.7 deaths per 1,000 live births) was nearly twice that for married mothers (8.6) (table G and figure 7). For the white population, infant mortality for unmarried and married mothers was 13.7 and 8.0 infant

deaths per 1,000 live births, respectively. For the black population, the corresponding rates for unmarried and married mothers were 20.5 and 15.1, respectively. The mortality rate ratio for lower risk married mothers (1.89) was larger than that for higher risk unmarried mothers (1.50) (table G).

Educational attainment of mother

In the 1985 birth cohort among mothers 20 years of age and over, 14.6 percent of the live births and 21.6 percent of the infant deaths were to mothers who had not finished high school (table H). Infant mortality rates were inversely related to years of schooling completed (table H and figure 8). For all races combined, mortality was 12.8 infant deaths per 1,000 live births for mothers who completed 8 or less years of education, 10.2 for high school graduates, and 7.0 for college graduates.

The pattern of declining infant mortality with increasing educational attainment characterized both major race groups.

Table G. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to mother's marital status; and mortality race ratios by mother's marital status: United States, 1985 birth cohort

Marital status	Live births			Infant deaths			Infant mortality			Race ratio black:white
	All races	White	Black	All races	White	Black	All races	White	Black	
	Percent distribution						Rate per 1,000 live births			
All mothers	100.0	100.0	100.0	100.0	100.0	100.0	10.4	8.9	18.3	2.06
Married	78.0	85.5	39.9	64.7	77.6	32.9	8.6	8.0	15.1	1.89
Not married	22.0	14.5	60.1	35.3	22.4	67.1	16.7	13.7	20.5	1.50

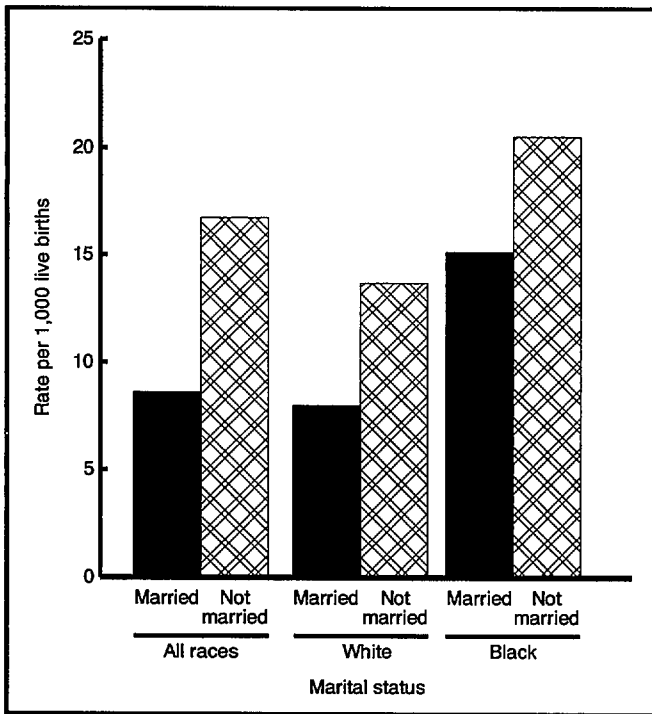


Figure 7. Infant mortality rates by race of child and mother's marital status: United States, 1985 birth cohort

For the white population, mortality declined from 12.2 infant deaths per 1,000 live births to 6.3 as years of education increased from 8 or less to 16 or more (table H). For the black population, the corresponding decline in mortality was from 17.5 to 14.6. While mortality decreased with increasing educational attainment, the race differential in mortality increased. The mortality race ratio increased from 1.43 to 2.32 with increasing educational attainment of mothers.

Trimester prenatal care began

Compared with all live births, infants who died were somewhat less likely to have received prenatal care in the first trimester and somewhat more likely to have received late or no prenatal care. In the 1985 birth cohort, mothers initiated prenatal care during the first trimester for 76.3 percent of the live births and 69.2 percent of the infant deaths (table J). In contrast, mothers received no prenatal care or initiated care

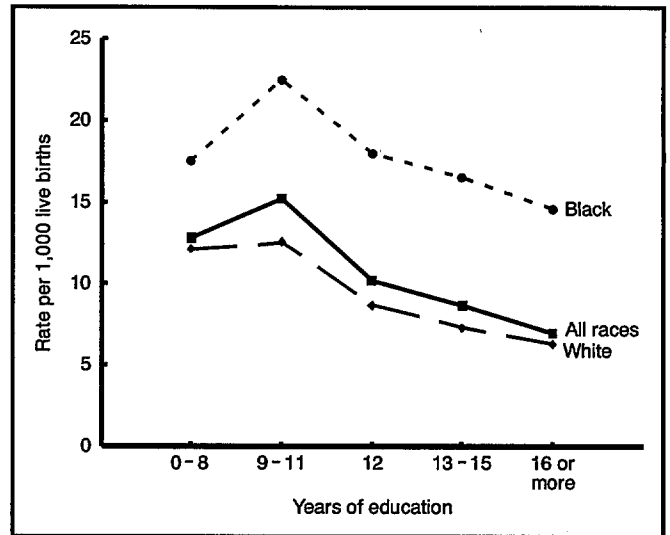


Figure 8. Infant mortality rates by race of child and mother's education: United States, 1985 birth cohort

during the third trimester for 5.8 percent of the live births and 11.3 percent of the infant deaths.

Although only 1.7 percent of all mothers giving birth in 1985 received no prenatal care, the infant mortality rate for those mothers (43.9 deaths per 1,000 live births) was 4.6 times the rate of 9.5 for other mothers who received care at any time during their pregnancy (table J, figure 9, and computed from data in table 8). There was little variation in infant mortality by trimester prenatal care began.

The absence of association between trimester care began and infant mortality masks opposite patterns of association for neonatal and postneonatal mortality. For deaths in the neonatal period, there was a weak inverse relationship between neonatal mortality and trimester prenatal care began. Neonatal mortality decreased from 6.6 to 6.5 to 4.3 deaths per 1,000 live births as initiation of care was delayed from first to second to third trimester. Those infants who received no care experienced a substantially higher neonatal mortality rate of 32.8 per 1,000 live births.

For deaths in the postneonatal period, mortality was directly related to trimester prenatal care began. Postneonatal mortality increased from 3.0 to 5.0 to 6.0 deaths per 1,000 live births as initiation of care was delayed from first to second to

Table H. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to educational attainment for mothers 20 years of age and over; and mortality race ratios by mother's education: United States, 1985 birth cohort

Educational attainment	Live births			Infant deaths			Infant mortality			Race ratio black:white
	All races	White	Black	All races	White	Black	All races	White	Black	
	Percent distribution						Rate per 1,000 live births			
All mothers 20 years of age and over	100.0	100.0	100.0	100.0	100.0	100.0	9.9	8.4	18.3	2.18
0-8 years	2.8	2.5	2.9	3.6	3.7	2.8	12.8	12.2	17.5	1.43
9-11 years	11.8	10.2	19.5	18.0	15.4	24.0	15.2	12.6	22.5	1.79
12 years	43.8	43.5	46.5	45.2	45.2	45.9	10.2	8.7	18.0	2.07
13-15 years	22.6	22.8	21.8	19.8	19.9	19.8	8.7	7.3	16.6	2.27
16 years and over	19.1	20.9	9.3	13.4	15.8	7.4	7.0	6.3	14.6	2.32

NOTE: Figures may not add to total due to rounding.

Table J. Percent distribution of live births and infant deaths and infant mortality rates by race of child, according to trimester prenatal care began; and mortality race ratios by trimester prenatal care began: United States, 1985 birth cohort

Trimester prenatal care began	Live births			Infant deaths			Infant mortality			Race ratio black:white
	All races	White	Black	All races	White	Black	All races	White	Black	
	Percent distribution						Rate per 1,000 live births			
All mothers	100.0	100.0	100.0	100.0	100.0	100.0	10.4	8.9	18.3	2.06
First trimester	76.3	79.8	61.2	69.2	74.4	58.0	9.5	8.3	17.3	2.08
Second trimester	17.9	15.5	28.5	19.5	16.9	24.8	11.3	9.6	16.2	1.69
Third trimester and no care . .	5.8	4.7	10.3	11.3	8.7	17.1	20.0	16.1	30.6	1.90
Third trimester	4.1	3.4	6.8	3.9	3.5	4.6	10.1	9.2	12.6	1.37
No care	1.7	1.3	3.5	7.4	5.1	12.6	43.9	33.9	65.9	1.94

NOTE: Figures may not add to total due to rounding.

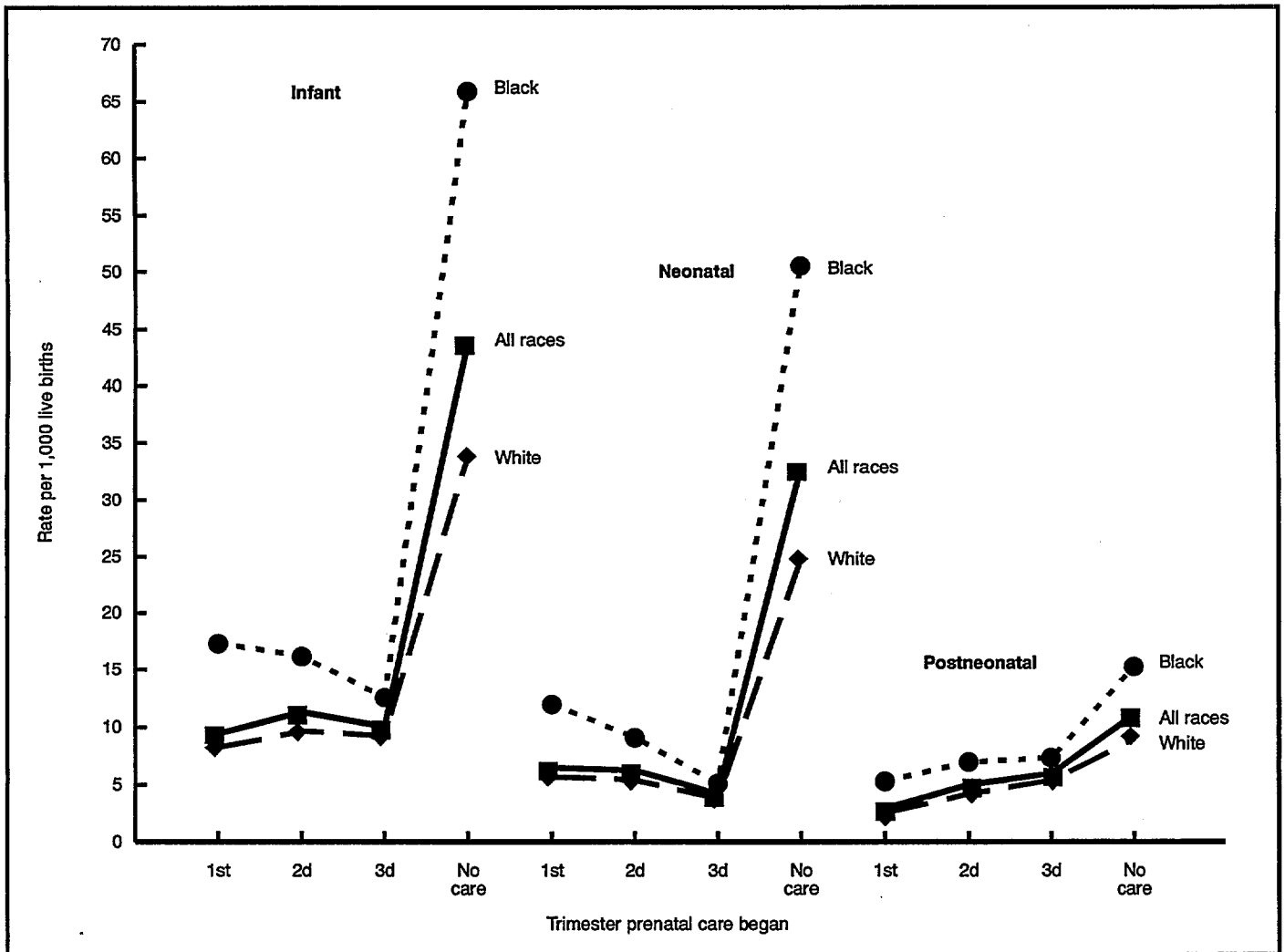


Figure 9. Infant mortality rates by age at death, race of child, and trimester prenatal care began: United States, 1985 birth cohort

third trimester. Postneonatal mortality was highest for infants who received no prenatal care (11.1).

The timing of the initiation of prenatal care is one measure of the adequacy of prenatal care received. An alter-

nate measure, the Kessner index, defines care as "adequate," "intermediate," and "inadequate" based on when prenatal care begins, the number of prenatal visits, and the gestational age of the infant (11). An analysis of birth outcomes in relation

to the Kessner index using the 1983 birth cohort national linked file found infant mortality rates for mothers receiving inadequate care to be 2.6 times that for mothers receiving adequate care (12).

Detailed race

The availability of national linked birth and infant death data offers an opportunity to evaluate race-specific period infant mortality rates published in *Vital Statistics of the United States, Volume II, Mortality (VSUS)* (13). Routinely published period rates for smaller minority race groups are generally understated because minority races are sometimes misreported as white on the death certificate (3).

Inconsistencies in race identification at the time of an infant's birth and death occur because of differences in reporting and processing race information from the birth and death certificates. For the birth certificate, race of each parent is usually reported by the mother at the time of delivery and, for births described in this report, race of infant was coded according to rules that take account of the race of both parents (see Technical notes). For the death certificate, race of the deceased infant is reported by the funeral director based on information supplied by an informant, such as a parent, or based on observation; and race is coded directly as it was reported on the death certificate.

Race-specific cohort infant mortality rates based on the national linked data set are more accurate than period rates, especially for minority race groups, because race information for both the numerator (infant deaths) and denominator (live births) is from the same source document, the birth certificate; and race is more accurately reported on the birth than death certificate. In contrast, race information for period rates is derived from two different source documents, the death certificate for the numerator and the birth certificate for the denominator.

Differences between race-specific cohort and period rates come from three sources:

- the different reference periods of the numerators comprising the two rates (NOTE: The different reference periods of the numerators account for a difference of 3,117 events between the numerators of the cohort and period rates in the analysis that follows. Thus, a total of 117,120 infant deaths occurred to the combined birth cohorts of 1983–85; whereas, 120,237 infant deaths occurred to U.S. residents during the calendar years 1983–85.) (See Methods section.)
- the percent of infant deaths to the birth cohort that are linked in the linked file (See Methods section and table A.)
- the differences in reporting race on the birth and death certificates as described previously.

Whereas the effect of the first two sources on cohort and period race-specific rates is obvious, the effect of the third source—differences in race-reporting between birth and death certificates—is more subtle and introduces systematic bias in period rates. The linked file is useful for evaluating the contribution of race-reporting differences to this bias because it includes information from both the birth and death certificates.

The evaluation was carried out using linked file data for the combined three birth cohorts of 1983–85 to improve stability of rates for smaller race groups. Race-specific cohort rates in which the race variable for the numerator is based on the birth certificate (the cohort rates used throughout this report) are compared with “special” rates constructed for this evaluation in which the race variable for the numerator is based on the death certificate (table K, columns 4 and 5). The difference between the race-specific cohort and special rates is due specifically to differences in reporting race at the time of birth and death. Percent differences between race-specific cohort and special rates are estimates of the bias in period rates by detailed race that are published in the VSUS. Because

Table K. Live births and infant deaths and mortality rates according to source of race information, and ratio of infant mortality rates by source of race information for detailed race groups: United States, 1983–85 birth cohorts

Race	Live births	Infant deaths based on source of race information		Infant mortality rates based on source of race information for infant death		Ratio of infant mortality rates by source of race information—birth:death certificate
		Birth ¹	Death ²	Birth ¹	Death ²	
		Number		Rate per 1,000 live births		
All races	11,069,214	117,120	117,120	10.6	10.6	1.00
White	8,819,529	79,778	81,770	9.0	9.3	0.97
Black	1,787,154	32,857	32,239	18.4	18.0	1.02
American Indian or Alaskan native	125,682	1,649	1,183	13.1	9.4	1.39
Chinese	48,434	347	264	7.2	5.5	1.31
Japanese	27,815	183	112	6.6	4.0	1.65
Hawaiian	21,767	236	198	10.8	9.1	1.19
Filipino	58,995	487	269	8.3	4.6	1.80
Other Asian or Pacific Islander	173,239	1,505	1,050	8.7	6.1	1.43
Other	6,599	78	35	11.8	5.3	2.23

¹Race of child at birth based on race of both parents as recorded on linked birth certificate.

²Race of child as recorded on the death certificate.

special rates in this evaluation represent period rates, they are referred to as "period" rates in the discussion that follows.

For the 1983–85 birth cohorts, the cohort infant mortality rate for the white population was 9.0 deaths per 1,000 live births, 3 percent lower than the period rate of 9.3 (table K). Period infant mortality rates for the white population slightly overstate mortality because infants of minority races tend to be reported as white on the death certificate.

Cohort infant mortality rates for each of the minority races were higher than period rates by 2 percent for the black population to more than double for other races (table K). For the black population, the cohort rate was 18.4 infant deaths per 1,000 live births, 2 percent higher than the period rate of 18.0. For other minority races, cohort rates were much higher than period rates. For example, for the Hawaiian population, the cohort rate of 10.8 infant deaths per 1,000 live births was

19 percent higher; for Chinese, the cohort rate of 7.2 was 31 percent higher; for the American Indian population, the cohort rate of 13.1 was 39 percent higher; for other Asian or Pacific Islanders, the cohort rate of 8.7 was 43 percent higher; for Japanese, the cohort rate of 6.6 was 65 percent higher; for the Filipino population, the cohort rate of 8.3 was 80 percent higher; and for other races, the cohort rate of 11.8 was 123 percent higher.

Compared with an infant mortality rate for the 1983–85 birth cohorts of 9.0 deaths per 1,000 live births for the white population, mortality was lower for infants of the Japanese, Chinese, Filipino, and other Asian or Pacific Islander populations; whereas, mortality was higher for infants of the Hawaiian, other nonwhite, American Indian, and black populations (table K).

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Table 1. Live births, infant deaths, and infant mortality rates, by age at death, race of child, and birthweight: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Not stated birthweight proportionally distributed for calculation of rates. Rates are per 1,000 live births.]

Race and birthweight	Live births	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal
	Number						Rate				
All races ¹	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
Less than 2,500 grams	253,711	23,210	18,804	16,390	2,414	4,406	94.5	77.1	67.5	9.6	17.4
Less than 500 grams	4,860	4,341	4,311	4,258	53	30	896.9	891.0	880.4	10.6	5.9
500–749 grams	8,291	6,137	5,655	5,175	480	482	747.6	691.0	634.2	56.7	56.6
750–999 grams	9,452	3,661	2,965	2,454	511	696	395.3	322.3	268.3	54.0	73.0
1,000–1,249 grams	10,578	1,964	1,489	1,146	343	475	190.2	145.4	112.7	32.6	44.9
1,250–1,499 grams	12,540	1,316	935	735	200	381	107.7	77.3	61.2	16.1	30.4
1,500–1,999 grams	48,402	2,544	1,656	1,277	379	888	53.9	35.5	27.6	7.9	18.4
2,000–2,499 grams	159,588	3,247	1,793	1,345	448	1,454	20.8	11.7	8.8	2.8	9.2
2,500 grams or more	3,502,342	14,807	5,720	3,934	1,786	9,087	4.3	1.7	1.2	0.5	2.6
2,500–2,999 grams	595,548	4,553	1,870	1,285	585	2,683	7.8	3.3	2.3	1.0	4.5
3,000–3,499 grams	1,378,114	5,734	2,079	1,399	680	3,655	4.2	1.6	1.1	0.5	2.7
3,500–3,999 grams	1,110,700	3,203	1,155	778	377	2,048	2.9	1.1	0.7	0.3	1.9
4,000–4,499 grams	345,358	958	382	267	115	576	2.8	1.1	0.8	0.3	1.7
4,500–4,999 grams	64,293	240	138	117	21	102	3.8	2.2	1.9	0.3	1.6
5,000 grams or more	8,329	119	96	88	8	23	14.8	12.0	11.1	*	2.8
Not stated	4,780	1,128	1,049	993	56	79	...	...	...	...	...
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
Less than 2,500 grams	168,478	14,959	12,368	10,699	1,669	2,591	91.5	76.1	66.1	10.0	15.4
Less than 500 grams	2,747	2,465	2,447	2,414	33	18	900.3	894.0	882.3	11.7	*
500–749 grams	4,863	3,683	3,456	3,177	279	227	763.7	718.2	661.7	56.5	45.5
750–999 grams	5,734	2,402	2,036	1,681	355	366	426.7	363.5	301.6	61.9	83.2
1,000–1,249 grams	6,755	1,390	1,118	873	245	272	210.7	170.5	134.0	36.5	40.2
1,250–1,499 grams	8,026	948	710	550	160	238	121.1	91.4	71.3	20.1	29.7
1,500–1,999 grams	32,057	1,807	1,257	978	279	550	57.8	40.6	31.8	8.8	17.2
2,000–2,499 grams	108,296	2,264	1,344	1,026	318	920	21.4	12.9	9.9	3.0	8.5
2,500 grams or more	2,819,364	10,857	4,356	3,012	1,344	6,501	3.9	1.6	1.1	0.5	2.3
2,500–2,999 grams	421,418	3,145	1,371	958	413	1,774	7.6	3.4	2.4	1.0	4.2
3,000–3,499 grams	1,079,510	4,171	1,583	1,079	504	2,588	3.9	1.5	1.0	0.5	2.4
3,500–3,999 grams	945,835	2,487	918	616	302	1,569	2.7	1.0	0.7	0.3	1.7
4,000–4,499 grams	307,164	779	315	216	99	464	2.6	1.1	0.7	0.3	1.5
4,500–4,999 grams	58,046	193	104	86	18	89	3.4	1.9	1.5	*	1.5
5,000 grams or more	7,391	82	65	57	8	17	11.5	9.1	8.0	*	*
Not stated	3,679	710	657	612	45	53	...	...	...	...	...
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
Less than 2,500 grams	75,482	7,476	5,832	5,172	660	1,644	102.7	80.9	72.1	8.8	21.8
Less than 500 grams	1,972	1,747	1,735	1,718	17	12	890.7	884.9	876.6	*	*
500–749 grams	3,197	2,282	2,039	1,856	183	243	722.7	648.9	593.2	55.7	73.8
750–999 grams	3,444	1,146	842	698	144	304	340.7	253.1	211.6	41.6	87.6
1,000–1,249 grams	3,464	491	308	221	87	183	145.2	92.3	67.2	25.2	52.9
1,250–1,499 grams	4,099	320	190	156	34	130	80.2	48.5	40.1	8.3	31.8
1,500–1,999 grams	14,596	645	341	255	86	304	45.3	24.4	18.4	5.9	20.9
2,000–2,499 grams	44,710	845	377	268	109	468	19.3	8.8	6.3	2.5	10.5

2,500 grams or more	531,968	3,291	1,155	778	377	2,136	6.3	2.3	1.5	0.7	4.0
2,500–2,999 grams	143,378	1,225	438	286	152	787	8.7	3.2	2.1	1.1	5.5
3,000–3,499 grams	232,934	1,293	414	260	154	879	5.6	1.8	1.2	0.7	3.8
3,500–3,999 grams	123,198	560	185	129	56	375	4.6	1.6	1.1	0.5	3.1
4,000–4,499 grams	27,436	144	62	50	12	82	5.4	2.4	1.9	*	3.0
4,500–4,999 grams	4,374	34	26	23	3	8	8.1	6.2	5.6	*	*
5,000 grams or more	648	35	30	30	–	5	56.5	48.8	48.8	*	*
Not stated	859	373	352	344	8	21	...	...	...	...	...

¹Includes races other than white and black.

Table 2. Live births, infant deaths, and infant mortality rates, by age at death, race of child, and gestational age: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Not stated gestational age proportionally distributed for calculation of rates. Rates are per 1,000 live births.]

Race and gestational age	Live births	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal
	Number						Rate				
All races ¹	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
Less than 28 weeks	27,658	11,672	10,686	9,832	854	986	435.4	400.7	370.2	30.4	34.8
28–31 weeks	40,373	3,561	2,646	2,078	568	915	93.5	70.4	55.9	14.5	23.1
32–35 weeks	168,271	3,574	2,257	1,809	448	1,317	22.6	14.5	11.8	2.8	8.0
36 weeks	116,806	1,313	706	539	167	607	11.9	6.5	5.1	1.5	5.3
37–39 weeks	1,400,106	7,227	2,986	2,055	931	4,241	5.4	2.3	1.6	0.7	3.1
40 weeks	797,930	3,085	1,223	850	373	1,862	4.1	1.7	1.2	0.5	2.4
41 weeks	551,067	2,162	907	636	271	1,255	4.1	1.8	1.3	0.5	2.3
42 weeks or more	513,233	2,697	1,181	861	320	1,516	5.5	2.5	1.8	0.6	3.0
Not stated	145,389	3,854	2,981	2,657	324	873	...	...	...	...	...
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
Less than 28 weeks	15,997	7,095	6,590	6,039	551	505	455.4	424.7	390.7	34.0	30.7
28–31 weeks	24,808	2,446	1,891	1,477	414	555	104.2	81.5	64.3	17.2	22.7
32–35 weeks	111,827	2,525	1,726	1,393	333	799	24.0	16.7	13.6	3.1	7.3
36 weeks	83,444	916	529	415	114	387	11.6	6.8	5.4	1.4	4.8
37–39 weeks	1,092,654	5,166	2,232	1,567	665	2,934	5.0	2.2	1.6	0.6	2.8
40 weeks	661,215	2,247	895	614	281	1,352	3.6	1.5	1.0	0.4	2.1
41 weeks	467,404	1,645	708	496	212	937	3.7	1.6	1.2	0.5	2.1
42 weeks or more	423,786	2,034	908	648	260	1,126	5.0	2.3	1.7	0.6	2.7
Not stated	110,386	2,452	1,902	1,674	228	550	...	...	...	...	...
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
Less than 28 weeks	10,835	4,247	3,793	3,519	274	454	408.2	367.2	342.3	24.9	41.0
28–31 weeks	14,056	985	661	527	134	324	75.0	51.3	41.5	9.9	23.6
32–35 weeks	48,707	901	454	352	102	447	19.7	10.2	8.0	2.2	9.5
36 weeks	28,094	348	149	102	47	199	13.1	5.8	4.0	1.7	7.3
37–39 weeks	241,498	1,727	633	411	222	1,094	7.5	2.9	1.9	1.0	4.7
40 weeks	104,336	702	276	197	79	426	7.1	2.9	2.1	0.8	4.2
41 weeks	64,105	431	173	119	54	258	7.1	2.9	2.1	0.9	4.2
42 weeks or more	70,648	556	235	186	49	321	8.4	3.7	2.9	0.7	4.7
Not stated	26,030	1,243	965	881	84	278	...	...	...	...	...

¹Includes races other than white and black.

Table 3. Live births, infant deaths, and infant mortality rates, by age at death, race of child, and sex: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Rates are per 1,000 live births.]

Race and sex	Live births	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal
	Number						Rate				
All races ¹	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
Male	1,928,138	22,466	14,604	12,182	2,422	7,862	11.7	7.6	6.3	1.3	4.1
Female	1,832,695	16,679	10,969	9,135	1,834	5,710	9.1	6.0	5.0	1.0	3.1
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
Male	1,536,729	15,446	10,044	8,261	1,783	5,402	10.1	6.5	5.4	1.2	3.5
Female	1,454,792	11,080	7,337	6,062	1,275	3,743	7.6	5.0	4.2	0.9	2.6
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
Male	308,643	6,161	4,065	3,516	549	2,096	20.0	13.2	11.4	1.8	6.8
Female	299,666	4,979	3,274	2,778	496	1,705	16.6	10.9	9.3	1.7	5.7

¹Includes races other than white and black.

Table 4. Live births, infant deaths, and infant mortality rates, by age at death, race of child, and maternal age: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0-6 days; late neonatal, 7-27 days; and postneonatal, 28 days-11 months. Rates are per 1,000 live births.]

Race and maternal age	Live births	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal
	Number						Rate				
All races ¹	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
Under 15 years	10,223	225	151	122	29	74	22.0	14.8	11.9	2.8	7.2
15-19 years	467,519	6,999	4,218	3,540	678	2,781	15.0	9.0	7.6	1.5	5.9
15-17 years	167,808	2,777	1,703	1,448	255	1,074	16.5	10.1	8.6	1.5	6.4
18-19 years	299,711	4,222	2,515	2,092	423	1,707	14.1	8.4	7.0	1.4	5.7
20-24 years	1,141,386	12,841	7,846	6,496	1,350	4,995	11.3	6.9	5.7	1.2	4.4
25-29 years	1,201,452	10,578	7,265	6,103	1,162	3,313	8.8	6.0	5.1	1.0	2.8
30-34 years	696,408	5,991	4,326	3,589	737	1,665	8.6	6.2	5.2	1.1	2.4
35-39 years	214,348	2,132	1,521	1,261	260	611	9.9	7.1	5.9	1.2	2.9
40-44 years	28,335	352	229	193	36	123	12.4	8.1	6.8	1.3	4.3
45-49 years	1,162	27	17	13	4	10	23.2	*	*	*	*
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
Under 15 years	4,102	85	56	46	10	29	20.7	13.7	11.2	2.4	7.1
15-19 years	318,738	4,150	2,507	2,067	440	1,643	13.0	7.9	6.5	1.4	5.2
15-17 years	106,049	1,516	942	788	154	574	14.3	8.9	7.4	1.5	5.4
18-19 years	212,689	2,634	1,565	1,279	286	1,069	12.4	7.4	6.0	1.3	5.0
20-24 years	894,231	8,610	5,187	4,253	934	3,423	9.6	5.8	4.8	1.0	3.8
25-29 years	997,284	7,528	5,195	4,313	882	2,333	7.5	5.2	4.3	0.9	2.3
30-34 years	580,433	4,376	3,172	2,606	566	1,204	7.5	5.5	4.5	1.0	2.1
35-39 years	173,692	1,520	1,099	902	197	421	8.8	6.3	5.2	1.1	2.4
40-44 years	22,265	240	153	127	26	87	10.8	6.9	5.7	1.2	3.9
45-49 years	776	17	12	9	3	5	*	*	*	*	*
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
Under 15 years	5,862	139	95	76	19	44	23.7	16.2	13.0	*	7.5
15-19 years	134,290	2,652	1,605	1,389	216	1,047	19.7	12.0	10.3	1.6	7.8
15-17 years	56,821	1,180	715	625	90	465	20.8	12.6	11.0	1.6	8.2
18-19 years	77,469	1,472	890	764	126	582	19.0	11.5	9.9	1.6	7.5
20-24 years	207,359	3,800	2,443	2,066	377	1,357	18.3	11.8	10.0	1.8	6.5
25-29 years	152,352	2,642	1,810	1,574	236	832	17.3	11.9	10.3	1.5	5.5
30-34 years	78,147	1,341	992	853	139	349	17.2	12.7	10.9	1.8	4.5
35-39 years	26,217	483	337	288	49	146	18.4	12.9	11.0	1.9	5.6
40-44 years	3,888	77	53	45	8	24	19.8	13.6	11.6	*	6.2
45-49 years	194	6	4	3	1	2	*	*	*	*	*

¹Includes races other than white and black.

Table 5. Live births, infant deaths, and infant mortality rates, by age at death, race of child, maternal age and live-birth order: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Not stated live birth order proportionally distributed for calculation of rates. Rates are per 1,000 live births.]

Race, maternal age, and live-birth order	Live births	Infant deaths	Number				Rate				
			Total neonatal	Early neonatal	Late neonatal	Post- neonatal	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post- neonatal
All races¹											
Mothers of all ages	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
First child	1,554,876	15,393	10,736	9,010	1,726	4,657	10.0	7.0	5.9	1.1	3.0
Second child	1,242,205	12,047	7,534	6,216	1,318	4,513	9.8	6.1	5.1	1.1	3.6
Third child	584,541	6,332	3,942	3,300	642	2,390	10.9	6.8	5.7	1.1	4.1
Fourth child and over	356,562	4,798	2,885	2,346	539	1,913	13.6	8.2	6.7	1.5	5.4
Not stated	22,649	575	476	445	31	99	...	...	...	...	...
Mothers under 20 years of age	477,742	7,224	4,369	3,662	707	2,855	15.1	9.1	7.7	1.5	6.0
First child	369,145	4,852	3,096	2,590	506	1,756	13.2	8.5	7.1	1.4	4.8
Second child	87,560	1,784	947	794	153	837	20.5	10.9	9.2	1.7	9.6
Third child	15,527	421	209	167	42	212	27.2	13.6	10.9	2.7	13.6
Fourth child and over	2,434	80	46	43	3	34	33.0	19.1	17.8	*	13.9
Not stated	3,076	87	71	68	3	16	...	...	...	...	...
Mothers 20–34 years of age	3,039,246	29,410	19,437	16,188	3,249	9,973	9.7	6.4	5.3	1.1	3.3
First child	1,142,376	10,054	7,277	6,114	1,163	2,777	8.9	6.5	5.4	1.0	2.4
Second child	1,089,014	9,685	6,181	5,089	1,092	3,504	9.0	5.8	4.7	1.0	3.2
Third child	513,591	5,392	3,374	2,830	544	2,018	10.6	6.7	5.6	1.1	3.9
Fourth child and over	276,377	3,837	2,238	1,815	423	1,599	14.0	8.2	6.7	1.5	5.8
Not stated	17,888	442	367	340	27	75	...	...	...	...	...
Mothers 35–49 years of age	243,845	2,511	1,767	1,467	300	744	10.3	7.2	6.0	1.2	3.1
First child	43,355	487	363	306	57	124	11.4	8.5	7.2	1.3	2.9
Second child	65,631	578	406	333	73	172	8.9	6.3	5.2	1.1	2.6
Third child	55,423	519	359	303	56	160	9.5	6.6	5.6	1.0	2.9
Fourth child and over	77,751	881	601	488	113	280	11.5	7.8	6.4	1.4	3.6
Not stated	1,685	46	38	37	1	8	...	...	...	...	...
White											
Mothers of all ages	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
First child	1,252,096	10,739	7,482	6,197	1,285	3,257	8.7	6.1	5.0	1.0	2.6
Second child	1,011,369	8,530	5,315	4,336	979	3,215	8.5	5.3	4.4	1.0	3.2
Third child	457,220	4,115	2,582	2,131	451	1,533	9.1	5.7	4.7	1.0	3.4
Fourth child and over	251,975	2,731	1,673	1,355	318	1,058	10.9	6.7	5.5	1.3	4.2
Not stated	18,861	411	329	304	25	82	...	...	...	...	...
Mothers under 20 years of age	322,840	4,235	2,563	2,113	450	1,672	13.1	7.9	6.5	1.4	5.2
First child	256,854	2,973	1,886	1,553	333	1,087	11.7	7.4	6.1	1.3	4.2
Second child	54,924	999	527	434	93	472	18.3	9.7	8.0	1.7	8.6
Third child	7,913	178	87	66	21	91	22.6	11.1	8.5	2.6	11.5
Fourth child and over	941	21	12	11	1	9	22.5	*	*	*	*
Not stated	2,208	64	51	49	2	13	...	...	...	...	...
Mothers 20–34 years of age	2,471,948	20,514	13,554	11,172	2,382	6,960	8.3	5.5	4.5	1.0	2.8
First child	958,998	7,415	5,330	4,422	908	2,085	7.8	5.6	4.7	0.9	2.2
Second child	902,122	7,088	4,470	3,646	824	2,618	7.9	5.0	4.1	0.9	2.9
Third child	403,976	3,562	2,238	1,855	383	1,324	8.9	5.6	4.7	1.0	3.3
Fourth child and over	191,607	2,136	1,266	1,021	245	870	11.2	6.7	5.4	1.3	4.6
Not stated	15,245	313	250	228	22	63	...	...	...	...	...

Table 5. Live births, infant deaths, and infant mortality rates, by age at death, race of child, maternal age and live-birth order: United States, 1985 birth cohort—Con.

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Not stated live birth order proportionally distributed for calculation of rates. Rates are per 1,000 live births.]

<i>Race, maternal age, and live-birth order</i>	<i>Live births</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post- neonatal</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post- neonatal</i>
	Number						Rate				
White—Con.											
Mothers 35–49 years of age	196,733	1,777	1,264	1,038	226	513	9.0	6.4	5.3	1.1	2.6
First child	36,244	351	266	222	44	85	9.8	7.5	6.2	1.2	2.4
Second child	54,323	443	318	256	62	125	8.3	5.9	4.8	1.1	2.3
Third child	45,331	375	257	210	47	118	8.4	5.8	4.7	1.0	2.6
Fourth child and over	59,427	574	395	323	72	179	9.8	6.7	5.5	1.2	3.0
Not stated	1,408	34	28	27	1	6	...	...	...	...	...
Black											
Mothers of all ages	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
First child	238,712	4,133	2,931	2,547	384	1,202	17.4	12.4	10.8	1.6	5.0
Second child	180,280	3,090	1,984	1,690	294	1,106	17.3	11.2	9.5	1.6	6.1
Third child	102,726	1,949	1,215	1,043	172	734	19.1	12.0	10.3	1.7	7.1
Fourth child and over	83,703	1,825	1,082	892	190	743	22.0	13.1	10.8	2.3	8.9
Not stated	2,888	143	127	122	5	16	...	...	...	...	...
Mothers under 20 years of age	140,152	2,791	1,700	1,465	235	1,091	19.9	12.1	10.5	1.7	7.8
First child	101,279	1,759	1,137	980	157	622	17.4	11.3	9.7	1.5	6.1
Second child	29,709	728	396	341	55	332	24.5	13.4	11.5	1.8	11.1
Third child	7,017	225	116	96	20	109	32.1	16.6	13.8	2.8	15.5
Fourth child and over	1,379	58	33	31	2	25	42.1	24.1	22.6	*	18.1
Not stated	768	21	18	17	1	3	...	...	...	...	...
Mothers 20–34 years of age	437,858	7,783	5,245	4,493	752	2,538	17.8	12.0	10.3	1.7	5.8
First child	133,541	2,270	1,718	1,500	218	552	17.2	13.1	11.4	1.6	4.1
Second child	144,088	2,264	1,521	1,290	231	743	15.9	10.7	9.1	1.6	5.2
Third child	89,144	1,610	1,019	875	144	591	18.2	11.6	10.0	1.6	6.6
Fourth child and over	69,161	1,525	885	730	155	640	22.2	13.0	10.7	2.2	9.3
Not stated	1,924	114	102	98	4	12	...	...	...	...	...
Mothers 35–49 years of age	30,299	566	394	336	58	172	18.7	13.0	11.1	1.9	5.7
First child	3,892	104	76	67	9	28	27.0	19.8	17.5	*	7.2
Second child	6,483	98	67	59	8	31	15.2	10.5	9.2	*	4.8
Third child	6,565	114	80	72	8	34	17.5	12.3	11.1	*	5.2
Fourth child and over	13,163	242	164	131	33	78	18.5	12.6	10.1	2.5	5.9
Not stated	196	8	7	7	—	1	...	...	...	...	...

¹Includes races other than white and black.

Table 6. Live births, infant deaths, and infant mortality rates, by age at death, race of child, and mother's marital status: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Rates are per 1,000 live births.]

<i>Race and marital status</i>	<i>Live births</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post-neonatal</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post-neonatal</i>
	Number						Rate				
All races ¹	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
Married	2,932,562	25,321	16,965	14,014	2,951	8,356	8.6	5.8	4.8	1.0	2.8
Unmarried	828,271	13,824	8,608	7,303	1,305	5,216	16.7	10.4	8.8	1.6	6.3
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
Married	2,558,522	20,592	13,756	11,284	2,472	6,836	8.0	5.4	4.4	1.0	2.7
Unmarried	432,999	5,934	3,625	3,039	586	2,309	13.7	8.4	7.0	1.4	5.3
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
Married	242,717	3,663	2,569	2,206	363	1,094	15.1	10.6	9.1	1.5	4.5
Unmarried	365,592	7,477	4,770	4,088	682	2,707	20.5	13.0	11.2	1.9	7.4

¹Includes races other than white and black.

Table 7. Live births, infant deaths, and infant mortality rates, by age at death, race of child, mother's age, and educational attainment: 47 States and the District of Columbia, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0-6 days; late neonatal, 7-27 days; and postneonatal, 28 days-11 months. Not stated education proportionally distributed for calculation of rates. Rates are per 1,000 live births.]

<i>Race, mother's age, and educational attainment</i>	<i>Live births</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post- neonatal</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post- neonatal</i>
	Number						Rate				
Mothers of all ages											
All races ¹	2,911,422	31,120	20,602	17,282	3,320	10,518	10.7	7.1	5.9	1.1	3.6
0-8 years	102,603	1,537	915	724	191	622	15.4	9.3	7.4	1.9	6.1
9-11 years	487,902	7,553	4,279	3,528	751	3,274	15.9	9.2	7.6	1.5	6.7
12 years	1,220,686	12,507	8,355	6,997	1,358	4,152	10.6	7.2	6.0	1.1	3.4
13-15 years	576,814	4,903	3,483	2,923	560	1,420	8.8	6.3	5.3	1.0	2.5
16 years or more	478,870	3,226	2,387	2,000	387	839	7.0	5.2	4.4	0.8	1.8
Not stated	44,547	1,394	1,183	1,110	73	211	...	...	...	...	...
White	2,299,167	20,517	13,613	11,290	2,323	6,904	8.9	5.9	4.9	1.0	3.0
0-8 years	73,092	1,002	589	456	133	413	14.1	8.4	6.6	1.8	5.7
9-11 years	329,286	4,300	2,452	2,000	452	1,848	13.4	7.8	6.4	1.4	5.6
12 years	967,887	8,366	5,547	4,598	949	2,819	8.9	6.0	5.0	1.0	2.9
13-15 years	471,504	3,348	2,353	1,945	408	995	7.3	5.2	4.3	0.9	2.1
16 years or more	423,712	2,600	1,913	1,583	330	687	6.3	4.7	3.9	0.8	1.6
Not stated	33,686	901	759	708	51	142	...	...	...	...	...
Black	517,097	9,700	6,477	5,565	912	3,223	18.8	12.5	10.8	1.8	6.2
0-8 years	22,102	454	276	226	50	178	21.1	13.0	10.8	2.3	8.0
9-11 years	142,445	3,030	1,723	1,446	277	1,307	21.8	12.7	10.7	2.0	9.2
12 years	219,401	3,833	2,632	2,251	381	1,201	18.1	12.6	10.8	1.7	5.5
13-15 years	89,069	1,425	1,055	913	142	370	16.6	12.4	10.8	1.6	4.2
16 years or more	36,260	508	396	351	45	112	14.6	11.5	10.2	1.2	3.1
Not stated	7,820	450	395	378	17	55	...	...	...	...	...
Mothers under 20 years of age											
All races ¹	372,196	5,901	3,591	3,019	572	2,310	15.9	9.6	8.1	1.5	6.2
0-8 years	33,344	675	389	316	73	286	20.7	12.2	10.0	2.2	8.6
9-11 years	193,895	3,204	1,822	1,510	312	1,382	16.9	9.8	8.2	1.6	7.1
12 years	126,259	1,644	1,070	904	166	574	13.4	8.9	7.5	1.3	4.5
13-15 years	12,590	138	103	90	13	35	11.3	8.5	7.5	*	2.8
16 years or more	102	1	1	1	-	-	10.4	*	*	*	*
Not stated	6,006	239	206	198	8	33	...	...	...	...	...
White	240,288	3,289	2,000	1,659	341	1,289	13.7	8.3	6.9	1.4	5.4
0-8 years	21,590	391	224	179	45	167	18.6	10.8	8.8	2.1	7.7
9-11 years	122,081	1,762	1,010	824	186	752	14.8	8.6	7.1	1.5	6.2
12 years	84,582	929	593	497	96	336	11.3	7.3	6.2	1.1	4.0
13-15 years	8,051	69	54	43	11	15	8.9	7.0	5.6	*	*
16 years or more	73	1	1	1	-	-	*	*	*	*	*
Not stated	3,911	137	118	115	3	19	...	...	...	...	...

Black	121,517	2,472	1,517	1,303	214	955	20.3	12.5	10.7	1.8	7.9
0-8 years	10,688	261	154	128	26	107	25.0	15.0	12.6	2.4	9.9
9-11 years	66,537	1,369	778	660	118	591	21.0	12.2	10.4	1.8	8.8
12 years	38,365	683	453	389	64	230	18.3	12.3	10.7	1.7	6.0
13-15 years	4,155	66	47	45	2	19	16.4	11.9	11.4	*	*
16 years or more	21	-	-	-	-	-	*	*	*	*	*
Not stated	1,751	93	85	81	4	8	...	...	...	...	...
Mothers age 20 years and over											
All races ¹	2,539,226	25,219	17,011	14,263	2,748	8,208	9.9	6.7	5.6	1.1	3.2
0-8 years	69,259	862	526	408	118	336	12.8	7.9	6.2	1.7	4.9
9-11 years	294,007	4,349	2,457	2,018	439	1,892	15.2	8.7	7.2	1.5	6.5
12 years	1,094,427	10,863	7,285	6,093	1,192	3,578	10.2	7.0	5.9	1.1	3.3
13-15 years	564,224	4,765	3,380	2,833	547	1,385	8.7	6.3	5.3	1.0	2.5
16 years or more	478,768	3,225	2,386	1,999	387	839	7.0	5.2	4.4	0.8	1.8
Not stated	38,541	1,155	977	912	65	178	...	...	...	...	...
White	2,058,879	17,228	11,613	9,631	1,982	5,615	8.4	5.6	4.7	1.0	2.7
0-8 years	51,502	611	365	277	88	246	12.2	7.4	5.6	1.7	4.8
9-11 years	207,205	2,538	1,442	1,176	266	1,096	12.6	7.3	6.0	1.3	5.3
12 years	883,305	7,437	4,954	4,101	853	2,483	8.7	5.9	4.9	1.0	2.8
13-15 years	463,453	3,279	2,299	1,902	397	980	7.3	5.2	4.3	0.9	2.1
16 years or more	423,639	2,599	1,912	1,582	330	687	6.3	4.7	3.9	0.8	1.6
Not stated	29,775	764	641	593	48	123	...	...	...	...	...
Black	395,580	7,228	4,960	4,262	698	2,268	18.3	12.5	10.8	1.8	5.7
0-8 years	11,414	193	122	98	24	71	17.5	11.2	9.1	2.1	6.3
9-11 years	75,908	1,661	945	786	159	716	22.5	13.1	11.0	2.1	9.5
12 years	181,036	3,150	2,179	1,862	317	971	18.0	12.6	10.9	1.8	5.4
13-15 years	84,914	1,359	1,008	868	140	351	16.6	12.5	10.8	1.7	4.2
16 years or more	36,239	508	396	351	45	112	14.6	11.5	10.3	1.2	3.1
Not stated	6,069	357	310	297	13	47	...	...	...	...	...

¹Includes races other than white and black.

NOTE: Excludes data from the States of California, Texas, and Washington, which did not report educational attainment of mother on birth certificate.

Table 8. Live births, infant deaths, and infant mortality rates, by age at death, race of child, and month of pregnancy prenatal care began: United States, 1985 birth cohort

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0–6 days; late neonatal, 7–27 days; and postneonatal, 28 days–11 months. Not stated prenatal care proportionally distributed for calculation of rates. Rates are per 1,000 live births.]

Race and month of pregnancy prenatal care began	Number						Rate				
	Live births	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal	Infant deaths	Total neonatal	Early neonatal	Late neonatal	Post-neonatal
All races ¹	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
First month	525,903	5,156	3,716	3,103	613	1,440	10.3	7.5	6.3	1.2	2.8
Second month	1,449,461	12,477	8,514	7,097	1,417	3,963	9.0	6.2	5.2	1.0	2.8
Third month	826,634	7,760	4,908	4,067	841	2,852	9.8	6.3	5.2	1.0	3.5
Fourth month	347,044	3,603	2,070	1,671	399	1,533	10.8	6.3	5.1	1.2	4.5
Fifth month	196,418	2,244	1,273	1,015	258	971	11.9	6.9	5.5	1.3	5.0
Sixth month	120,002	1,355	617	474	143	738	11.7	5.4	4.2	1.2	6.2
Seventh month	80,613	784	305	206	99	479	10.0	4.0	2.7	1.3	6.0
Eighth month	47,326	431	160	112	48	271	9.4	3.6	2.5	1.0	5.8
Ninth month	20,683	243	122	90	32	121	12.2	6.2	4.6	1.6	5.9
No care	61,481	2,579	1,906	1,712	194	673	43.9	32.8	29.6	3.2	11.1
Not stated	85,268	2,513	1,982	1,770	212	531	...	...	...	...	...
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
First month	435,896	3,717	2,720	2,264	456	997	8.9	6.6	5.5	1.1	2.3
Second month	1,233,840	9,406	6,402	5,290	1,112	3,004	8.0	5.5	4.6	0.9	2.5
Third month	658,355	5,332	3,327	2,713	614	2,005	8.4	5.3	4.4	1.0	3.1
Fourth month	250,752	2,165	1,249	984	265	916	9.0	5.3	4.2	1.1	3.7
Fifth month	133,411	1,314	746	583	163	568	10.2	5.9	4.7	1.3	4.3
Sixth month	80,251	820	373	290	83	447	10.6	4.9	3.8	1.1	5.7
Seventh month	54,473	488	192	133	59	296	9.2	3.7	2.6	1.1	5.5
Eighth month	31,838	260	100	71	29	160	8.4	3.3	2.4	0.9	5.1
Ninth month	13,991	148	72	55	17	76	11.0	5.4	4.2	*	5.5
No care	38,823	1,256	910	802	108	346	33.9	24.8	22.0	2.9	9.0
Not stated	59,891	1,620	1,290	1,138	152	330	...	...	...	...	...
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
First month	68,582	1,229	866	734	132	363	18.7	13.3	11.4	2.0	5.4
Second month	161,472	2,653	1,839	1,587	252	814	17.2	12.0	10.4	1.6	5.1
Third month	133,662	2,146	1,433	1,232	201	713	16.7	11.3	9.8	1.5	5.4
Fourth month	79,832	1,285	750	628	122	535	16.7	9.9	8.4	1.6	6.8
Fifth month	52,834	826	467	384	83	359	16.2	9.3	7.7	1.6	6.9
Sixth month	33,045	470	218	166	52	252	14.7	6.9	5.3	1.6	7.7
Seventh month	21,509	249	97	62	35	152	11.9	4.7	3.1	1.7	7.2
Eighth month	12,429	148	52	36	16	96	12.2	4.4	3.1	*	7.8
Ninth month	5,331	83	46	32	14	37	16.1	9.1	6.4	*	7.0
No care	19,886	1,255	954	870	84	301	65.9	50.6	46.3	4.3	15.3
Not stated	19,727	796	617	563	54	179	...	...	...	...	...

¹Includes races other than white and black.

Table 9. Live births, infant deaths, and infant mortality rates, by detailed race of child: United States, 1983, 1984, and 1985 birth cohorts

[Live births and infant deaths are by State of residence at birth. Race is according to race reported on the matching birth certificate. Infant deaths are under 1 year of age. Neonatal deaths are under 28 days; early neonatal, 0-6 days; late neonatal, 7-27 days; and postneonatal, 28 days-11 months. Rates are per 1,000 live births.]

<i>Detailed race and birth cohort</i>	<i>Live births</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post-neonatal</i>	<i>Infant deaths</i>	<i>Total neonatal</i>	<i>Early neonatal</i>	<i>Late neonatal</i>	<i>Post-neonatal</i>
			Number				Rate				
1983 birth cohort											
All races	3,639,113	39,683	25,830	21,689	4,141	13,853	10.9	7.1	6.0	1.1	3.8
White	2,904,381	27,094	17,786	14,858	2,928	9,308	9.3	6.1	5.1	1.0	3.2
Black	586,085	11,087	7,202	6,151	1,051	3,885	18.9	12.3	10.5	1.8	6.6
American Indian or Alaskan Native . . .	41,591	598	293	224	69	305	14.4	7.0	5.4	1.7	7.3
Chinese	14,368	127	78	64	14	49	8.8	5.4	4.5	*	3.4
Japanese	8,667	59	34	30	4	25	6.8	3.9	3.5	*	2.9
Hawaiian	7,313	78	50	46	4	28	10.7	6.8	6.3	*	3.8
Filipino	17,658	144	89	70	19	55	8.2	5.0	4.0	*	3.1
Other Asian or Pacific Islander	57,399	473	281	231	50	192	8.2	4.9	4.0	0.9	3.3
Other races	1,651	23	17	15	2	6	13.9	*	*	*	*
1984 birth cohort											
All races	3,669,268	38,292	24,995	20,977	4,018	13,297	10.4	6.8	5.7	1.1	3.6
White	2,923,627	26,158	17,178	14,304	2,874	8,980	8.9	5.9	4.9	1.0	3.1
Black	592,760	10,630	6,927	5,946	981	3,703	17.9	11.7	10.0	1.7	6.2
American Indian or Alaskan Native . . .	41,444	520	252	192	60	268	12.5	6.1	4.6	1.4	6.5
Chinese	16,185	115	67	59	8	48	7.1	4.1	3.6	*	3.0
Japanese	9,345	61	33	29	4	28	6.5	3.5	3.1	*	3.0
Hawaiian	7,260	90	60	52	8	30	12.4	8.3	7.2	*	4.1
Filipino	19,855	170	105	92	13	65	8.6	5.3	4.6	*	3.3
Other Asian or Pacific Islander	56,577	520	350	283	67	170	9.2	6.2	5.0	1.2	3.0
Other races	2,215	28	23	20	3	5	12.6	10.4	9.0	*	*
1985 birth cohort											
All races	3,760,833	39,145	25,573	21,317	4,256	13,572	10.4	6.8	5.7	1.1	3.6
White	2,991,521	26,526	17,381	14,323	3,058	9,145	8.9	5.8	4.8	1.0	3.1
Black	608,309	11,140	7,339	6,294	1,045	3,801	18.3	12.1	10.3	1.7	6.2
American Indian or Alaskan Native . . .	42,647	531	254	208	46	277	12.5	6.0	4.9	1.1	6.5
Chinese	17,881	105	64	52	12	41	5.9	3.6	2.9	*	2.3
Japanese	9,803	63	39	31	8	24	6.4	4.0	3.2	*	2.4
Hawaiian	7,194	68	41	35	6	27	9.5	5.7	4.9	*	3.8
Filipino	21,482	173	114	86	28	59	8.1	5.3	4.0	1.3	2.7
Other Asian or Pacific Islander	59,263	512	323	274	49	189	8.6	5.5	4.6	0.8	3.2
Other races	2,733	27	18	14	4	9	9.9	*	*	*	*

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Appendix

Technical notes

Nature and sources of data

Data in this report for the 1983, 1984, and 1985 birth cohorts of live births and infant deaths are from birth certificates and death certificates for infants filed in the 50 States and the District of Columbia. Some of the data were coded by the National Center for Health Statistics (NCHS) from copies of original certificates received from the State registration offices and the remainder by the States, who provided them to NCHS through the Vital Statistics Cooperative Program (VSCP).

For 1983 and 1984, the VSCP included 46 States, which provided data based on 100 percent of their birth certificates. Data on births for 1983 and 1984 for Arizona, California, Delaware, the District of Columbia, and Georgia were based on a 50-percent sample of birth certificates, the even-numbered certificates filed in those States and coded by NCHS. To the national file of linked birth and infant death records was added information coded by NCHS for the odd-numbered birth certificates for those infants who died. Sampling procedures and sampling errors for 1983 and 1984 births are provided in the annual report, *Vital Statistics of the United States, Volume I, Natality*. For 1985, all States and the District of Columbia submitted data based on 100 percent of the birth certificates to NCHS through the VSCP.

For 1983 and 1984, nonmedical mortality data were provided by the 46 States in the VSCP on computer tape to NCHS. For Arizona, California, Delaware, Georgia, and the District of Columbia, which were not participants in the VSCP, NCHS coded all the nonmedical data. For 1985 and 1986, all States and the District of Columbia participated in the VSCP and submitted precoded nonmedical data for all deaths on computer tape to NCHS.

Statistics on births and deaths for the United States refer to events occurring within the United States to U.S. residents. Residence in this report is based on the usual place of residence of the mother at the time of the infant's birth.

Race classification

The racial designation used in this report is that of the child, which is determined from the race of the parents as entered on the birth certificate. When the parents are of different races and one parent is white, the child is assigned to the other parent's race. When the parents are of different races and neither parent is white, the child is assigned to the father's race with one exception: If the mother is Hawaiian or part

Hawaiian, the child is considered Hawaiian. When the race of one parent is missing on the certificate, the child is assigned the race of the other parent. When race is not reported for either parent, the child is assigned the race of the child on the immediately preceding record.

Births by marital status of mother

Beginning with 1980 data, marital status of mother is derived from two sources. For 41 States and the District of Columbia, marital status is reported directly on the birth certificate; for the remaining 9 States, which lack such an item, marital status is inferred from a comparison of the child's and parents' surnames. This method represents an attempt to use related information on the birth certificate to improve the quality of national data on this topic as well as to provide data for the individual nonreporting States. The method is based on a comparison of the child's surname, the mother's present and maiden surnames, and the father's surname. An evaluation of the new method and its continuing validity for California (the largest nonreporting State) was recently published (14).

Because of the substantial increase in all measures of nonmarital childbearing in 1985, an intensive evaluation of the national data was made. There has been continuing concern that the new method, incorporating data based on a comparison of surnames, might overstate the number of births to unmarried women, particularly among those women who have retained their maiden surname as their legal surname after marriage. The evaluation included comparisons of trends in all measures of births to unmarried mothers between 1980, when the new method was first put into use, and 1985. Trends in States with a marital status item on the birth certificate were compared with trends in those States providing inferential data based on a comparison of surnames. The comparisons were made for white and black births separately and by age of mother. The results were remarkably similar for both data sets. Nonmarital births increased at virtually the same rate in both sets of States. The findings were similar for white and black women and for the various age-of-mother groups.

Not-stated values and computation of percent distributions and infant mortality rates

Vital records with not-stated values for variables in the source document are handled in two different ways during the

processing of data. Not-stated values for race of decedent, sex, mother's age, and marital status are imputed based on other information on the record or on the previous record. Not-stated values for the following variables are retained during processing: Mother's educational attainment, month of pregnancy prenatal care began, live-birth order, birthweight, and date of last normal menstrual period (from which gestational age is derived). In this report, not-stated values for these variables are distributed in proportion to stated values for calculating percent distributions and variable-specific infant mortality rates. The proportional distribution of not-stated values for the denominator (live births) incorporates the distribution of not-stated values for the numerator, a subgroup of the denominator.

Birth cohort infant mortality rates shown throughout this report are based on deaths under 1 year of age that occur in the year of birth or the following year to all infants born in a calendar year, the birth cohort. Birth cohort infant mortality rates differ from the more commonly used measure of infant mortality, which is based on the number of live births and infant deaths that occur in the same calendar year period. Period infant mortality rates are published by NCHS in *Vital Statistics of the United States, Volume II, Mortality*, section 2.

Birth cohort infant mortality rates are calculated by dividing the number of infant deaths to the birth cohort by the number of live births in the cohort and are presented as rates per 1,000 live births in the cohort. In contrast, period infant mortality rates based on annual data 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 also presented as rates per 1,000 live births. In this report, only birth cohort infant mortality rates are presented.

Random variation

Although the mortality data in this report are not subject to sampling error, they may be affected by random variation in the number of deaths involved. 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. For this distribution, a simple approximation may be used to estimate the confidence interval, as follows:

If N is the number of registered deaths in the population and R is the corresponding rate, the chances are 19 in 20 (95-percent confidence interval) that

$$N - 2\sqrt{N} \text{ and } N + 2\sqrt{N}$$

covers the "true" number of events; and

$$(R - 2)\frac{R}{\sqrt{N}} \text{ and } (R + 2)\frac{R}{\sqrt{N}}$$

covers the "true" rate.

If the rate R corresponding to N events is compared with the rate S corresponding to M events, the difference between the two rates may be regarded as statistically significant if it exceeds

$$2\sqrt{\frac{R^2}{N} + \frac{S^2}{M}}$$

Additional information on random variation may be found in the Technical appendix of *Vital Statistics of the United States, 1988, Volume II, Mortality, Part A*.

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For answers to questions about this report or for a list of reports published in these series, contact:

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