

Series 20

No. 26



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# Vital and Health Statistics

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From the CENTERS FOR DISEASE CONTROL AND PREVENTION / National Center for Health Statistics

## Perinatal Mortality in the United States: 1985–91

August 1995



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Centers for Disease Control and Prevention  
National Center for Health Statistics



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**Suggested citation**

Hoyert DL. Perinatal mortality in the United States, 1985–91. National Center for Health Statistics. Vital Health Stat 20(26). 1995.

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**Library of Congress Cataloging-in-Publication Data**  
**Perinatal mortality in the United States.**

p. cm. — (Vital and health statistics. Series 20, Data from the national vital statistics system ; no. 26) (DHHS publication ; no. (PHS) 95-1854)

"August 1995".

ISBN 0-8406-0508-0

1. Perinatal death—United States—Statistics. 2. Perinatal death—United States—States—Statistics. 3. United States—Statistics, Medical. I. National Center for Health Statistics (U.S.) II. Series. III. Series: DHHS publication ; no. (PHS) 95-1854.

HB1335.A18 no. 26

[RG632.U6]

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95-30868

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# Vital and Health Statistics

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## Perinatal Mortality in the United States: 1985–91

Series 20:  
Data From the National Vital  
Statistics System  
No. 26

This report presents recent trend data on perinatal mortality. Deaths and mortality rates are shown by race and State. In addition, the rank of the United States' perinatal mortality rate relative to other countries is presented.

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Centers for Disease Control and Prevention  
National Center for Health Statistics  
Hyattsville, Maryland  
August 1995  
DHHS Publication No. (PHS) 95-1854

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**Symbols**

- - - Data not available
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  - \* Figure does not meet standard of reliability or precision (estimate is based on fewer than 20 deaths in numerator or denominator)
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# Perinatal Mortality in the United States: 1985–91

by Donna L. Hoyert, Ph.D., Division of Vital Statistics

## Highlights

In 1991 a total of 35,926 perinatal deaths occurred in the United States; this includes fetal deaths occurring at 28 weeks of gestation or later and infant deaths occurring under 7 days of age. The perinatal mortality rate was at a record low of 8.7 perinatal deaths per 1,000 live births and fetal deaths, 19 percent lower than the rate in 1985.

Perinatal mortality rates differ by race. In 1991 the rates for the white and black populations were 7.4 and 15.7 perinatal deaths per 1,000 live births and fetal deaths, respectively. The rate for the Hispanic population was 7.9 compared with a rate of 7.1 for the non-Hispanic white population of an area comprised of 36 States and the District of Columbia. This area includes those States that reported Hispanic origin and whose reporting completeness was considered adequate for analysis.

Variation in perinatal mortality rates is evident within the United States. States with the lowest rates typically are located

west of the Mississippi River and States with the highest rates, east of the Mississippi. Geographic patterns differ by race, but a few States have either high or low rates for the black and white populations. Likewise, perinatal mortality rates differ between the United States and other industrialized countries. In terms of international ranking of perinatal rates, the substantial decline in the rate in the United States has been less than that of other industrialized countries. Consequently, the U.S. rank has deteriorated over the past 40 years relative to other industrialized countries.

The trends observed for perinatal mortality are similar to the trends for infant and fetal mortality. Rates for all three decreased between 1985 and 1991 but the average annual decrease is greatest for perinatal mortality.

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NOTES: This report was prepared in the Division of Vital Statistics under the general direction of Harry M. Rosenberg, Ph.D., Chief, Mortality Statistics Branch. This report closely follows the format of two previous reports on perinatal mortality prepared by Eve Powell-Griner, Ph.D., formerly of the National Center for Health Statistics staff. Marian F. MacDorman, Ph.D., Mortality Statistics Branch, and Robert B. Hartford, Ph.D., Office of International Statistics, peer-reviewed this report. Betty L. Smith of the Statistical Resources Branch provided content review. Charles E. Royer of the Systems and Programming Branch provided programming support. Staff of the Registration Methods Branch and the Technical Services Branch provided consultation to State vital statistics offices regarding collection of the vital statistics data on which this report is based. This report was edited by Patricia Keaton-Williams and typeset by Annette F. Facemire of the Publications Branch, Division of Data Services.

# Introduction

This report describes recent levels of perinatal mortality in the United States for 1985–91. Two previous reports described trends in perinatal mortality for the periods 1950–81 (1) and 1981–85 (2). Perinatal deaths include spontaneous fetal deaths of a specified gestational age and neonatal deaths. National Center for Health Statistics (NCHS) has developed three definitions of perinatal mortality derived from data on three types of vital events—fetal deaths, infant deaths, and live births. These perinatal mortality measures supplement other statistics on fetal and infant mortality published by NCHS in *Vital Statistics of the United States, Volume II, Mortality, Part A*.

## Development of perinatal mortality measures

Perinatal mortality is comprised of fetal and infant deaths. A fetal death refers to the death of a product of human conception before complete extraction or expulsion from its mother, irrespective of the duration of pregnancy (3). In this report, fetal deaths refer only to deaths of fetuses of at least 20 weeks of gestation. (For further details, see Technical notes.) Fetal deaths can be further characterized as “early” (20–27 weeks of gestation) and “late” (28 weeks of gestation or more). An infant death refers to the death of a liveborn infant under 1 year of age. Typically, infant deaths are described in terms of neonatal (under 28 days of age) and postneonatal (aged 28 days–11 months) deaths. Neonatal deaths can be further divided into “early” (under 7 days of age) and “late” (aged 7–27 days) components. Perinatal deaths refer to a combination of fetal deaths of at least 20 weeks of gestation and neonatal deaths; definitions of perinatal death used by NCHS vary depending on whether deaths in the “early” or “late” fetal or neonatal periods are included (1).

The concept of a perinatal period emerged in the late 1940’s as physicians and other researchers became increasingly aware of the relatively large number of deaths occurring in the period immediately before and after delivery. This concept reflected the belief that circumstances responsible for the majority of neonatal deaths arose from conditions established before delivery or from the stresses introduced by the birth process. Because many of these same circumstances were responsible for fetal deaths at 20 weeks of gestation or more, a concept that combined fetal deaths of at least 20 weeks of gestation with infant deaths under 28 days of age seemed particularly useful in studying reproductive loss (4).

Another factor contributing to the interest in developing a new mortality measure was the awareness that some infant deaths occurring shortly after birth were reported as fetal deaths and that fetal deaths were sometimes reported as infant deaths (1).

The term “perinatal mortality” was first proposed by Sigismund Peller in 1948 (5) to denote deaths of fetuses during pregnancy and labor and deaths of infants in the early days of life. In 1954 the World Health Organization (WHO) supported the concept of perinatal mortality but did not specify the range of the perinatal period (6). The 1956 Public Health Conference on Records and Statistics (PHCRS) in the United States recommended that for general use in analysis of vital record data within this country the perinatal mortality rate include fetal deaths at 20 weeks of gestation or more and infant deaths under 7 days of age. However, PHCRS acknowledged the usefulness of perinatal mortality rates based on fetal deaths at 20 weeks of gestation or more and infant deaths under 28 days of age, particularly for evaluation of maternal and child health programs (7). In 1965 the WHO recommended that the definition of the perinatal period include fetal deaths from the 28th completed week of pregnancy and neonatal deaths of under 7 days of age. At that time, the WHO also encouraged countries not already doing so to extend requirements for reporting of perinatal data down to the 20th completed week of gestation and up to the 28th day of life (8).

The recommendations of the WHO and PHCRS are the basis for the three perinatal mortality measures generally used in the United States. Perinatal Definition I, the most restrictive definition, refers only to fetal deaths at 28 weeks of gestation or more and infant deaths under 7 days of age. The most inclusive measure, Perinatal Definition II, refers to fetal deaths at 20 weeks of gestation or more and infant deaths under 28 days of age. Perinatal Definition III includes fetal deaths at 20 weeks of gestation or more and infant deaths under 7 days of age.

Effective with data for 1979, NCHS began publishing statistics for all three perinatal measures; however, this report, like the two previous reports (1,2), focuses on Perinatal Definition I for the following reasons:

- Definition I limits the infant death group to those under 7 days of age; during this early infant period, prenatal conditions and circumstances surrounding the delivery have more effect on mortality than do postnatal factors (4).
- Definition I limits fetal deaths to those at 28 weeks of gestation or more; such deaths appear to be better reported than those occurring before 28 weeks of gestation (9).

- More than two-thirds of all perinatal deaths by the broadest definition (II) occurred within the period encompassed by Definition I in 1991.
- Definition I is generally used for international comparisons.

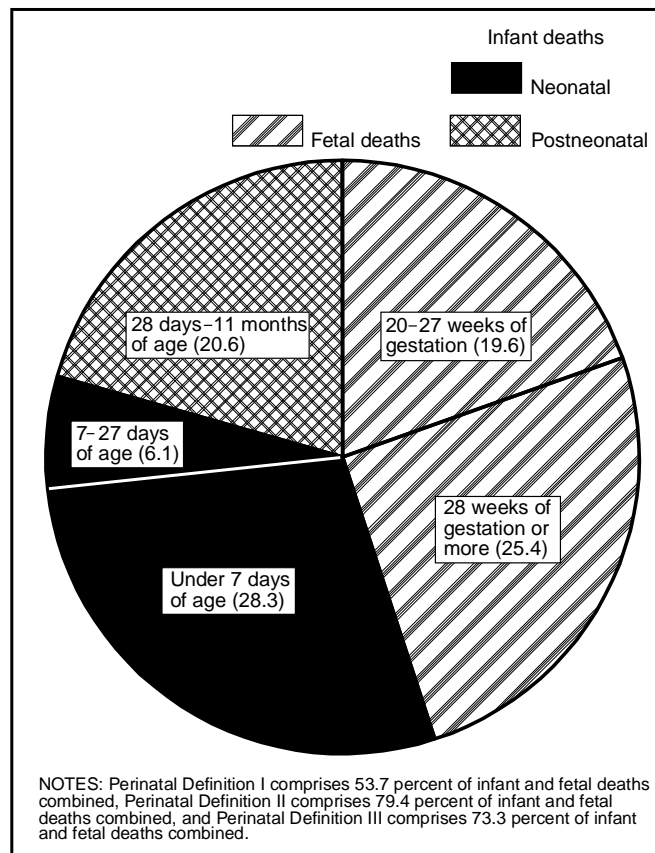
Although the text of this report emphasizes Perinatal Definition I, the detailed tables show values for all three perinatal definitions. Additional information on WHO recommendations and presentation of perinatal mortality is provided in the Technical notes.

Measures of perinatal mortality estimate the risk of death in the perinatal period and can be expressed as either a rate or a ratio. The perinatal rate is defined as the number of perinatal deaths per 1,000 live births and fetal deaths. The perinatal ratio is the number of perinatal deaths per 1,000 live births. The perinatal mortality rate is the preferred measure because for any data year, the denominator more closely approximates the population at risk. However, actual numerical differences between perinatal mortality rates and ratios in the United States are small, and the relative difference between the two measures decreases as perinatal mortality decreases (2).

In recent years, other perinatal mortality measures have been introduced. One of these, the fetoinfant mortality rate developed by the International Collaborative Effort on Perinatal and Infant Mortality, broadens perinatal mortality to include the entire infant period (10). Like other perinatal mortality measures, the fetoinfant mortality rate avoids problems in the distinction between a fetal death and live birth, which complicates, in particular, international comparisons. In comparison to the traditional perinatal mortality rate, the fetoinfant mortality rate provides more encompassing information on pregnancy performance through the first year of life. The perinatal mortality measures presented in this report and the fetoinfant mortality rate ignore fetal losses early in pregnancy; although these losses are an important component of pregnancy performance, they are poorly reported even in the industrialized countries.

### Components of fetal and infant mortality

The distribution of fetal deaths and infant deaths by age at death for 1991 is shown in figure 1. The largest proportion of these events is accounted for by early neonatal deaths (28.3 percent), followed by late fetal deaths (25.4 percent). Postneonatal deaths accounted for 20.6 percent of fetal deaths and infant deaths combined. Fetal deaths at 20–27 weeks of gestation (19.6 percent) and late neonatal deaths (6.1 percent) contributed least to reported fetal and infant mortality. Perinatal deaths, according to Perinatal Definition I, included over one-half (53.7 percent) of the infant deaths and fetal deaths at 20 weeks of gestation or more.



**Figure 1. Percent distribution of fetal and infant deaths combined: United States, 1991**

Trends in numbers of fetal and infant deaths and their relative distribution are shown in table A. The sum of the number of fetal deaths at 20 weeks of gestation or more and infant deaths continued a long-standing pattern of decline, decreasing from 69,691 in 1985 to 66,926 in 1991. The percentage of fetal and infant deaths encompassed by Perinatal Definition I deaths also continued to decrease, dropping from 58.2 percent in 1985 to 53.7 percent in 1991. The relative proportion of the components changed, but ranking of the components remained unchanged: Deaths of fetuses at 28 weeks of gestation or more and of early neonatal deaths were greater than the numbers of deaths of any other component group; late neonatal deaths contributed the fewest deaths of any of the components. Between 1985 and 1991, the early fetal death component increased from 15.7 to 19.6 percent of all fetal and infant deaths, continuing an earlier trend that may reflect improvements in reporting early fetal deaths.

**Table A. Number and percent distribution of components of fetal and infant deaths combined: United States, 1950, 1960, 1970, 1980, and 1985–91**

Year	Infant deaths						
	Fetal and infant deaths	Fetal deaths		Neonatal deaths			Perinatal Definition I <sup>2</sup>
		Early (20–27 weeks of gestation) <sup>1</sup>	Late (28 weeks of gestation or more) <sup>1</sup>	Early (Under 7 days of age)	Late (7–27 days of age)	Postneonatal deaths (28 days–11 months of age)	
				Number			
1991	66,926	13,150	17,010	18,916	4,062	13,788	35,926
1990	69,737	13,427	17,959	20,020	4,289	14,042	37,979
1989	70,124	12,405	18,064	20,796	4,372	14,487	38,860
1988	68,352	11,855	17,587	20,471	4,219	14,220	38,058
1987	67,757	11,683	17,666	20,471	4,156	13,781	38,137
1986	67,863	11,115	17,857	21,053	4,159	13,679	38,910
1985	69,691	10,958	18,703	21,865	4,314	13,851	40,568
1980	78,879	10,754	22,599	25,492	5,126	14,908	48,091
1970	127,528	17,170	35,791	50,821	5,458	18,288	86,612
1960	179,353	16,496	51,984	71,125	8,608	31,140	123,109
1950	172,087	14,522	53,740	63,417	9,438	30,970	117,157
				Percent distribution			
1991	100.0	19.6	25.4	28.3	6.1	20.6	53.7
1990	100.0	19.3	25.8	28.7	6.2	20.1	54.5
1989	100.0	17.7	25.8	29.7	6.2	20.7	55.4
1988	100.0	17.3	25.7	29.9	6.2	20.8	55.7
1987	100.0	17.2	26.1	30.2	6.1	20.3	56.3
1986	100.0	16.4	26.3	31.0	6.1	20.2	57.3
1985	100.0	15.7	26.8	31.4	6.2	19.9	58.2
1980	100.0	13.6	28.7	32.3	6.5	18.9	61.0
1970	100.0	13.5	28.1	39.9	4.3	14.3	67.9
1960	100.0	9.2	29.0	39.7	4.8	17.4	68.6
1950	100.0	8.4	31.2	36.9	5.5	18.0	68.1

<sup>1</sup>Figures for gestational age not stated are distributed; see Technical notes.

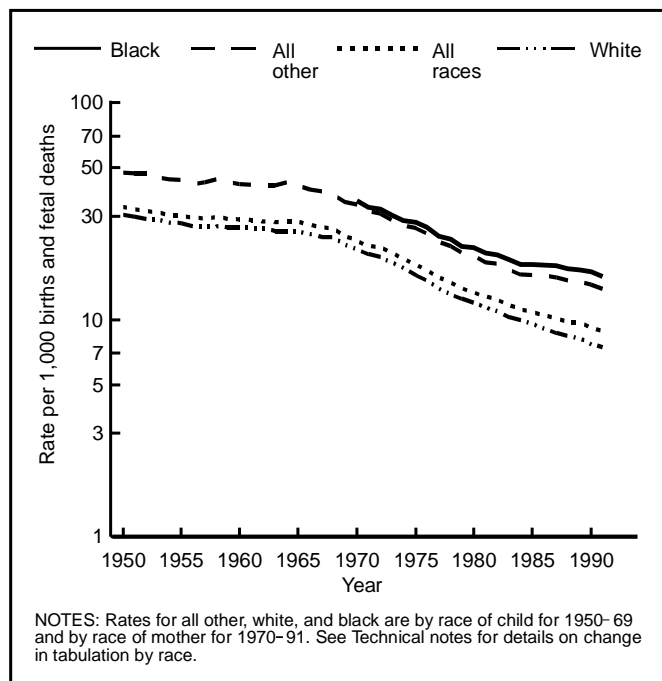
<sup>2</sup>Perinatal Definition I refers to infant deaths under 7 days of age (early neonatal) and fetal deaths with stated or presumed gestation of 28 weeks or more (late fetal). Figures for gestational age not stated are distributed for fetal deaths. The numbers for Definition I differ from those published in *Vital Statistics of the United States, Volume II*; see Technical notes.

# Trends and differentials in perinatal mortality

In 1991 a total of 35,926 perinatal deaths occurred in the United States, a decrease of 4,623 (11 percent) from the number in 1985 (table A). The perinatal mortality rate of 8.7 perinatal deaths per 1,000 live births and fetal deaths (Perinatal Definition I) is the lowest perinatal rate yet recorded in the United States; it represents a decrease of 19 percent since 1985, continuing the generally downward trend since 1950 (figure 2 and table 1).

The average annual decline in the perinatal mortality rate between 1985 and 1991 (3.4 percent) was somewhat less than the decline in the rate between 1980 and 1985 (4.1 percent) because of a slowing in the rate of decline for neonatal and late fetal mortality. The average annual decline in the early

infant deaths per 1,000 live births is the lowest rate ever recorded in the United States. Likewise, the fetal mortality rate of 7.3 fetal deaths per 1,000 live births and fetal deaths is the lowest rate yet recorded in the United States. The average annual decrease in infant and fetal mortality rates (2.9 and 1.1 percent, respectively) was less than that for the perinatal mortality rate (Perinatal Definition I) between 1985 and 1991 (3.4 percent). This reflects that perinatal mortality is comprised of two subcomponents of fetal and infant mortality, a late fetal and an early neonatal period component, for which rates decreased more than for the total fetal and infant rates, respectively.



**Figure 2. Perinatal mortality by race: United States, 1950-91**

neonatal mortality rate slowed from 4.0 percent during 1980 to 1985 to 3.8 percent between 1985 and 1991. Likewise, the decline in the late fetal mortality rate decelerated from 4.6 percent to 2.9 percent annually during these two periods, respectively.

However, perinatal mortality declined more rapidly than either infant mortality (all deaths of infants under 1 year of age) or fetal mortality (gestations of 20 weeks or more) during 1985 through 1991. The 1991 infant mortality rate of 8.9

## Race and ethnic differentials

The perinatal mortality rate for the black population in 1991 (15.7) was 2.1 times that of the white population (7.4) (table 1), considerably higher than the ratio of the rates in 1985 (1.9). The widening gap in perinatal mortality between the two major race groups results from a much greater slowing in the rate of decline in perinatal mortality for the black population compared with the white population. For the white population, the average annual decline in the perinatal mortality rate between 1985 and 1991 was 4.1 percent compared to 4.2 between 1980 and 1985. For the black population, the declines were 2.2 percent and 3.4 percent, respectively. (For details on tabulation of race in perinatal mortality, see Technical notes.)

Changes in both major components of perinatal mortality contributed to the increase in the race differential in perinatal mortality during 1985 through 1991. The decline in the late fetal mortality rate (fetal deaths at 28 weeks of gestation or more) was much greater for white fetuses (17.8 percent) than for black fetuses (12.5 percent). Similarly, the decline in the early neonatal mortality rate (infant deaths under 7 days of age) was substantially greater for the white population (26.0 percent) than for the black population (13.0 percent).

In 1991 the perinatal mortality rate for the Hispanic population (7.9) was 11 percent higher than that of the non-Hispanic white population (7.1) for an area comprised of 36 States and the District of Columbia (table 2). States included were those with an Hispanic-origin item and at least 90 percent completion of the item on a place-of-occurrence basis. In the 1990 Census 83 percent of the Hispanic population living in the United States lived in this area.

Race and ethnic differentials in perinatal mortality like those for infant mortality may reflect differences in socioeconomic status, access to medical care, and the prevalence of specific risks (11). Likewise, race and ethnic differentials in perinatal mortality are associated with differentials in the birthweight distribution of these groups. Vital statistics data available for 1988 (not shown in this report) indicate that more than three-quarters of all perinatal deaths were of low birthweight although fewer than one-tenth of the deliveries were of low birthweight (12).

## Geographic differentials

Perinatal mortality rates (Perinatal Definition I) are shown by State and race in this report for the combined period of 1989–91 to increase the reliability and stability of the rates (table 3). Perinatal mortality rates varied greatly by State, with a range of 6.1 to 21.2 perinatal deaths per 1,000 live births and fetal deaths.

Perinatal mortality generally is less than the national rate for States west of the Mississippi River and in New England and greater than the national rate for States with borders on the Gulf of Mexico and the Atlantic Ocean (e.g., Georgia, Louisiana, New York, North Carolina) (figure 3). Rates are also greater than the national rate in Illinois and Indiana. Data limitations that affect geographic comparability are discussed in the Technical notes.

Geographic patterns of perinatal mortality differ by race; however, there are some similarities. For the white population (figure 4), more States with lower rates than the national rate are located west of the Mississippi River and all States with higher rates are east of the Mississippi. Two groups of adjoining States with high rates are evident: (a) Illinois, Indiana, Ohio, West Virginia, Pennsylvania, and New York, and (b) Alabama, Georgia, South Carolina, and North Carolina.

For the black population (figure 5), States in the West South Central region (i.e., Arkansas, Louisiana, Oklahoma, and Texas) have lower perinatal rates than the national rate. The States with higher rates than the U.S. perinatal mortality rate are located within or near the previously noted high States for the white population. High States common to both race groups are Georgia, Illinois, New York, and Pennsylvania, and low States in common are Alaska and Massachusetts.

## International comparisons, 1950–90

Although perinatal mortality has declined in the United States by more than 70 percent between 1950 and 1990, the United States' ranking (table 4) relative to countries with at least 1 million population and complete demographic counts has deteriorated over the same period from 3rd lowest to 19th lowest perinatal mortality rate (13). Data limitations that affect international comparability of perinatal statistics are discussed in the Technical notes.

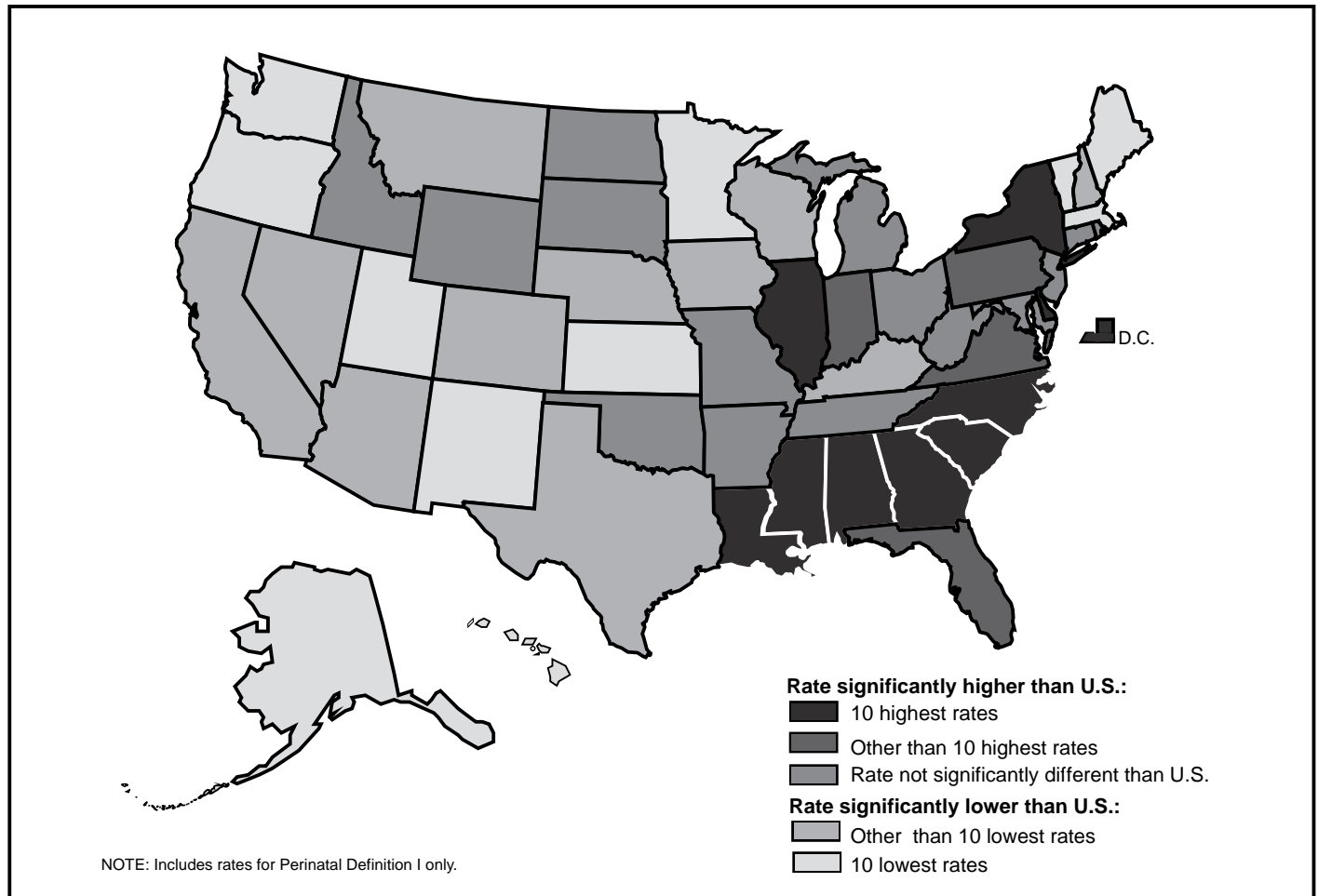


Figure 3. Perinatal mortality rates for all races by State, 1989–91

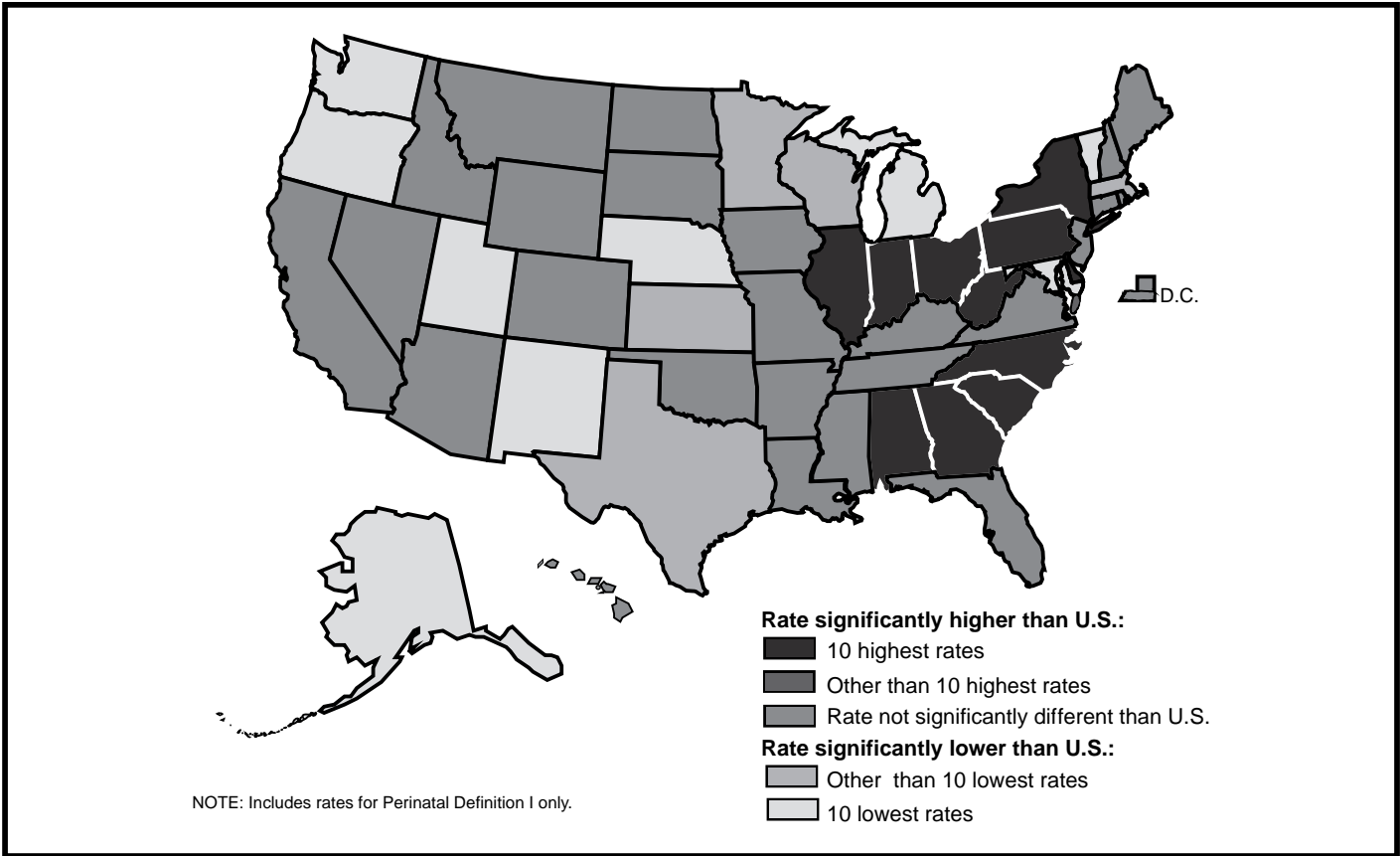


Figure 4. Perinatal mortality rates for the white population by State, 1989-91

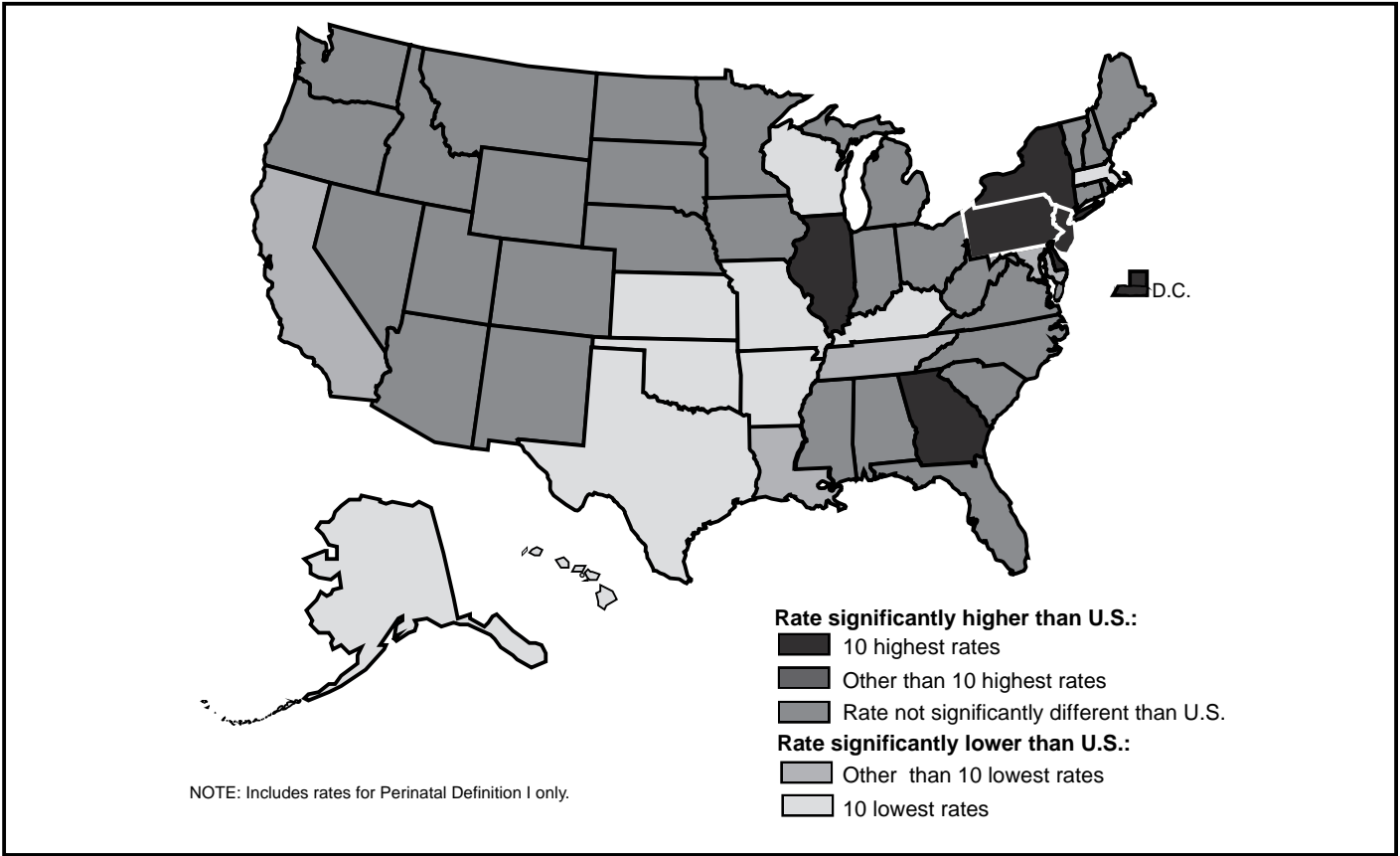
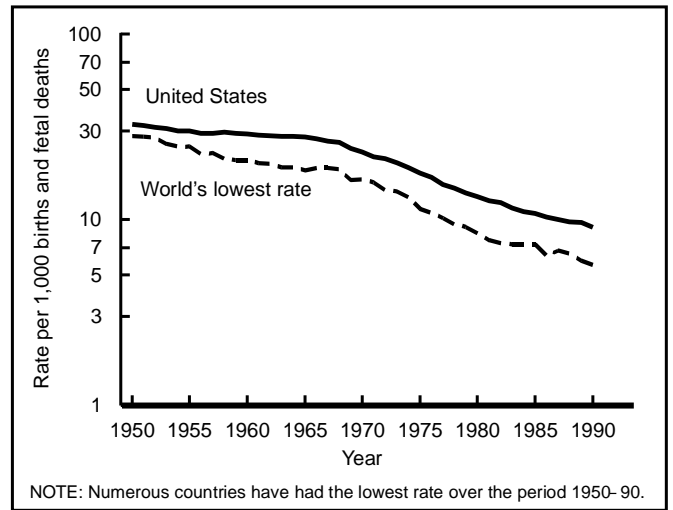


Figure 5. Perinatal mortality rates for the black population by State, 1989-91

The list of countries for which perinatal mortality rates have been ranked between 1950 and 1990 has changed. During this period, countries such as Chile, Costa Rica, Cuba, the German Democratic Republic, and Greece have been added to those considered in ranking perinatal rates. However, the only country with a lower rate than the United States in 1990 that was not in the list in 1950 is Northern Ireland. Consequently, the change in the U.S. rank does not result from changes in the list of countries that are ranked.

Instead, over this 40-year period, the ranking of the United States' perinatal mortality rate deteriorated because the decline in the rate in the United States has not kept pace with the decline in other countries (figure 6). The perinatal rate for the United States in the 1950's was roughly 20 percent greater than that for the country with the best rate; by the 1980's, the U.S. rate was close to 60 percent greater than that for the country with the lowest rate. As the differential between the United States and the country with the lowest perinatal rate widened, rates for 14 countries that had higher perinatal rates than the United States in 1950 improved to the point where their rates were better than that of the United States in 1990. These countries include Australia, Austria, Canada, Denmark,

England and Wales, Finland, Federal Republic of Germany, Hong Kong, Japan, New Zealand, Scotland, Singapore, Sweden, and Switzerland.



**Figure 6. International perinatal rates: United States and world's lowest rates, 1950-90**

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**Table 1. Perinatal mortality rates for perinatal definitions I, II, and III by race: United States, 1950–91**

[Perinatal Definition I includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 28 weeks or more; Perinatal Definition II includes infant deaths under 28 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more; Perinatal Definition III includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more. Rates per 1,000 live births and fetal deaths in specified group]

Year	Perinatal Definition I <sup>1</sup>			Perinatal Definition II			Perinatal Definition III		
	All races	White	Black	All races	White	Black	All races	White	Black
	Race of mother and child <sup>2</sup>								
1991	8.7	7.4	15.7	12.8	10.7	23.9	11.9	9.9	22.1
1990	9.1	7.7	16.4	13.3	11.1	24.7	12.3	10.2	22.9
1989	9.6	8.2	16.8	13.7	11.5	24.9	12.6	10.6	23.0
1988	9.7	8.3	17.1	13.7	11.6	24.9	12.7	10.7	23.2
1987	10.0	8.6	17.5	14.1	12.0	25.2	13.0	11.1	23.4
1986	10.3	9.0	17.6	14.3	12.4	24.9	13.2	11.4	23.2
1985	10.7	9.5	17.9	14.7	12.9	25.3	13.6	11.9	23.5
1984	11.0	9.8	17.9	15.1	13.3	25.1	14.0	12.3	23.4
1983	11.5	10.2	18.7	15.6	13.7	26.5	14.5	12.6	24.6
1982	12.3	10.9	19.7	16.4	14.5	27.5	15.2	13.4	25.4
1981	12.6	11.2	20.0	16.9	14.9	27.8	15.6	13.8	25.6
1980	13.2	11.8	21.3	17.5	15.4	29.1	16.1	14.2	26.8
1979	13.8	12.4	21.7	18.1	16.0	29.7	16.7	14.7	27.5
1978	14.6	12.9	23.3	19.0	16.6	31.6	17.5	15.3	29.3
1977	15.4	13.8	24.0	19.6	17.3	32.2	18.1	16.0	29.5
1976	16.7	15.0	26.5	21.1	18.7	34.4	19.6	17.3	31.7
1975	17.7	15.9	27.6	22.1	19.6	35.6	20.5	18.2	32.9
1974	18.9	17.2	28.3	23.5	21.1	36.7	21.9	19.7	34.1
1973	20.1	18.2	30.0	24.9	22.3	38.9	23.4	20.9	36.5
1972	21.2	19.2	32.1	26.0	23.1	41.1	24.5	21.9	38.5
1971	21.7	19.8	32.5	27.3	24.4	43.0	25.9	23.2	40.7
1970	23.0	20.9	34.9	28.9	25.8	46.0	27.4	24.6	43.6
	Race of child <sup>3</sup>								
1990	9.1	7.8	15.7	13.3	11.2	23.7	12.3	10.3	22.0
1989	9.6	8.3	16.2	13.7	11.6	24.0	12.6	10.7	22.3
1988	9.7	8.4	16.5	13.7	11.7	24.1	12.7	10.8	22.4
1987	10.0	8.7	16.9	14.1	12.1	24.4	13.0	11.1	22.7
1986	10.3	9.1	17.0	14.3	12.5	24.1	13.2	11.5	22.5
1985	10.7	9.6	17.4	14.7	13.0	24.5	13.6	12.0	22.7
1984	11.0	9.9	17.4	15.1	13.4	24.4	14.0	12.4	22.8
1983	11.5	10.3	18.2	15.6	13.8	25.7	14.5	12.7	24.0
1982	12.3	11.0	19.1	16.4	14.6	26.7	15.2	13.5	24.7
1981	12.6	11.3	19.4	16.9	15.0	27.1	15.6	13.8	25.0
1980	13.2	11.9	20.7	17.5	15.6	28.3	16.1	14.3	26.1
1979	13.8	12.5	21.1	18.1	16.1	28.9	16.7	14.8	26.8
1978	14.6	13.0	22.7	19.0	16.7	30.8	17.5	15.4	28.6
1977	15.4	13.9	23.5	19.6	17.4	31.5	18.1	16.1	28.9
1976	16.7	15.1	25.8	21.1	18.8	33.6	19.6	17.4	31.0
1975	17.7	16.0	26.9	22.1	19.7	34.8	20.5	18.3	32.2
1974	18.9	17.3	27.8	23.5	21.2	36.0	21.9	19.8	33.5
1973	20.1	18.3	29.5	24.9	22.4	38.3	23.4	21.0	35.9
1972	21.2	19.3	31.5	26.0	23.3	40.4	24.5	22.0	37.9
1971	21.7	19.8	32.0	27.3	24.5	42.4	25.9	23.3	40.2
1970	23.0	21.0	34.5	28.9	25.9	45.4	27.4	24.6	43.0
1969	23.9	21.8	---	29.3	26.2	---	27.8	25.0	---
1968	25.8	23.5	---	31.4	28.1	---	30.0	26.9	---
1967	26.2	23.7	---	31.6	28.2	---	30.1	26.8	---
1966	26.9	24.3	---	32.4	28.8	---	30.8	27.5	---
1965	27.6	25.0	---	33.3	29.6	---	31.5	28.1	---
1964	28.0	25.2	---	33.7	29.8	---	31.9	28.4	---
1963 <sup>4</sup>	27.9	25.3	---	33.5	29.9	---	31.7	28.4	---
1962 <sup>4</sup>	28.1	25.7	---	33.7	30.4	---	31.9	28.9	---
1961	28.3	25.9	---	34.0	30.6	---	32.1	29.0	---
1960	28.6	26.2	---	34.3	30.9	---	32.3	29.3	---
1959	28.8	26.3	---	34.6	31.2	---	32.5	29.5	---
1958	29.3	26.7	---	35.4	31.9	---	33.1	30.0	---
1957	28.8	26.5	---	34.8	31.6	---	32.5	29.7	---
1956	28.9	26.6	---	34.8	31.6	---	32.6	29.8	---
1955	29.7	27.4	---	35.6	32.4	---	33.5	30.6	---
1954	29.8	27.5	---	35.9	32.8	---	33.6	30.9	---
1953	30.6	28.3	---	36.7	33.6	---	34.3	31.6	---

See footnotes at end of table.

**Table 1. Perinatal mortality rates for perinatal definitions I, II, and III by race: United States, 1950–91—Con.**

[Perinatal Definition I includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 28 weeks or more; Perinatal Definition II includes infant deaths under 28 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more; Perinatal Definition III includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more. Rates per 1,000 live births and fetal deaths in specified group]

Year	Perinatal Definition I <sup>1</sup>			Perinatal Definition II			Perinatal Definition III		
	All races	White	Black	All races	White	Black	All races	White	Black
Race of child <sup>3</sup> —Con.									
1952 . . . . .	31.1	28.7	---	37.4	34.1	---	34.9	32.0	---
1951 . . . . .	31.8	29.4	---	38.1	35.0	---	35.6	32.8	---
1950 . . . . .	32.5	30.1	---	39.0	35.8	---	36.4	33.6	---

<sup>1</sup>Figures for gestational age not stated are distributed for fetal deaths; see Technical notes.

<sup>2</sup>Fetal deaths and live births, by race of mother; infant deaths by race of child.

<sup>3</sup>Fetal deaths by race of fetus; live births and infant deaths, by race of child.

<sup>4</sup>Figures by race exclude data for residents of New Jersey; see Technical notes.

**Table 2. Perinatal mortality rates by specified Hispanic origin and race for non-Hispanic origin: Total of 31 States, 1989, and 36 States and the District of Columbia, 1990 and 1991**

[Perinatal Definition I includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 28 weeks or more; Perinatal Definition II includes infant deaths under 28 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more; Perinatal Definition III includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more; see Technical notes. Fetal deaths and live births based on race and Hispanic origin of mother; infant deaths based on race and Hispanic origin of child; see Technical notes. Rates per 1,000 live births and specified fetal deaths]

Year	All origins <sup>1</sup>	Hispanic					Non-Hispanic		
		Total	Mexican	Puerto Rican	Cuban	Other Hispanic <sup>2</sup>	Total <sup>3</sup>	White	Black
Perinatal Definition I									
1991	8.7	7.9	7.8	8.2	7.7	8.4	8.7	7.1	15.6
1990	9.1	8.5	8.4	9.5	8.4	8.7	9.0	7.5	15.9
1989	9.5	9.0	8.5	10.1	10.1	10.5	9.3	7.9	16.0
Perinatal Definition II									
1991	12.7	11.0	10.7	12.2	11.5	12.1	12.7	10.3	23.4
1990	13.1	11.5	11.2	13.3	12.8	12.4	13.1	10.8	23.7
1989	13.4	12.1	11.3	13.9	14.0	14.5	13.3	11.1	23.4
Perinatal Definition III									
1991	11.7	10.2	9.8	11.3	10.6	11.5	11.7	9.5	21.6
1990	12.1	10.7	10.3	12.4	11.7	11.6	12.1	9.9	22.0
1989	12.3	11.2	10.5	13.1	13.2	13.4	12.2	10.1	21.6

<sup>1</sup>Figures for origin not stated included in "all origins" but not distributed among origins.

<sup>2</sup>Includes Central and South American and other and unknown Hispanic.

<sup>3</sup>Includes races other than white and black.

**Table 3. Perinatal mortality rates for perinatal definitions I, II, and III by race: United States, each State, and the District of Columbia, 1989–91 combined**

[Perinatal Definition I includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 28 weeks or more; Perinatal Definition II includes infant deaths under 28 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more; Perinatal Definition III includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 20 weeks or more. Rates per 1,000 live births and fetal deaths in specified group]

Area and race	Perinatal Definition I <sup>1</sup>			Perinatal Definition II			Perinatal Definition III		
	All races	White	Black	All races	White	Black	All races	White	Black
	Rates <sup>2</sup>								
United States . . . . .	9.1	7.8	16.3	13.3	11.1	24.5	12.2	10.2	22.7
Alabama . . . . .	11.5	8.9	16.4	17.3	13.1	25.4	16.0	12.1	23.4
Alaska . . . . .	6.1	6.0	*	9.5	8.5	13.1	8.4	7.8	12.5
Arizona . . . . .	7.8	7.4	16.8	11.0	10.5	23.1	9.9	9.5	20.8
Arkansas . . . . .	8.9	7.4	13.7	12.8	10.6	20.0	11.6	9.5	18.2
California . . . . .	8.2	7.7	15.3	11.3	10.6	22.2	10.4	9.8	20.3
Colorado . . . . .	8.2	7.8	15.8	11.9	11.2	23.7	11.0	10.4	21.3
Connecticut . . . . .	8.9	7.7	16.9	12.9	11.1	25.0	12.3	10.6	23.7
Delaware . . . . .	11.4	9.2	17.9	14.7	12.1	23.1	13.7	11.1	21.8
District of Columbia . . . . .	21.2	10.4	25.2	28.6	13.5	34.2	26.9	11.9	32.2
Florida . . . . .	9.9	7.8	16.8	14.3	11.2	24.3	13.2	10.4	22.6
Georgia . . . . .	11.8	8.4	17.8	19.5	13.6	30.2	18.2	12.5	28.3
Hawaii . . . . .	6.9	6.6	10.1	11.5	11.6	20.6	10.6	11.0	19.1
Idaho . . . . .	8.6	8.4	*	12.1	11.9	*	11.3	11.1	*
Illinois . . . . .	10.5	8.2	18.6	14.6	11.5	25.8	13.3	10.5	23.6
Indiana . . . . .	9.7	8.9	17.0	13.2	11.9	24.0	12.2	11.0	22.4
Iowa . . . . .	7.9	7.5	19.1	11.2	10.7	26.3	10.3	9.8	23.9
Kansas . . . . .	7.5	7.1	13.0	10.6	9.8	20.1	9.7	9.0	17.9
Kentucky . . . . .	8.5	8.0	13.2	12.5	11.6	21.4	11.5	10.6	19.5
Louisiana . . . . .	10.6	7.9	14.6	15.0	11.0	20.7	13.7	10.1	19.1
Maine . . . . .	7.2	7.2	*	9.9	9.9	*	9.2	9.2	*
Maryland . . . . .	9.4	6.8	15.4	14.1	10.1	23.3	13.0	9.2	21.8
Massachusetts . . . . .	7.5	6.9	13.5	10.7	9.8	20.4	9.8	9.0	18.9
Michigan . . . . .	8.9	7.0	16.2	12.3	9.6	22.4	11.2	8.8	20.2
Minnesota . . . . .	7.5	7.1	16.7	10.4	9.8	24.6	9.7	9.2	21.8
Mississippi . . . . .	11.7	8.1	15.7	17.7	11.2	24.7	16.6	10.3	23.3
Missouri . . . . .	8.9	7.8	14.5	12.5	10.6	21.9	11.4	9.6	20.0
Montana . . . . .	8.1	7.3	*	11.8	11.0	*	10.9	10.2	*
Nebraska . . . . .	7.6	7.0	15.3	11.0	10.3	21.3	10.0	9.4	19.1
Nevada . . . . .	7.8	7.3	13.8	12.1	11.0	23.4	11.1	10.2	19.9
New Hampshire . . . . .	7.6	7.6	*	10.4	10.3	*	9.8	9.7	*
New Jersey . . . . .	9.4	7.5	17.3	13.9	11.0	26.1	13.0	10.2	24.6
New Mexico . . . . .	6.9	6.8	13.4	9.4	9.2	18.8	8.2	8.0	15.2
New York . . . . .	10.4	8.7	17.5	16.6	13.6	28.5	15.5	12.7	26.7
North Carolina . . . . .	10.9	8.3	17.0	15.7	11.7	25.1	14.6	10.8	23.5
North Dakota . . . . .	8.1	8.0	*	11.5	11.2	*	10.5	10.2	*
Ohio . . . . .	9.3	8.2	15.7	13.1	11.4	22.3	12.1	10.5	20.8
Oklahoma . . . . .	8.7	8.3	12.8	12.7	11.8	20.3	11.5	10.7	18.7
Oregon . . . . .	6.9	6.9	13.6	10.2	10.1	21.3	9.4	9.3	19.5
Pennsylvania . . . . .	9.8	8.5	17.6	15.2	13.0	27.7	14.2	12.2	25.7
Rhode Island . . . . .	8.8	8.6	14.9	12.8	12.5	21.0	11.8	11.5	19.5
South Carolina . . . . .	11.9	8.6	17.3	17.8	12.5	26.2	16.5	11.5	24.3
South Dakota . . . . .	8.9	8.0	*	11.5	10.1	*	10.6	9.3	*
Tennessee . . . . .	9.5	7.7	15.2	12.2	9.7	20.3	10.9	8.8	17.9
Texas . . . . .	8.1	7.2	13.8	11.5	10.2	19.8	10.5	9.3	18.3
Utah . . . . .	6.1	6.0	*	9.2	9.2	*	8.4	8.3	*
Vermont . . . . .	6.4	6.4	*	9.7	9.6	*	9.0	8.9	*
Virginia . . . . .	9.8	7.5	17.0	15.5	11.9	27.0	14.4	11.1	25.1
Washington . . . . .	6.8	6.5	14.9	9.9	9.4	22.1	9.0	8.6	20.4
West Virginia . . . . .	9.5	9.2	16.7	13.8	13.4	25.2	12.6	12.2	23.6
Wisconsin . . . . .	8.0	7.4	13.4	11.2	10.2	20.6	10.3	9.3	19.4
Wyoming . . . . .	8.9	8.8	*	11.7	11.6	*	11.0	11.0	*

<sup>1</sup>Figures for gestational age not stated are distributed for fetal deaths; see Technical notes.

<sup>2</sup>Fetal deaths and live births by race of mother; infant deaths by race of child.

**Table 4. Trends in the international ranking of perinatal mortality: 1950–90**

[Rank is based on Perinatal Definition I rates. Perinatal Definition I includes infant deaths under 7 days of age and fetal deaths with stated or presumed period of gestation of 28 weeks or more. Rankings are based on the latest data available for countries or geographic areas with at least 1 million population and with "complete" counts of live births and infant deaths as indicated in the *United Nations: Demographic Yearbook, 1991*. Ratio is the rate for the United States divided by the rate for the country with the lowest perinatal mortality rate]

Year	All races		White		Black	
	Rank	Ratio <sup>1</sup>	Rank	Ratio <sup>2</sup>	Rank	Ratio <sup>3</sup>
1990	19	1.60	10	1.37	30	2.75
1989	18	1.60	14	1.38	30	2.70
1988	20	1.49	11	1.29	35	2.54
1987	20	1.47	12	1.28	34	2.49
1986	19	1.61	12	1.42	31	2.66
1985	17	1.47	10	1.32	32	2.38
1984	18	1.51	11	1.36	31	2.38
1983	19	1.58	13	1.41	33	2.49
1982	19	1.66	13	1.49	32	2.58
1981	17	1.64	13	1.47	33	2.52
1980	16	1.57	12	1.42	33	2.46
1979	13	1.52	12	1.37	30	2.32
1978	14	1.57	10	1.40	32	2.44
1977	14	1.52	9	1.38	30	2.33
1976	15	1.56	11	1.41	31	2.41
1975	15	1.57	10	1.42	31	2.38
1974	16	1.44	12	1.32	31	2.12
1973	17	1.44	12	1.31	31	2.11
1972	18	1.48	13	1.35	29	2.20
1971	18	1.39	11	1.27	31	2.05
1970	18	1.40	12	1.28	32	2.10
1969	19	1.48	13	1.35	---	---
1968	21	1.41	16	1.28	---	---
1967	20	1.39	13	1.26	---	---
1966	20	1.43	14	1.29	---	---
1965	21	1.52	15	1.37	---	---
1964	20	1.48	15	1.33	---	---
1963	17	1.47	13	1.33	---	---
1962	16	1.43	11	1.31	---	---
1961	16	1.42	8	1.30	---	---
1960	17	1.38	9	1.27	---	---
1959	15	1.40	8	1.28	---	---
1958	15	1.39	6	1.27	---	---
1957	13	1.27	5	1.17	---	---
1956	10	1.30	4	1.19	---	---
1955	10	1.21	4	1.12	---	---
1954	7	1.23	3	1.13	---	---
1953	8	1.21	4	1.12	---	---
1952	6	1.15	2	1.06	---	---
1951	3	1.15	3	1.06	---	---
1950	3	1.17	3	1.08	---	---

<sup>1</sup>Ratio of U.S. rate for all races divided by the rate for the country with the lowest perinatal rate. The countries are as follows: Norway (1950–2, 1954), Czechoslovakia (1953, 1955–63), Bulgaria (1964–5), Sweden (1966–73, 1975–77, 1979, 1981, 1983–85), Denmark (1974), Finland (1978, 1980, 1982, 1986–87), and Japan (1988–90).

<sup>2</sup>Ratio of U.S. rate for the white population divided by the rate for the country with the lowest perinatal rate.

<sup>3</sup>Ratio of U.S. rate for the black population divided by the rate for the country with the lowest perinatal rate.

# Appendix

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# Appendix

## Technical notes

### Sources of data

Counts of fetal deaths are based on data from reports of fetal deaths; counts of infant deaths are based on certificates of death; and counts of live births are based on information from certificates of live birth. For detailed information on the processing, classification, and tabulation of these events, see the technical appendixes of *Vital Statistics of the United States, Volume I, Natality* (14) and *Volume II, Mortality* (15).

In the *Ninth Revision, International Classification of Diseases* (ICD-9), the World Health Organization (WHO) recommends that “national perinatal statistics should include all fetuses and infants delivered weighing at least 500 grams (or when birthweight is unavailable, the corresponding gestational age (22 weeks) or body length (25 cm crown-heel)), whether alive or dead. . . .” It further recommends that “countries should present, solely for international comparisons, ‘standard perinatal statistics’ in which both the numerator and denominator of all rates are restricted to fetuses and infants weighing 1,000 grams or more (or, where birthweight is unavailable, the corresponding gestational age (28 weeks) or body length (35 cm crown-heel)).” Because birthweight and gestational age are not reported on the death certificate in the United States, the National Center for Health Statistics (NCHS) was unable to adopt these definitions. Instead, NCHS uses three definitions of perinatal mortality: Perinatal Definition I is generally used for international comparisons, Perinatal Definition II, and Perinatal Definition III. These definitions were developed to address WHO and Public Health Conference on Records and Statistics recommendations for perinatal statistics.

### Classification of data

*Period of gestation*—Period of gestation is the number of completed weeks elapsed between the first day of the last normal menstrual period (LMP) and the date of delivery. The first day of the last normal menstrual period is used as the initial date because it can be more accurately determined than the date of conception, which usually occurs 2 weeks after LMP. Data on period of gestation are computed from information on “date of delivery” and “date last normal menses began.” If “date last normal menses began” is not on the record or the calculated gestation falls beyond a duration considered biologically plausible, the “physician’s estimate of gestation” is used.

To improve data quality, beginning with data for 1989, NCHS instituted a new computer edit to check for consistency between gestation and birthweight to improve data quality (15). If LMP gestation is inconsistent, the physician’s estimate is used; if both are inconsistent with birthweight, LMP gestation is used and birthweight is assigned to unknown. When the period of gestation is reported in months on the report, it is allocated to gestational intervals in weeks.

All areas reported LMP in 1989 and 1990 except Puerto Rico. All areas reported physician’s estimate of gestation except California, the District of Columbia, Louisiana, Maryland, and Oklahoma. Nebraska also was excluded because of the large proportion of unknown. In 1991 data on reported physician’s estimate of gestation became available for the District of Columbia and Nebraska.

*Gestation not stated*—A fetal death with gestation not stated is presumed to be at 20 weeks of gestation or more if (a) the death occurred in a State that requires reporting of all fetal deaths of gestational age 20 weeks or more, or if (b) the fetus weighed 500 grams or more in a State that requires reporting of all fetal deaths regardless of gestational age. For Perinatal Definition I, fetal deaths with gestation not stated but presumed to be at 20 weeks of gestation or more are allocated to 28 weeks of gestation or more according to the proportion of fetal deaths with stated gestational age that falls into that category. For perinatal definitions II and III, fetal deaths with presumed gestation of 20 weeks or more are included with those of stated gestation of 20 weeks or more.

*Race*—Beginning with the 1989 data year, NCHS changed the method of tabulating live birth and fetal death data by race from race of child to race of mother. As in previous years, race for infant deaths is tabulated by the race of the decedent. This results in perinatal mortality rates for 1989 and later that are not comparable with those published for previous years. In this report, data are provided for race of mother and race of child when available.

The change to race of mother for fetal deaths and live births affects perinatal mortality rates because these rates are calculated by dividing the number of fetal deaths and live births by the number of fetal deaths and live births. Consequently, the fetal death component of the numerator of a perinatal rate is affected, and the fetal and live-birth components of the denominator of a perinatal rate are affected by the change from using race of child to using race of mother.

As noted in detail in the technical appendixes to *Vital Statistics of the United States* (14,15), data on live births and

fetal deaths are tabulated by the race of the mother beginning with 1989. When the race of the mother is unknown, the race of the mother is assigned to the father's race; when information for both parents is missing, the race of the mother is assigned to the specific race of the mother of the preceding record with known race. In previous years, birth and fetal death tabulations were calculated by race of child as determined statistically by an algorithm based on information reported for the mother and father. If the parents were of different races, the following rules applied: (a) When only one parent was white, the fetus or infant was assigned to the other parent's race. (b) When neither parent was white, the fetus or infant was assigned to the father's race with one exception—If the mother was Hawaiian or part-Hawaiian, the fetus or infant was classified as Hawaiian.

When race of one parent was missing or ill-defined, the race of the other determined that of the fetus or infant. When the race of both parents was missing, the race of the fetus or infant was allocated according to the specific race of the fetus or infant on the preceding record. Further details on the change in tabulation from race of child to race of mother are provided in a separate report (16).

*New Jersey, 1962–64*—New Jersey omitted the race item from its certificates and reports of live birth, death, and fetal death in the beginning of 1962. The item was restored during the latter part of 1962. However, the certificate revision without the race item was used for most of 1962 as well as most of 1963. Therefore, figures by race for 1962 and 1963 exclude New Jersey. Adjustments made in vital statistics to account for the omission of the race item in New Jersey for part of the certificates filed during 1962–64 are described in the Technical Appendix from *Vital Statistics of the United States* for each of those data years.

## Hispanic origin

Perinatal mortality data for the Hispanic-origin population are based on fetal deaths to mothers of Hispanic origin who were residents of those States and the District of Columbia that included items on the certificates and reports of live birth, death, and fetal death to identify Hispanic or ethnic origin of mother. The table in this report further restricts the data to States reporting the Hispanic-origin item on at least 90 percent of records by place of occurrence. The list of States included for each year is as follows:

1989

Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Hawaii, Idaho, Illinois, Iowa, Kansas, Kentucky, Minnesota, Mississippi, Missouri, Nebraska, Nevada, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, West Virginia, Wisconsin, and Wyoming

1990

Alabama, Alaska, Arizona, Arkansas, California, Colorado, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jer-

sey, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, West Virginia, Wisconsin, and Wyoming

1991

Alabama, Alaska, Arizona, Arkansas, California, Colorado, Delaware, District of Columbia, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Jersey, New Mexico, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Vermont, West Virginia, Wisconsin, and Wyoming

Rates are shown each year for a reporting area that had an item on Hispanic or ethnic origin and whose data for all three files were at least 90 percent complete on a place-of-occurrence basis and considered to be sufficiently comparable to be used for analysis.

## International ranking

Rankings of perinatal rates are based on the latest data available for countries or geographic areas with at least 1 million population and with “complete” counts of live births, infant deaths, and fetal deaths as indicated in the *United Nations: Demographic Yearbook, 1991* (17). For the U.S. data, Perinatal Definition I is used to rank the rate.

For international comparison, countries provide perinatal mortality rates that use fetal deaths at 28 weeks of gestation or more and infant deaths of under 7 days of age. Among the perinatal definitions used in the United States, Perinatal Definition I meets this standard. The comparability of international perinatal rates is affected by differences in the definitions used in the various countries around the world. With a few exceptions, all the countries use definitions of live birth and fetal death that are consistent with the WHO definitions. In Bulgaria, the definition of a fetal death includes a length restriction of 25 centimeters in addition to the 28 weeks of gestational period. The additional restriction would result in an undercount of fetal deaths. Germany follows the alternate WHO recommendation to restrict fetal deaths to those of 1,000 grams or more. In the German Democratic Republic, definition of fetal deaths also includes deliveries of 1,000 grams or more that breathe or have a heart beat but do not have both signs of life. This difference in definition results in an undercount of fetal deaths (18).

An additional factor that affects comparability is differences in the reporting requirements for fetal deaths occurring before 28 weeks of gestation. Research has shown that earlier mandatory reporting results in more complete data for subsequent gestational periods. A comparison of the distribution of fetal deaths by gestation according to the reporting requirements indicates that underreporting occurs at the lower limit of the requirement. Consequently, areas with a reporting requirement have substantially fewer fetal deaths reported near the lower limit of the requirement than areas requiring reporting of all fetal deaths (15,19).

However, in most countries, no requirement exists for reporting these earlier fetal deaths. Consequently, reporting of

fetal deaths is not as complete for the countries that do not require an earlier reporting period. The countries that do require reporting of fetal deaths at gestations earlier than 28 weeks are Japan (all fetal deaths at 12 weeks of gestation or more), Norway (all fetal deaths at 16 weeks of gestation or more), and the United States (all fetal deaths of 20 weeks of gestation or more).

## Quality of data

In the United States, all States have adopted laws that require the registration of births and deaths and reporting of fetal deaths. It is believed that over 99 percent of the births and deaths occurring in this country are registered.

State requirements for reporting of fetal deaths vary. Most States require reporting of fetal deaths at gestations of 20 weeks or more. There are a few that require reporting of all fetal deaths and others that require reporting of fetal deaths at any period if the weight is 350 grams, 400 grams, or 500 grams (15).

As discussed in the case of countries, substantial evidence indicates that not all fetal deaths for which reporting is required are reported. Likewise, underreporting of fetal deaths in the United States may occur near the lower limit for States that have a minimum gestational period requirement. Research has found that in areas requiring the reporting of fetal deaths at 20 weeks of gestation or more, the total number reported at 20–23 weeks of gestation is lower than the number reported at 24–27 and 28–31 weeks of gestation. In contrast, in areas requiring reporting of all fetal deaths, regardless of the period of gestation, the number reported at 20–23 weeks of gestation is larger than the number at 24–27 and 28–31 weeks of gestation (15,19).

To maximize comparability of data by year and by State, U.S. fetal death and perinatal mortality statistics are based on fetal deaths at 20 weeks of gestation or more. In States requiring reporting of all products weighing 500 grams or more—New Mexico, South Dakota, and Tennessee—fetal deaths at 20 weeks of gestation or more but weighing less than 500 grams are excluded. Beginning with 1969 fetal deaths of not-stated gestation were excluded for States requiring reporting of all products of conception except for those with a stated birthweight of 500 grams or more. In 1990 this rule applied to the following States: Georgia, Hawaii, New York, Rhode Island, and Virginia.

Variations in fetal death reporting requirements and practices have implications for comparing perinatal rates among States. Because reporting is generally poorer near the lower limit of the reporting requirement, States that require reporting of all products of conception regardless of gestation are likely to have more complete reporting of fetal deaths at 20–27 weeks of gestation than are States not requiring reporting of all products. The larger number of fetal deaths reported by these “all periods” States may result in higher perinatal rates compared to States in which reporting is less complete. Accordingly, reporting completeness may account, in part, for differences among State perinatal rates, particularly differ-

ences for perinatal definitions II and III, which use data for fetal deaths at 20–27 weeks of gestation.

Slight comparability problems in perinatal mortality ratios also arise from the inconsistent application of the definition of fetal death by individual reporting units (19). For example, some live-born infants who die shortly after birth, particularly those born prematurely who die before the umbilical cord is severed or while the placenta is still attached, may erroneously be reported as fetal deaths. Differences in application of the definition of live birth and fetal death can have the effect of increasing perinatal ratios by decreasing the number of live births in the denominator by a small amount. Perinatal rates, however, are not as affected by this situation because births and fetal deaths are included in the denominator.

Another factor that may have a minor effect on comparability of perinatal rates among States involves fetal deaths with unknown gestation. There is variation among the States in the proportion of fetal deaths of unknown gestation. These fetal deaths are allocated in the perinatal statistics to 20–27 weeks of gestation and to 28 weeks of gestation or more according to the proportion of fetal deaths with known gestation that fall into the two categories. For example, a State that requires reporting of all products of conception and also has a relatively high proportion of fetal deaths with unknown gestation may have a larger proportionate share of fetal deaths allocated to 20–27 weeks of gestation than a State that has a similar proportion of fetal deaths with unknown gestation but which requires reporting only for 20 weeks of gestation or more.

## Computation of rates

The rates shown in this report were computed using the following formulas.

$$\begin{array}{l}
 \text{Perinatal Definition I mortality rate per 1,000 live births and fetal deaths} \\
 = \frac{\text{Number of infant deaths of under 7 days of age + number of fetal deaths with stated or presumed period of gestation of 28 weeks or more during a period}}{\text{Number of live births + number of fetal deaths with stated or presumed period of gestation of 28 weeks or more during the same period}} \times 1,000 \\
 \\
 \text{Perinatal Definition II mortality rate per 1,000 live births and fetal deaths} \\
 = \frac{\text{Number of infant deaths of under 28 days of age + number of fetal deaths with stated or presumed period of gestation of 20 weeks or more during a period}}{\text{Number of live births + number of fetal deaths with stated or presumed period of gestation of 20 weeks or more during the same period}} \times 1,000 \\
 \\
 \text{Perinatal Definition III mortality rate per 1,000 live births and fetal deaths} \\
 = \frac{\text{Number of infant deaths of under 7 days of age + number of fetal deaths with stated or presumed period of gestation of 20 weeks or more during a period}}{\text{Number of live births + number of fetal deaths with stated or presumed period of gestation of 20 weeks or more during the same period}} \times 1,000
 \end{array}$$

## Random variation

Although the mortality data in this report except data for 1972 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 (approximate 95-percent confidence interval) that

$$N - 2 \sqrt{N}$$

and

$$N + 2 \sqrt{N}$$

covers the "true" number of events.

$$R - 2 \frac{R}{\sqrt{N}}$$

and

$$R + 2 \frac{R}{\sqrt{N}}$$

covers the "true" rate.

If the rate  $R_1$  corresponding to  $N_1$  events is compared with the rate  $R_2$  corresponding to  $N_2$  events, the difference between the two rates may be regarded as statistically significant if it exceeds

$$2 \sqrt{\frac{R_1^2}{N_1} + \frac{R_2^2}{N_2}}$$

Additional information on random variation may be found in the Technical Appendix from *Vital Statistics of the United States, Volume II, Mortality* (15). An asterisk is shown in place of a rate based on fewer than 20 deaths. These rates have a relative standard error of 23 percent or more and therefore are considered highly variable.

## State maps

Assigning the States into the given categories on the maps was carried out in two steps: (a) Determining whether the State perinatal mortality rate (Perinatal Definition I) differed significantly from the corresponding U.S. rate at the 0.05 level of significance; (b) then grouping the State rates found to be significantly different from the U.S. rate into the four categories: 10 highest State rates of those significantly greater than the U.S. rate, remaining State rates significantly greater than the U.S. rate, 10 lowest State rates of those significantly lower than the U.S. rate, and remaining State rates significantly lower than the U.S. rate. Depending on the number of deaths, different procedures were used to test statistical significance and to determine confidence intervals.

For 50 deaths or more, the standard normal Z statistic was used to perform the significance test. For 1–49 deaths the lower and upper 95-percent confidence limits were estimated as described elsewhere (20). The difference between the State and U.S. rates was determined to be statistically significant at the 0.05 level if the rates' respective 95-percent confidence limits did not overlap.

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