

## Fetal and Perinatal Mortality: United States, 2013

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### Abstract

**Objectives**—This report presents 2013 fetal and perinatal mortality data by maternal age, marital status, race, Hispanic origin, and state of residence, as well as by fetal birthweight, gestational age, plurality, and sex. Trends in fetal and perinatal mortality are also examined.

**Methods**—Descriptive tabulations of data are presented and interpreted.

**Results**—A total of 23,595 fetal deaths at 20 weeks of gestation or more were reported in the United States in 2013. The U.S. fetal mortality rate was 5.96 fetal deaths at 20 weeks of gestation or more per 1,000 live births and fetal deaths, not significantly different from the rate of 6.05 in 2012. The lack of decline in fetal mortality in recent years, coupled with declines in infant mortality, meant that more fetal deaths than infant deaths occurred in the United States for 2011–2013 (although the rates were essentially the same). In 2013, the fetal mortality rate for non-Hispanic black women (10.53) was more than twice the rate for non-Hispanic white (4.88) and Asian or Pacific Islander (4.68) women. The rate for American Indian or Alaska Native women (6.22) was 27% higher, and the rate for Hispanic women (5.22) was 7% higher, than the rate for non-Hispanic white women. Fetal mortality rates were highest for teenagers, women aged 35 and over, unmarried women, and women with multiple pregnancies.

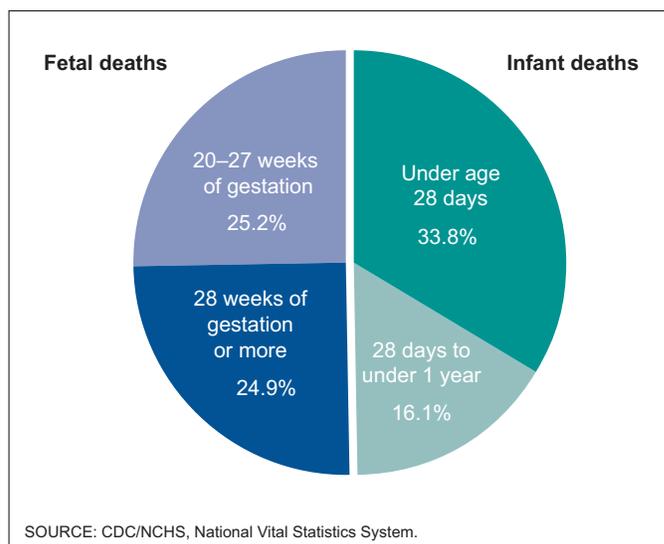
**Keywords:** fetal death • perinatal death • stillbirth • pregnancy loss

### Introduction

Fetal mortality—the intrauterine death of a fetus at any gestational age—is a major but often overlooked public health issue. Much of the public concern surrounding reproductive loss has focused on infant mortality, due in part to a lesser knowledge of the incidence, etiology, and prevention strategies for fetal mortality. The National Survey of Family Growth, conducted by the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS), estimates that there are more than 1 million fetal

losses per year in the United States (1), with the vast majority of these occurring before 20 weeks of gestation. Fetal mortality data from the National Vital Statistics System (NVSS) are usually presented for fetal deaths at 20 weeks of gestation or more. Even when only fetal deaths at 20 weeks or more are considered, slightly more fetal than infant deaths occurred in the United States in 2013 (Figure 1). The concept of a perinatal period emerged in the late 1940s as clinicians and researchers became increasingly aware of the relatively large number of deaths occurring in the period immediately before and after delivery (2). Perinatal mortality refers to death around the time of delivery and includes both fetal deaths (at least 20 weeks of gestation) and early infant (neonatal) deaths.

The U.S. fetal mortality rate declined from 25.0 fetal deaths at 20 weeks of gestation or more per 1,000 live births and fetal deaths in 1942 (3) to 5.96 in 2013. The real decline in fetal mortality during this period was probably larger because reporting of fetal deaths



**Figure 1. Percent distribution of fetal deaths at 20 weeks of gestation or more, and infant deaths: United States, 2013**

has improved over time (4,5). This report presents detailed data on fetal and perinatal deaths and mortality rates for the United States for 2013. Data are presented by maternal age, marital status, race, Hispanic origin, and state of residence, as well as by fetal gestational age at delivery, birthweight, plurality, and sex. Trends in fetal and perinatal mortality are also examined.

## Methods

### Data sources

Data in this report are drawn from two different NCHS vital statistics data files: the 2013 fetal death data set (for fetal deaths) and the 2013 period linked birth/infant death data set (linked file, for live births and infant deaths). The 2013 fetal death data set contains information from all Reports of Fetal Death filed in the 50 states, the District of Columbia, American Samoa, Guam, the Northern Marianas, and Puerto Rico (6). In the linked file, the information from the death certificate is linked to the information from the birth certificate for each infant under age 1 year who died in 2013 (7,8). The purpose of the linkage is to use the many additional variables available from the birth certificate to conduct more detailed analyses of infant and perinatal mortality patterns. Infant deaths from the linked file are used in preference to those from the main mortality file for tabulating perinatal deaths because the linked file contains data by birth and maternal characteristics, similar to the fetal death file. Tables showing data by state also provide separate information for Puerto Rico and Guam; however, these data are not included in U.S. totals.

### Fetal mortality

Fetal death refers to the intrauterine death of a fetus prior to delivery (see [Technical Notes](#) at the end of this report). Fetal mortality is generally divided into three periods: early (less than 20 completed weeks of gestation), intermediate (20–27 weeks of gestation), and late (28 weeks of gestation or more). Although the vast majority of fetal deaths occur early in pregnancy, most states in the United States only report fetal deaths at 20 weeks of gestation or more, and these intermediate and late fetal deaths are the subject of this report. Statistics on fetal death exclude data for induced terminations of pregnancy. Fetal mortality rates in this report are computed as the number of fetal deaths at 20 weeks of gestation or more per 1,000 live births and fetal deaths at 20 weeks or more (see [Technical Notes](#)).

### Data limitations

Reporting requirements and completeness of reporting for fetal death data vary substantially among states, and these variations have important implications for data quality and completeness (see [Technical Notes](#)). The majority of states require reporting of fetal deaths at 20 weeks of gestation or more, or a minimum of 350 grams birthweight (roughly equivalent to 20 weeks), or some combination of the two. However, several states require reporting of fetal deaths at all periods of gestation, and one requires reporting beginning at 16 weeks of gestation (see [Technical Notes](#)). At the other end of the spectrum, two states require reporting of fetal deaths with birthweights of 500 grams or more (roughly equivalent to 22 weeks

of gestation). Lack of full reporting for these states leads to a slight underestimate of the U.S. fetal mortality rate. For example, when data for these two states were excluded, the 2013 fetal mortality rate was 5.99, compared with 5.96 for all states combined, although these rates were not significantly different.

There is substantial evidence that not all fetal deaths for which reporting is required are reported (9,10). Underreporting of fetal deaths is most likely to occur in the earlier part of the required reporting period for each state (see [Technical Notes](#)). Because reporting is generally incomplete near the lower limit of the reporting requirement, states that require reporting of all fetal deaths at any gestational age are likely to have more complete reporting of fetal deaths at 20 weeks or more than states that do not. The larger number of fetal deaths reported for these “all periods” states may result in higher perinatal mortality rates than for states whose reporting is less complete. In contrast, the lower fetal mortality rates for New Mexico and South Dakota—the two states that only report fetal deaths of 500 grams or more—are likely due to differences in reporting, although real differences in fetal mortality risk may also be a factor. Thus, reporting completeness may account, in part, for differences in fetal and perinatal mortality rates among states. To promote the comparability of data by year and by state while including as much meaningful data as possible, this report presents data on fetal deaths with a stated or presumed period of gestation of 20 weeks or more (6); however, differences in reporting completeness may still affect some comparisons.

Correct interpretation of fetal death data must include an evaluation of the completeness of reporting of fetal deaths, as well as an evaluation of the completeness of reporting for the specific variables of interest (11–13). The percentage of not-stated responses for fetal death data varies substantially among variables and states (see [Technical Notes](#)).

### Perinatal mortality

Two different definitions of perinatal mortality are discussed in this report. Perinatal definition I includes infant deaths under age 7 days and fetal deaths at 28 weeks of gestation or more. Perinatal definition II is the most inclusive definition and includes infant deaths under age 28 days and fetal deaths at 20 weeks or more. The denominators for all perinatal rate computations are per 1,000 live births plus fetal deaths for their respective time period (see [Technical Notes](#)). Definition I is preferred for international and state-specific comparisons because of differences among countries and states in the completeness of reporting of fetal deaths at 20–27 weeks of gestation. Definition II is useful for monitoring perinatal mortality throughout the gestational age spectrum because the majority of fetal deaths occur before 28 weeks of gestation.

## 2003 Revision of the U.S. Standard Report of Fetal Death

This report includes data for the United States and selected territories. For the United States, 35 states (Arizona, California, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina,

South Dakota, Tennessee, Texas, Utah, Washington, Wisconsin, and Wyoming), the District of Columbia, and New York City implemented the 2003 revision of the U.S. Standard Report of Fetal Death on or before January 1, 2013 (revised). In 2013, the revised reporting areas represented 75.6% of all U.S. fetal deaths at 20 weeks of gestation or more. The remaining reporting areas included in this report have data that are based on the 1989 revision of the U.S. Standard Report of Fetal Death (unrevised) (see [Technical Notes](#)). Among the territories, Guam and the Northern Marianas implemented the 2003 revision of the U.S. Standard Report of Fetal Death on or before January 1, 2013 (revised). American Samoa and Puerto Rico data are based on the 1989 revision (unrevised) (see [Technical Notes](#)). Data for the Virgin Islands are unavailable for 2013. Only data for Guam and Puerto Rico are shown in selected tables in this report due to small numbers of fetal deaths for other territories. Only variables comparable between revisions are included in this report.

## Race and Hispanic origin

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

The 2003 revision of the U.S. Standard Report of Fetal Death allows the reporting of more than one race (multiple races) for each parent (14). In 2013, the 35 revised states, the District of Columbia, and New York City allowed the reporting of more than one race for fetal death data. To provide uniformity and comparability of these data with data from unrevised states, multiple-race data were bridged to a single race (see [Technical Notes](#)).

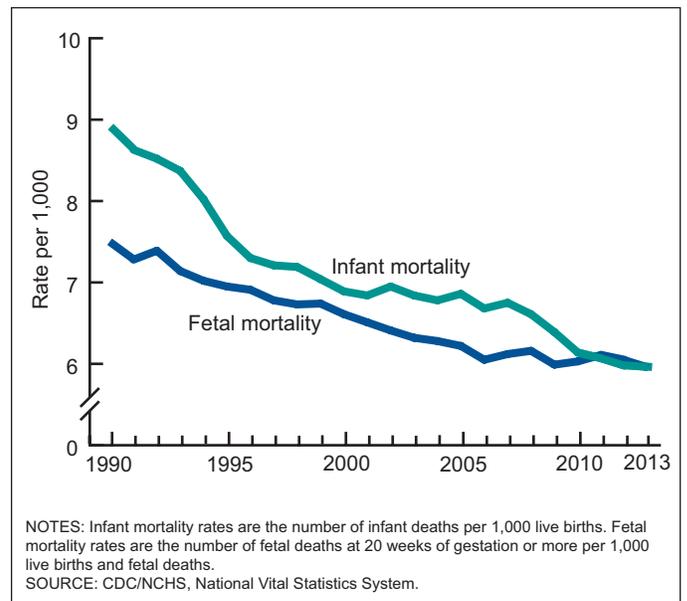
## Statistical significance

Statements in this report have been tested for statistical significance. A statement that a given mortality rate is higher or lower than another rate indicates that the rates are significantly different. For information on the methods used to test for statistical significance, as well as more detailed information on the collection, interpretation, and availability of fetal and perinatal data, see [Technical Notes](#).

## Results

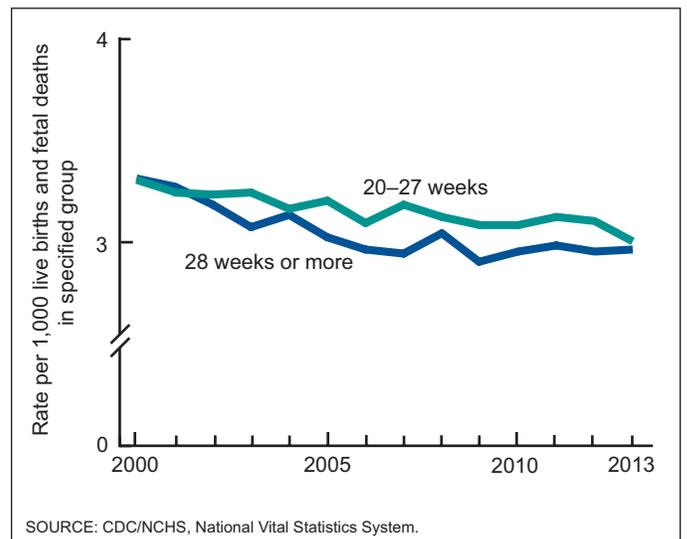
### Trends in fetal and perinatal mortality

In 2013, the U.S. fetal mortality rate was 5.96 fetal deaths at 20 weeks of gestation or more per 1,000 live births and fetal deaths, which was not significantly different from the rate of 6.05 in 2012 ([Table A](#)). Despite minor fluctuations, the U.S. fetal mortality rate has remained relatively unchanged since 2006 ([Figure 2](#)). In contrast, the infant mortality rate has declined 11% in the same time period. Additionally, although the total fetal mortality rate has historically been lower than the total infant mortality rate, as of 2011 these two rates have been essentially the same.



**Figure 2. Fetal and infant mortality rates: United States, 1990–2013**

The trend in fetal mortality rates by period of gestation is shown in [Figure 3](#). The fetal mortality rate at 20–27 weeks of gestation declined 3% from 2012 (3.11) to 2013 (3.01), after remaining essentially unchanged from 2006 through 2012 ([Table A](#) and [Figure 3](#)). The late fetal mortality rate (at 28 weeks or more) did not change significantly from 2012 (2.96) to 2013 (2.97). The late fetal mortality rate has been relatively stable since 2006.



**Figure 3. Fetal mortality rates, by period of gestation: United States, 2000–2013**

[Figure 4](#) shows trends for perinatal mortality rates (definitions I and II) from 2000–2013. In 2013, the perinatal mortality rate, definition I, was 6.24, while the perinatal mortality rate, definition II, was 9.98. After a decline of 4% from 2006–2011, the 2013 perinatal mortality rate, definition I, was not significantly

**Table A. Fetal and perinatal mortality rates: United States, 1990, 1995, and 2000–2013**

Year	Fetal mortality rate <sup>1</sup>			Perinatal mortality rate	
	Total <sup>2</sup>	20–27 weeks <sup>3</sup>	28 weeks or more <sup>3</sup>	Definition I <sup>4</sup>	Definition II <sup>5</sup>
2013.....	5.96	3.01	2.97	6.24	9.98
2012.....	6.05	3.11	2.96	6.22	10.05
2011.....	6.11	3.13	2.99	6.26	10.14
2010.....	6.03	3.09	2.96	6.18	10.05
2009.....	5.99	3.09	2.91	6.23	10.14
2008.....	6.16	3.13	3.05	6.49	10.43
2007.....	6.12	3.19	2.95	6.45	10.52
2006.....	6.05	3.10	2.97	6.51	10.49
2005.....	6.22	3.21	3.03	6.64	10.73
2004.....	6.28	3.17	3.14	6.73	10.78
2003.....	6.32	3.25	3.08	6.78	10.92
2002.....	6.41	3.24	3.19	6.91	11.05
2001.....	6.51	3.25	3.28	6.90	11.02
2000.....	6.61	3.31	3.32	6.97	11.19
1995.....	6.95	3.33	3.64	7.60	11.84
1990.....	7.49	3.22	4.30	8.95	13.12

<sup>1</sup>Number of fetal deaths in specified age group per 1,000 live births and fetal deaths.

<sup>2</sup>Fetal deaths with stated or presumed period of gestation of 20 weeks or more.

<sup>3</sup>Not-stated gestational age proportionally distributed; see [Technical Notes](#).

<sup>4</sup>Infant deaths at less than 7 days and fetal deaths with stated or presumed period of gestation of 28 weeks or more, per 1,000 live births and fetal deaths.

<sup>5</sup>Infant deaths at less than 28 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more, per 1,000 live births and fetal deaths.

SOURCE: CDC/NCHS, National Vital Statistics System.

different from the 2011 rate (6.26). The perinatal mortality rate, definition II, declined 3% from 10.49 in 2006 to 10.14 in 2011. From 2011–2013, in contrast to the perinatal mortality rate, definition I, this rate continued to drop, with a 2% decline during this time.

Trends in numbers of fetal deaths, neonatal deaths (under 28 days), and live births—the components used to compute fetal and perinatal mortality rates—are shown in [Table B](#). Consistent with a trend observed for many years, the number of fetal deaths at 20 weeks of gestation or more in 2013 (23,595) was higher than the

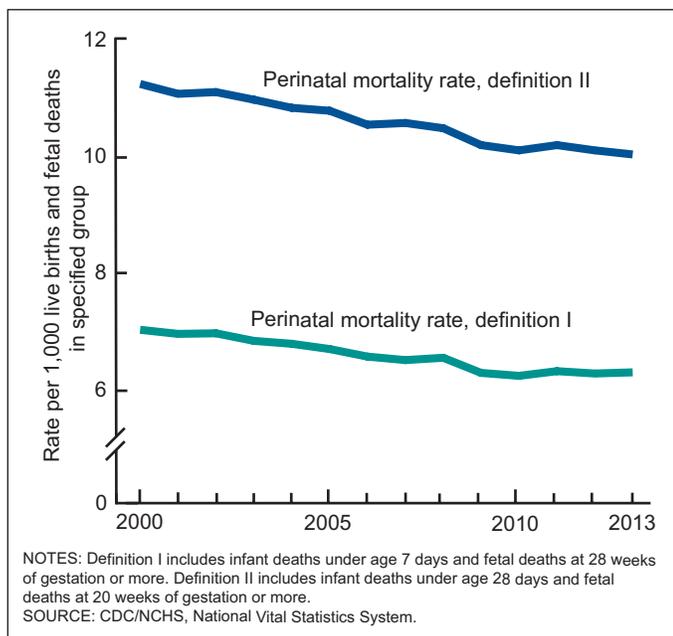
number of neonatal deaths (15,893) by 48%. However, in a recent departure from long-term trends, since 2011 the total number of fetal deaths at 20 weeks of gestation or more has outnumbered the number of total infant deaths (8). Previously, from 1990–2010, the total number of infant deaths had consistently been higher. In 2013, the number of total fetal deaths was about 1% higher than the total number of infant deaths (23,446).

### Race and Hispanic origin

Fetal and perinatal mortality rates vary considerably by race and Hispanic origin of the mother ([Table C](#) and [Figure 5](#)). The fetal mortality rate for non-Hispanic white women was 4.88, similar to the rate of 4.68 for API women. The fetal mortality rate of 10.53 for non-Hispanic black women was more than twice the rate for non-Hispanic white women. The rate for AIAN women (6.22) was 27% higher, and the rate for Hispanic women (5.22) was 7% higher, than the rate for non-Hispanic white women. From 2012 to 2013, changes in the fetal mortality rate were not statistically significant for any of the race and Hispanic origin groups.

Differences by race and Hispanic origin in the perinatal mortality rate, definition I, are shown in [Figure 6](#). Rates were lowest for API women (4.79), followed by non-Hispanic white (5.25), Hispanic (5.58), and AIAN (6.72) women. The rate for non-Hispanic black women (10.75) was the highest among the race and Hispanic origin groups, and was more than twice the rate for non-Hispanic white women.

Data by race and Hispanic origin for the perinatal mortality rate, definition II, are shown in [Figure 7](#). The patterns were similar to those for definition I: Rates were lowest for API women (7.66), followed by non-Hispanic white (8.20), Hispanic (8.76), and AIAN (10.31) women. The rate for non-Hispanic black women (17.92) was more than double the rate for non-Hispanic white women. Part of the higher risk



NOTES: Definition I includes infant deaths under age 7 days and fetal deaths at 28 weeks of gestation or more. Definition II includes infant deaths under age 28 days and fetal deaths at 20 weeks of gestation or more.  
SOURCE: CDC/NCHS, National Vital Statistics System.

**Figure 4. Perinatal mortality rates: United States, 2000–2013**

**Table B. Components of perinatal mortality: United States, 1990, 1995, and 2000–2013**

Year	Fetal deaths			Infant deaths		Live births
	Total <sup>1</sup>	20–27 weeks <sup>2</sup>	28 weeks or more <sup>2</sup>	Less than 7 days	Less than 28 days	
2013.....	23,595	11,874	11,721	12,900	15,893	3,932,181
2012.....	24,073	12,334	11,739	12,911	15,887	3,952,841
2011.....	24,289	12,432	11,857	12,960	16,065	3,953,590
2010.....	24,258	12,388	11,870	12,900	16,193	3,999,386
2009.....	24,872	12,813	12,059	13,768	17,261	4,130,665
2008.....	26,335	13,347	12,988	14,648	18,238	4,247,726
2007.....	26,593	13,822	12,771	15,139	19,094	4,316,233
2006.....	25,972	13,269	12,703	15,148	19,041	4,265,593
2005.....	25,894	13,326	12,568	15,013	18,782	4,138,573
2004.....	26,001	13,068	12,933	14,836	18,602	4,112,055
2003.....	26,004	13,348	12,656	15,152	18,935	4,090,007
2002.....	25,943	13,072	12,871	15,020	18,791	4,021,825
2001.....	26,373	13,122	13,251	14,622	18,275	4,026,036
2000.....	27,003	13,497	13,506	14,893	18,733	4,058,882
1995.....	27,294	13,043	14,251	15,483	19,186	3,899,589
1990.....	31,386	13,427	17,959	19,439	23,591	4,158,445

<sup>1</sup>Fetal deaths with stated or presumed period of gestation of 20 weeks or more.<sup>2</sup>Not-stated gestational age proportionally distributed; see [Technical Notes](#).

SOURCE: CDC/NCHS, National Vital Statistics System.

**Table C. Fetal deaths and mortality rates, by race and Hispanic origin of mother: United States, 1995, and 2000–2013**

Year	Non-Hispanic <sup>1</sup>					Hispanic <sup>1</sup>					
	All races and origins	White	Black	American Indian or Alaska Native	Asian or Pacific Islander	Total	Mexican	Puerto Rican	Cuban	Central or South American	Other and unknown
Rate											
2013.....	5.96	4.88	10.53	6.22	4.68	5.22	5.11	6.00	4.65	4.55	6.02
2012.....	6.05	4.91	10.67	6.64	4.67	5.33	5.03	6.62	4.63	5.16	6.15
2011.....	6.11	4.97	10.85	5.72	5.18	5.19	5.04	6.02	4.13	4.79	5.95
2010.....	6.03	4.78	10.76	5.51	4.95	5.16	4.88	5.86	5.07	4.87	6.53
2009.....	5.99	4.78	10.38	5.38	4.65	5.19	4.95	5.68	5.02	4.72	6.81
2008.....	6.16	4.79	10.88	6.32	4.71	5.51	5.17	6.86	5.83	5.04	7.31
2007.....	6.12	4.76	10.92	5.17	4.69	5.24	4.87	6.14	4.86	4.73	8.72
2006.....	6.05	4.81	10.73	6.04	4.89	5.29	4.84	6.09	5.46	4.74	10.24
2005.....	6.22	4.79	11.13	6.17	4.78	5.44	5.24	6.09	4.15	4.50	9.60
2004 <sup>†</sup> .....	6.28	5.00	11.35	6.11	4.80	5.54	5.20	6.26	5.46	4.62	12.00
2003 <sup>†</sup> .....	6.32	4.97	11.67	6.30	5.04	5.56	5.20	7.44	5.29	4.65	10.53
2002.....	6.41	5.14	11.47	6.24	4.95	5.71	5.42	7.03	5.32	4.76	10.14
2001.....	6.51	5.24	11.72	5.91	5.21	5.64	5.22	6.91	5.40	4.93	11.28
2000.....	6.61	5.26	11.97	5.54	5.17	5.79	5.48	6.61	7.55	4.73	10.49
1995.....	6.95	5.67	12.18	7.11	5.02	6.09	5.76	8.05	6.37	5.54	8.26
Number of deaths											
2013.....	23,595	10,435	6,216	288	1,250	4,730	2,798	412	88	600	832
2012.....	24,073	10,520	6,292	308	1,280	4,863	2,812	448	81	683	839
2011.....	24,289	10,726	6,386	267	1,322	4,787	2,870	406	71	656	784
2010.....	24,258	10,394	6,413	259	1,229	4,904	2,933	391	86	699	795
2009.....	24,872	10,625	6,396	263	1,172	5,217	3,211	391	84	705	826
2008.....	26,335	10,905	6,852	315	1,197	5,769	3,559	477	98	788	847
2007.....	26,593	11,043	6,923	257	1,200	5,595	3,530	423	83	808	751
2006.....	25,972	11,147	6,695	290	1,184	5,523	3,490	410	93	788	742
2005.....	25,894	10,973	6,573	278	1,109	5,387	3,651	388	67	683	598
2004 <sup>†</sup> .....	26,001	11,367	6,594	270	1,106	5,239	3,512	385	82	665	595
2003 <sup>†</sup> .....	26,004	11,419	6,746	273	1,120	5,065	3,397	437	79	632	520
2002.....	25,943	11,690	6,654	266	1,050	5,002	3,393	406	76	601	526
2001.....	26,373	12,080	6,939	249	1,049	4,803	3,183	400	76	600	544
2000.....	27,003	12,324	7,264	232	1,042	4,728	3,189	386	102	538	513
1995.....	27,294	12,777	6,840	267	809	4,079	2,704	409	79	501	386

<sup>1</sup>Rates and numbers have been revised from those published previously; see [Technical Notes](#).<sup>†</sup>Figures exclude data from Maryland, Massachusetts, and Oklahoma for 1995–1997, Maryland and Oklahoma for 1998, and Oklahoma for 1999–2004, which did not report Hispanic origin on the fetal death report.

SOURCE: CDC/NCHS, National Vital Statistics System.

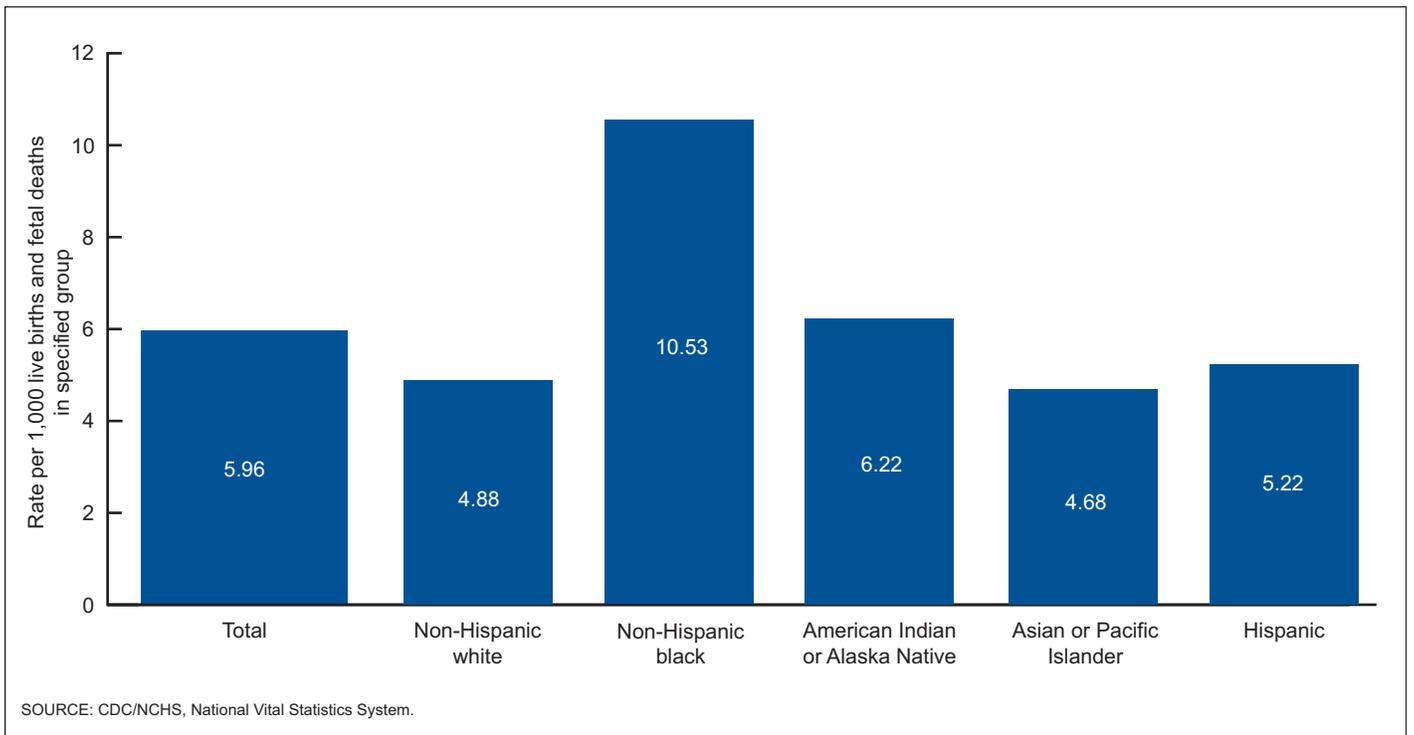


Figure 5. Fetal mortality rates, by race and Hispanic origin of mother: United States, 2013

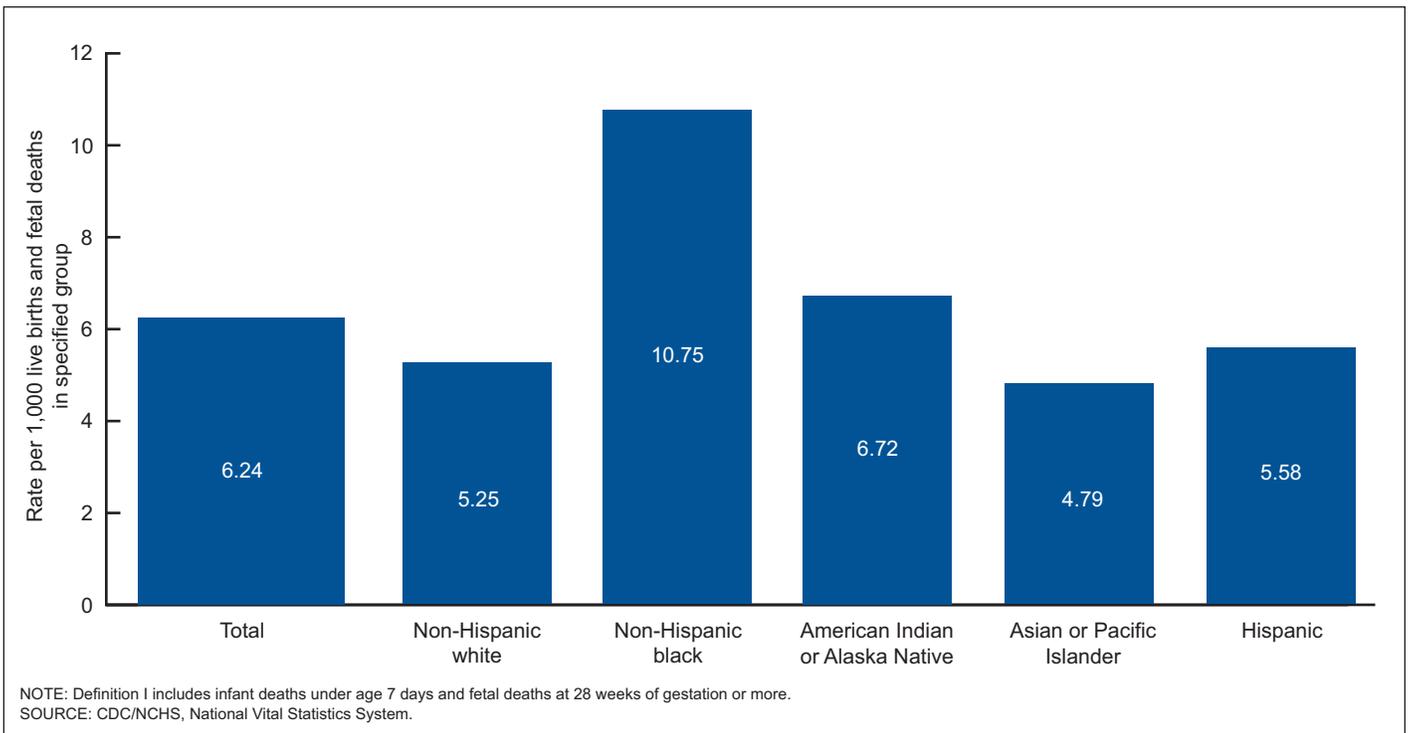


Figure 6. Perinatal mortality rate, definition I, by race and Hispanic origin of mother: United States, 2013

of fetal and perinatal mortality for non-Hispanic black women relates to their higher risk of preterm delivery (15–19).

## Maternal age

Fetal mortality rates vary considerably by maternal age. Rates were lowest for women aged 25–34 and higher for teenagers and those aged 35 and over (Table 1). The rates for teenagers under age 15 (15.88) and for women aged 45 and over (13.76) were more than twice the rate of 5.34 for women aged 25–29, the lowest risk group. Rates for teenagers aged 15–17 (7.03) and 18–19 (6.52) were 32% and 22% higher, respectively, than for women aged 25–29. The higher risk for teenagers may relate in part to less favorable socioeconomic and behavioral conditions, although biologic immaturity may also play a role (20,21). Maternal age 35 and over appears to be an independent risk factor for fetal death, even after adjusting for medical conditions (e.g., hypertension, diabetes, and multiple gestation) that are more common among older women (22–24).

## Marital status

In 2013, about one-half (51%) of fetal deaths were to unmarried women, compared with 41% of live births, in an area including 48 states and the District of Columbia (Tables D and E). Marital status was not reported for fetal deaths in California and New York. In general, fetal mortality rates were higher for unmarried than for married women, although the relationship differs by race and ethnicity (Table E) (25,26). For non-Hispanic white women, the fetal mortality rate for unmarried women was 44% higher than for married women, whereas differences were smaller for non-Hispanic black (14%) and Hispanic (11%) women. Marital status may be a marker for the

presence or absence of social, emotional, and financial resources (25).

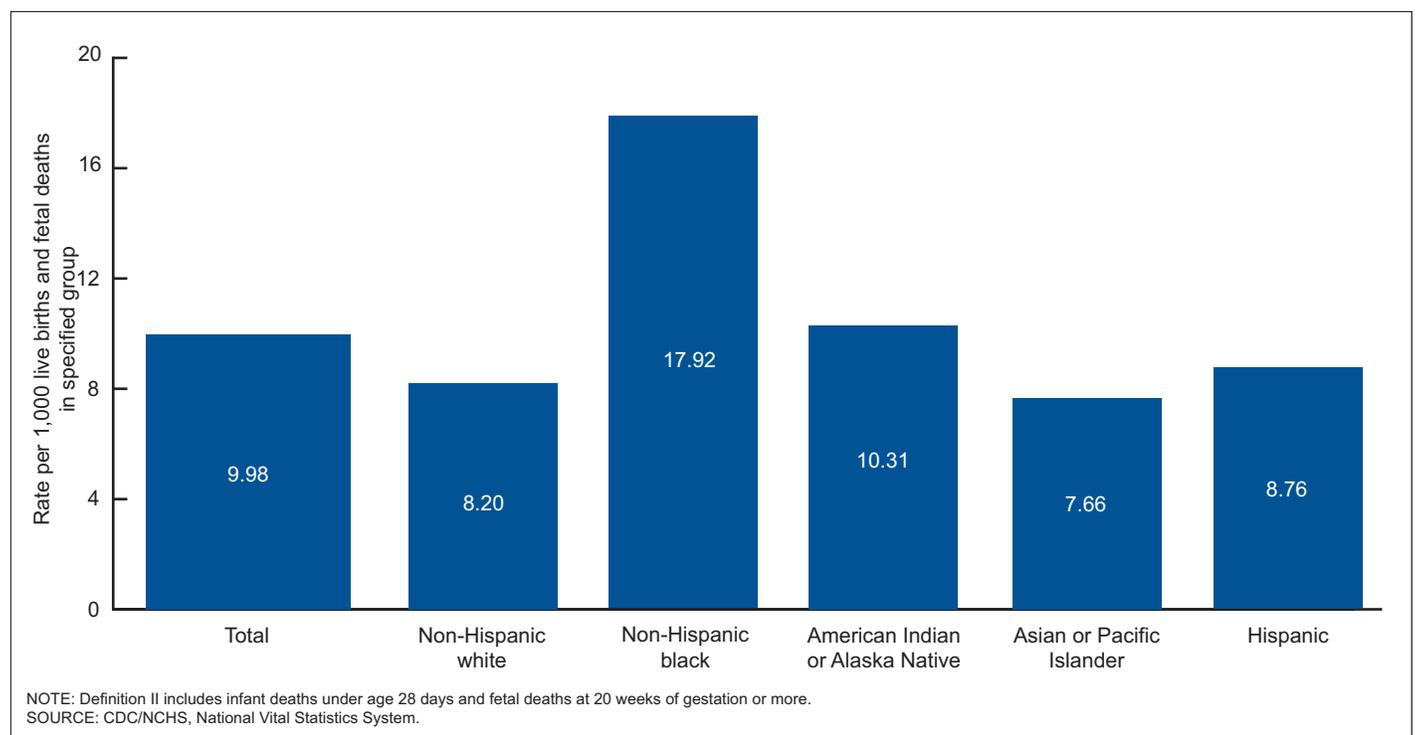
## Plurality

In 2013, 8.6% of fetal deaths occurred in multiple deliveries, compared with 3.5% of live births that occurred in multiple deliveries (Table D). A multiple delivery is one in which more than one fetus is delivered alive or dead at any time during the pregnancy, and a given multiple pregnancy may include any combination of fetal deaths or live births.

The fetal mortality rate for twins (14.07) was 2.5 times that for singletons (5.65) (Table E). The rate for triplet or higher-order deliveries (30.53) was five times that for singletons. The increased risks for multiple pregnancies may relate in part to increased rates of preterm labor, fetal growth restriction, and placental and cord problems (26–28).

## Sex of fetus

In 2013, the fetal mortality rate for male fetuses was 6.12, 6% higher than for female fetuses (5.80) (Table E). For non-Hispanic black women, the fetal mortality rate was 12% higher for male than for female fetuses, and for non-Hispanic white women the rate was 4% higher. However, there was no significant difference for Hispanic women. Although sex-specific risks of fetal death vary during the gestational period (29), most recent studies of fetal deaths at 20 weeks or more find an elevated risk for male fetuses (30). A more detailed discussion of sex ratios for fetal deaths was included in a previous report (31).



**Figure 7. Perinatal mortality rate, definition II, by race and Hispanic origin of mother: United States, 2013**

**Table D. Percentage of fetal deaths and live births with selected demographic, medical, and health characteristics: United States, 2013**

Characteristic	Fetal deaths				Live births			
	Total <sup>1</sup>	Non-Hispanic			Total <sup>1</sup>	Non-Hispanic		
		White	Black	Hispanic		White	Black	Hispanic
<b>Mother</b>								
Under age 20 . . . . .	8.0	6.0	10.7	10.0	7.0	5.1	10.8	10.5
Aged 40 or over . . . . .	5.2	5.0	4.8	5.5	3.0	2.9	2.6	2.9
Unmarried <sup>2</sup> . . . . .	51.2	38.1	74.5	54.9	40.8	29.9	71.9	52.3
<b>Fetal and infant</b>								
<b>Birthweight:</b>								
Less than 1,500 grams . . . . .	65.1	61.9	71.2	63.6	1.4	1.1	3.0	1.2
Less than 2,500 grams . . . . .	81.1	78.5	85.7	80.8	8.1	7.0	13.1	7.1
4,000 grams or more . . . . .	2.0	2.0	1.5	2.5	8.0	9.6	4.4	7.2
<b>Period of gestation:</b>								
Less than 32 weeks . . . . .	62.9	59.7	69.1	61.2	1.9	1.5	3.7	1.7
Preterm (less than 37 weeks) . . . . .	80.8	78.3	85.4	79.9	11.4	10.2	16.3	11.3
Plural delivery . . . . .	8.6	9.3	8.1	7.2	3.5	3.8	3.9	2.5

<sup>1</sup>Includes races other than white and black, and origin not stated.<sup>2</sup>Excludes data from California and New York (including New York City), which did not report marital status on the fetal death report.

NOTE: Not-stated responses excluded when computing percent distributions.

SOURCE: CDC/NCHS, National Vital Statistics System.

**Table E. Fetal mortality rates, by selected characteristics and race and Hispanic origin of mother: United States, 2013**

Characteristic	Fetal mortality rates <sup>1</sup>				Fetal deaths				Live births			
	All races <sup>2</sup>	Non-Hispanic white	Non-Hispanic black	Hispanic	All races <sup>2</sup>	Non-Hispanic white	Non-Hispanic black	Hispanic	All races <sup>2</sup>	Non-Hispanic white	Non-Hispanic black	Hispanic
Marital status, total <sup>3</sup> . . . . .	5.99	4.89	10.45	5.08	19,298	9,197	5,462	3,102	3,200,496	1,870,160	517,290	607,716
Married . . . . .	4.77	4.22	9.20	4.68	9,081	5,558	1,349	1,364	1,896,140	1,310,386	145,214	290,180
Unmarried . . . . .	7.25	6.08	10.47	5.20	9,524	3,422	3,936	1,661	1,304,356	559,774	372,076	317,536
Unmarried-married ratio . . . . .	1.52	1.44	1.14	1.11	...	...	...	...	...	...	...	...
Plurality . . . . .	5.96	4.88	10.53	5.22	23,595	10,435	6,216	4,730	3,932,181	2,129,196	583,834	901,033
Single . . . . .	5.65	4.60	10.09	4.97	21,559	9,464	5,714	4,390	3,795,157	2,047,990	560,865	878,879
Twin . . . . .	14.07	11.31	20.47	14.79	1,888	893	467	323	132,324	78,072	22,346	21,511
Triplet or higher-order . . . . .	30.53	24.28	53.19	*	148	78	35	17	4,700	3,134	623	643
Sex of fetus . . . . .	5.96	4.88	10.53	5.22	23,595	10,435	6,216	4,730	3,932,181	2,129,196	583,834	901,033
Male . . . . .	6.12	4.97	11.14	5.31	12,404	5,461	3,340	2,454	2,012,954	1,092,625	296,426	459,931
Female . . . . .	5.80	4.78	9.91	5.13	11,191	4,974	2,876	2,276	1,919,227	1,036,571	287,408	441,102
Male-female ratio . . . . .	1.06	1.04	1.12	1.04	...	...	...	...	...	...	...	...

... Category not applicable.

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

<sup>1</sup>Rate per 1,000 live births and fetal deaths in specified group.<sup>2</sup>Includes races other than white and black, and origin not stated.<sup>3</sup>Excludes data from California and New York, which did not report marital status on the fetal death report. Includes records with marital status not stated.

SOURCE: CDC/NCHS, National Vital Statistics System.

## Period of gestation

In general, a much larger percentage of fetal deaths than live births occur early in pregnancy. In 2013, about one-third (34%) of all fetal deaths at 20 weeks of gestation or more occurred at 20–23 weeks of gestation, and one-half (50%) occurred at 20–27 weeks (Table 2).

Traditionally, fetal mortality rates by gestational age have been computed as the number of fetal deaths at a given gestational age per 1,000 live births and fetal deaths at that gestational age. Fetal mortality rates computed in this fashion are very high at the earliest

gestational ages (where few live births occur), are lowest at 40 and 41 weeks of gestation, and then increase slightly at 42 weeks of gestation or more. In 2013, the fetal mortality rate computed by this method was 507.57 at 20–23 weeks of gestation, declined to a low of 0.84 at 39–40 weeks of gestation, and then increased to 1.55 for fetal deaths at 42 weeks of gestation or more (Table 2). Gestational age data are based primarily on the interval between the first day of the mother's last normal menstrual period (LMP) and the date of birth, and are subject to error due to imperfect maternal recall or misidentification of the LMP (15) (see Technical Notes). Beginning

with 2014 data, NCHS will transition to using the obstetric estimate of gestational age, rather than gestational age based on the LMP, as the primary measure of gestational age (32).

Some researchers have suggested that fetal mortality rates by gestational age be computed using a different denominator, to represent the population at risk of the event (33–35), that is, all of the women who are still pregnant at that gestational age. This “prospective fetal mortality rate” is computed as the number of fetal deaths at a given gestational age (in single weeks) per 1,000 live births and fetal deaths at that gestational age or greater. Prospective fetal mortality rates are shown in [Figure 8](#) for fetal deaths between 20 and 42 weeks of gestation. In general, rates were high at the earliest and latest gestational ages. The rate was high (0.52–0.56) at 20–22 weeks of gestation, and declined to a low of 0.18–0.19 at 29–33 weeks of gestation. The rate remained relatively low until about 37 weeks of gestation and then increased to a high of 0.62 at 42 weeks of gestation.

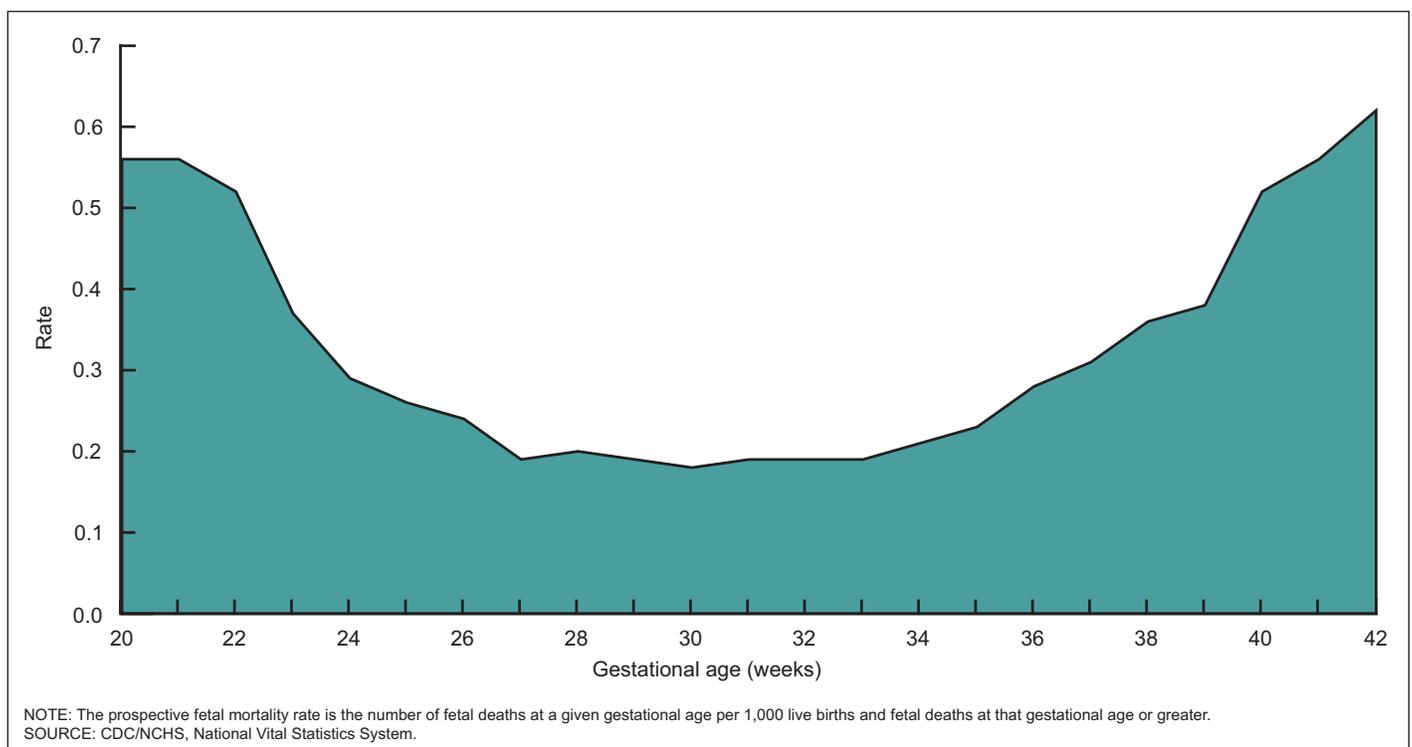
The prospective fetal mortality rate is useful in identifying two distinct peaks in fetal mortality risk: early fetal mortality (less than 23 weeks) and fetal mortality at 40 weeks of gestation or more. These two peaks suggest etiological differences. Much of the early fetal mortality is related to congenital anomalies, infections, intrauterine growth restriction, and underlying maternal medical conditions (36–40). Fetal mortality at 40 weeks or more may be due to the previously mentioned conditions but may also be related to problems that manifest around the time of delivery, such as placental (abruptio, previa) and cord (prolapse) problems, or other problems in the labor and delivery process (36,38). Despite intensive investigations, for a substantial number of fetal deaths a specific cause of death cannot be determined (36–38).

## Birthweight

In 2013, more than one-third (36%) of fetal deaths at 20 weeks of gestation or more weighed less than 500 grams (1 lb 1 oz) at delivery, and one-half (50%) weighed less than 750 grams (1 lb 12 oz) ([Table 2](#)). Birthweight-specific fetal mortality rates were computed as the number of fetal deaths at a given birthweight per 1,000 fetal deaths and live births at that birthweight. The rate was highest for less than 500-gram fetuses and decreased with increasing birthweight. Fetal mortality rates were lowest at 3,500–3,999 grams, and then increased slightly for heavier fetuses ([Table 2](#)). However, 9% of fetal deaths in the United States in 2013 had unknown birthweight, and proportional distribution of unknown responses was not attempted because unknowns were more frequent at earlier gestational ages (see [Table II](#) in [Technical Notes](#)). Thus, the birthweight-specific fetal mortality rates shown in [Table 2](#) may be understated and should be interpreted with caution.

## Fetal and perinatal mortality rates, by state

Fetal and perinatal mortality rates by state are shown in [Table 3](#). Comparisons of fetal and perinatal mortality rates by state are affected by differences in reporting requirements for fetal deaths among registration areas (see [Technical Notes](#)). Although most states report fetal deaths starting at 20 weeks of gestation if not earlier, two states (New Mexico and South Dakota) report fetal deaths at 500 grams or more. Because 500 grams is roughly the equivalent of 22 weeks of gestation, fetal mortality rates are not comparable for these states for measures that include fetal deaths at 20 weeks of gestation or more. Also, small numbers of fetal deaths in some states lead to considerable random variation in fetal mortality



**Figure 8. Prospective fetal mortality rate, by single weeks of gestation: United States, 2013**

rates between years. [Table F](#) attempts to address these problems by comparing fetal mortality rates for fetal deaths at 24 weeks of gestation or more for the latest 3-year period (2011–2013). The U.S. fetal mortality rate specially computed for this measure was 3.98 fetal deaths at 24 weeks of gestation or more per 1,000 live births and fetal deaths. When data were compared by state, fetal mortality rates were highest (5.00 or above) in Alabama, Georgia, Mississippi, South Carolina, Tennessee, Puerto Rico, and Guam and were lowest (below 3.20) in New Hampshire, New Mexico, and Vermont. Part of the variation even in this more refined measure may be due to state differences in reporting.

In 2013, the perinatal mortality rate, definition I (fetal deaths at 28 weeks of gestation or more and infant deaths at less than 7 days), was 6.24 for the United States as a whole ([Table 3](#)). The highest rates (8.00 or above) were for Alabama and Guam, whereas the lowest rates (below 5.00) were for Alaska, Iowa, and Wyoming.

In 2013, the perinatal mortality rate, definition II (fetal deaths at 20 weeks of gestation or more and infant deaths at less than 28 days), was 9.98 for the United States as a whole. However, if data from the two states that only report fetal deaths of 500 grams or more (New Mexico and South Dakota) are excluded, the rate was 10.01. Among the states with comparable data, the highest rates (above 14.0) were for the District of Columbia, Mississippi, Guam, and Puerto Rico, whereas the lowest rates (below 7.5) were for Iowa, Montana, and New Hampshire.

Differences in population characteristics among areas (by race and ethnicity, socioeconomic status, access to health care, and prevalence of risk behaviors such as maternal smoking) may help explain differences in fetal and perinatal mortality rates among states. Caution must be used in interpreting observed differences in fetal and perinatal mortality rates among states because the differences may not be statistically significant.

## Discussion

The U.S. fetal mortality rate was 5.96 in 2013, similar to a rate of 6.05 in 2012. The fetal mortality rate at 20–27 weeks of gestation declined by 3% from 2012 to 2013, while the fetal mortality rate at 28 weeks or more was essentially unchanged. Fetal mortality rates were also higher for a number of groups, including teenagers, women aged 35 and over, unmarried women, male fetuses, and multiple deliveries. Fetal and perinatal mortality rates varied considerably by state, reflecting differences in perinatal risk, as well as differences in fetal death reporting among states. In 2013, there were more fetal than infant deaths in the United States.

In 2013, the fetal mortality rate for non-Hispanic black women (10.53) was more than twice the rate for non-Hispanic white women (4.88). Part of the higher risk of fetal and perinatal mortality for non-Hispanic black women relates to their higher risk of preterm delivery (15–17,19); however, the reasons for the preterm disparity are not well understood. Factors frequently mentioned as contributing to the black-white fetal and perinatal mortality gap are racial differences in maternal preconception health, infection, income, access to quality health care, stress and racism, and cultural factors; however, much of the black-white disparity in perinatal mortality remains unexplained (15–19).

**Table F. Fetal deaths at 24 weeks of gestation or more and fetal mortality rates, by state or selected territories: 2011–2013**

State or territory	Fetal deaths	Fetal mortality rate <sup>1</sup>
Total . . . . .	47,356	3.98
Alabama . . . . .	1,066	6.02
Alaska . . . . .	131	3.83
Arizona . . . . .	1,004	3.88
Arkansas . . . . .	574	4.97
California . . . . .	5,330	3.54
Colorado . . . . .	719	3.67
Connecticut . . . . .	371	3.36
Delaware . . . . .	144	4.33
District of Columbia . . . . .	134	4.77
Florida . . . . .	2,946	4.57
Georgia . . . . .	2,010	5.11
Hawaii . . . . .	205	3.59
Idaho . . . . .	268	3.95
Illinois . . . . .	1,778	3.71
Indiana . . . . .	1,028	4.09
Iowa . . . . .	382	3.28
Kansas . . . . .	463	3.88
Kentucky . . . . .	738	4.40
Louisiana . . . . .	609	3.23
Maine . . . . .	131	3.41
Maryland . . . . .	1,005	4.59
Massachusetts . . . . .	706	3.24
Michigan . . . . .	1,157	3.39
Minnesota . . . . .	749	3.62
Mississippi . . . . .	692	5.87
Missouri . . . . .	856	3.76
Montana . . . . .	135	3.68
Nebraska . . . . .	279	3.58
Nevada . . . . .	480	4.54
New Hampshire . . . . .	119	3.15
New Jersey . . . . .	1,200	3.82
New Mexico . . . . .	212	2.62
New York . . . . .	3,176	4.40
North Carolina . . . . .	1,593	4.42
North Dakota . . . . .	123	4.05
Ohio . . . . .	1,833	4.39
Oklahoma . . . . .	597	3.75
Oregon . . . . .	519	3.82
Pennsylvania . . . . .	1,849	4.32
Rhode Island . . . . .	141	4.29
South Carolina . . . . .	933	5.42
South Dakota . . . . .	152	4.18
Tennessee . . . . .	1,226	5.08
Texas . . . . .	3,783	3.29
Utah . . . . .	534	3.46
Vermont . . . . .	57	3.15
Virginia . . . . .	1,193	3.86
Washington . . . . .	975	3.72
West Virginia . . . . .	222	3.55
Wisconsin . . . . .	764	3.77
Wyoming . . . . .	77	3.39
Guam . . . . .	84	8.19
Puerto Rico . . . . .	727	6.20

<sup>1</sup>Rate per 1,000 live births and specified fetal deaths.

NOTES: Fetal deaths with not-stated period of gestation are proportionally distributed to less than 24 weeks and 24 weeks or more; see [Technical Notes](#). Numbers may not add to totals due to rounding. Data not shown for American Samoa and the Northern Marianas, due to small numbers of fetal deaths. Data not shown for the Virgin Islands due to the unavailability of data for 2012 and 2013.

SOURCE: CDC/NCHS, National Vital Statistics System.

In addition to the variables discussed in this report, a wide variety of other risk factors for perinatal mortality have been identified, including maternal obesity, smoking during pregnancy, severe or uncontrolled hypertension or diabetes, congenital anomalies, infections, placental and cord problems, intrauterine growth retardation, previous poor pregnancy outcome or perinatal death, and previous cesarean section (26,36–38,40–48).

Much of the public concern regarding reproductive loss has concentrated on infant mortality, in part due to a lesser knowledge of the incidence, etiology, and prevention strategies for fetal mortality. However, interest in fetal mortality is increasing (49,50), with several recent initiatives examining the etiology and prevention of fetal death, such as the Stillbirth Collaborative Research Network (19,26,38,47) and CDC's active fetal death surveillance in Iowa and metropolitan Atlanta (9). The International Stillbirth Alliance coordinates research, prevention, and family support activities (51). As enhanced research leads to the development of fetal death prevention strategies, the continued surveillance of fetal mortality levels and trends through the NVSS will remain critical. Research opportunities will be improved as more states implement the 2003 revision of the U.S. Standard Report of Fetal Death, with its expanded medical and health information (52). However, because longstanding concerns about data quality and completeness reduce the usefulness of these data for public health surveillance, quality improvement efforts are needed (9–13,53,54).

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## List of Detailed Tables

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**Table 1. Fetal deaths and mortality rates, by period of gestation and age, race, and Hispanic origin of mother: United States, 2013**

Age, race, and Hispanic origin of mother	Fetal deaths			Fetal mortality rate <sup>1</sup>		
	Total	20–27 weeks <sup>2</sup>	28 weeks or more <sup>2</sup>	Total	20–27 weeks <sup>2</sup>	28 weeks or more <sup>2</sup>
All races <sup>3</sup> . . . . .	23,595	11,874	11,721	5.96	3.01	2.97
Under 15 years . . . . .	50	37	13	15.88	11.80	*
15–19 years . . . . .	1,832	964	868	6.66	3.52	3.17
15–17 years . . . . .	530	307	223	7.03	4.09	2.97
18–19 years . . . . .	1,302	657	645	6.52	3.30	3.24
20–24 years . . . . .	5,337	2,631	2,706	5.92	2.93	3.01
25–29 years . . . . .	6,015	2,950	3,065	5.34	2.63	2.73
30–34 years . . . . .	5,772	2,961	2,811	5.54	2.85	2.70
35–39 years . . . . .	3,361	1,707	1,654	6.90	3.52	3.41
40–44 years . . . . .	1,114	565	549	10.07	5.13	4.99
45 years and over . . . . .	114	60	54	13.76	7.29	6.56
Non-Hispanic white . . . . .	10,435	4,932	5,503	4.88	2.31	2.58
Under 15 years . . . . .	15	12	3	*	*	*
15–19 years . . . . .	611	308	303	5.63	2.85	2.80
15–17 years . . . . .	150	84	66	5.93	3.33	2.62
18–19 years . . . . .	461	223	238	5.54	2.69	2.87
20–24 years . . . . .	2,131	978	1,153	4.91	2.26	2.66
25–29 years . . . . .	2,818	1,312	1,506	4.40	2.05	2.36
30–34 years . . . . .	2,828	1,335	1,493	4.53	2.15	2.40
35–39 years . . . . .	1,507	732	775	5.57	2.71	2.87
40–44 years . . . . .	478	237	241	8.33	4.15	4.22
45 years and over . . . . .	47	19	28	10.48	*	6.27
Non-Hispanic black . . . . .	6,216	3,479	2,737	10.53	5.92	4.67
Under 15 years . . . . .	18	11	7	*	*	*
15–19 years . . . . .	647	341	306	10.32	5.46	4.91
15–17 years . . . . .	185	113	72	10.44	6.40	4.09
18–19 years . . . . .	462	228	234	10.27	5.09	5.23
20–24 years . . . . .	1,745	950	795	9.31	5.09	4.26
25–29 years . . . . .	1,511	837	674	9.72	5.41	4.36
30–34 years . . . . .	1,277	765	512	11.21	6.75	4.52
35–39 years . . . . .	718	408	310	13.23	7.56	5.76
40–44 years . . . . .	272	148	124	19.26	10.57	8.87
45 years and over . . . . .	28	19	9	24.54	*	*
Hispanic <sup>4</sup> . . . . .	4,730	2,287	2,443	5.22	2.53	2.70
Under 15 years . . . . .	10	7	3	*	*	*
15–19 years . . . . .	463	255	208	4.96	2.74	2.23
15–17 years . . . . .	152	86	66	5.15	2.92	2.24
18–19 years . . . . .	311	169	142	4.87	2.65	2.23
20–24 years . . . . .	1,106	516	590	4.63	2.17	2.48
25–29 years . . . . .	1,115	511	604	4.54	2.09	2.47
30–34 years . . . . .	1,056	519	537	5.35	2.64	2.73
35–39 years . . . . .	718	352	366	6.95	3.42	3.55
40–44 years . . . . .	242	116	126	9.78	4.71	5.12
45 years and over . . . . .	20	11	9	14.71	*	*

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

<sup>1</sup>Rate per 1,000 live births and fetal deaths in specified group.<sup>2</sup>Fetal deaths with gestational age not stated were proportionally distributed; see [Technical Notes](#).<sup>3</sup>Includes races other than white and black, and origin not stated.<sup>4</sup>Includes all persons of Hispanic origin of any race.

SOURCE: CDC/NCHS, National Vital Statistics System.

**Table 2. Fetal deaths and mortality rates, by birthweight, gestational age, and race and Hispanic origin of mother: United States, 2013**

Birthweight (grams) and race and Hispanic origin of mother	Gestational age (weeks)											Fetal mortality rate <sup>1</sup>
	Total	20–23	24–27	28–31	32–33	34–36	37–38	39–40	41	42 or more	Not stated	
All races <sup>2</sup>	23,595	7,949	3,858	2,960	1,477	2,713	2,223	1,639	307	335	134	5.96
Less than 500	7,788	5,459	1,482	410	107	130	89	59	13	13	26	540.01
500–749	2,837	1,154	1,128	429	38	27	29	12	2	9	9	220.83
750–999	1,424	177	576	521	71	54	14	4	–	1	6	113.12
1,000–1,249	1,026	47	177	481	153	100	36	19	4	7	2	74.14
1,250–1,499	895	27	63	361	210	143	53	24	2	8	4	53.08
1,500–1,999	1,773	27	57	376	433	561	189	74	17	24	15	28.07
2,000–2,499	1,641	–	18	118	252	680	346	156	27	37	7	8.19
2,500–2,999	1,679	–	11	29	79	499	572	357	61	60	11	2.34
3,000–3,499	1,322	–	–	21	26	219	452	448	83	67	6	0.86
3,500–3,999	630	–	–	9	10	65	185	259	47	51	4	0.60
4,000 or more	428	–	–	–	10	68	130	146	32	36	6	1.37
Not stated	2,152	1,058	346	205	88	167	128	81	19	22	38	...
Fetal mortality rate <sup>1</sup>	5.96	507.57	167.50	59.28	24.82	8.57	2.28	0.84	0.92	1.55	...	...
Non-Hispanic white	10,435	3,252	1,658	1,291	663	1,271	1,099	832	160	162	47	4.88
Less than 500	3,205	2,189	613	184	45	80	52	26	6	3	7	571.71
500–749	1,183	448	501	176	17	13	12	7	1	3	5	232.74
750–999	613	69	252	231	28	26	6	–	–	–	1	118.29
1,000–1,249	448	12	84	204	74	44	15	10	2	2	1	73.95
1,250–1,499	391	13	30	159	87	65	23	11	–	3	–	49.24
1,500–1,999	775	16	23	174	190	234	87	33	3	8	7	25.22
2,000–2,499	783	–	4	53	121	322	177	73	14	18	1	8.17
2,500–2,999	859	–	7	13	39	261	269	203	33	31	3	2.55
3,000–3,499	665	–	–	7	11	106	238	225	44	32	2	0.83
3,500–3,999	318	–	–	4	2	25	87	137	30	30	3	0.50
4,000 or more	190	–	–	–	4	15	63	66	16	22	4	0.93
Not stated	1,005	505	144	86	45	80	70	41	11	10	13	...
Fetal mortality rate <sup>1</sup>	4.88	535.75	175.10	55.86	23.12	8.11	2.22	0.76	0.81	1.31	...	...
Non-Hispanic black	6,216	2,321	1,137	809	367	642	478	303	46	76	37	10.53
Less than 500	2,350	1,656	476	123	24	25	19	8	5	4	10	490.61
500–749	830	356	315	126	11	4	11	1	1	3	2	192.49
750–999	384	40	164	143	21	11	2	2	–	–	1	97.49
1,000–1,249	268	10	48	134	30	29	13	2	1	1	–	66.11
1,250–1,499	236	7	16	100	48	39	15	7	–	–	4	55.19
1,500–1,999	452	4	12	83	124	154	44	14	5	8	4	30.25
2,000–2,499	376	–	8	32	52	160	76	29	5	10	4	8.30
2,500–2,999	349	–	3	8	23	106	122	59	9	17	2	2.41
3,000–3,499	251	–	–	6	6	41	87	88	9	12	2	1.11
3,500–3,999	129	–	–	1	1	20	39	48	6	13	1	1.17
4,000 or more	88	–	–	–	3	18	26	33	3	4	1	3.42
Not stated	503	248	95	53	24	35	24	12	2	4	6	...
Fetal mortality rate <sup>1</sup>	10.53	455.72	154.76	63.10	27.95	10.51	2.99	1.16	1.17	2.56	...	...
Hispanic <sup>3</sup>	4,730	1,539	737	603	330	554	467	335	72	70	23	5.22
Less than 500	1,506	1,080	280	72	25	11	11	19	2	3	3	537.86
500–749	592	238	234	95	5	7	5	4	–	3	1	231.34
750–999	290	46	106	100	17	11	6	2	–	–	2	113.99
1,000–1,249	223	17	32	100	39	22	4	4	1	4	–	82.75
1,250–1,499	191	6	11	69	55	28	12	5	1	4	–	57.62
1,500–1,999	409	7	14	90	93	121	44	22	8	8	2	32.96
2,000–2,499	350	–	5	25	57	149	67	36	6	5	–	8.48
2,500–2,999	308	–	1	8	12	83	123	56	11	10	4	1.86
3,000–3,499	294	–	–	6	8	56	93	91	21	17	2	0.80
3,500–3,999	131	–	–	3	5	16	41	48	10	8	–	0.55
4,000 or more	111	–	–	–	1	29	32	34	10	5	–	1.72
Not stated	325	145	54	35	13	21	29	14	2	3	9	...
Fetal mortality rate <sup>1</sup>	5.22	501.30	159.32	57.95	24.63	7.51	1.97	0.76	1.01	1.46	...	...

– Quantity zero.

... Category not applicable.

<sup>1</sup>Rate per 1,000 live births and fetal deaths in specified group.<sup>2</sup>Includes races other than white and black, and origin not stated.<sup>3</sup>Includes all persons of Hispanic origin of any race.

SOURCE: CDC/NCHS, National Vital Statistics System.

**Table 3. Fetal and perinatal deaths and mortality rates: United States and each state and selected territories, 2013**

State or territory	Fetal deaths <sup>1</sup>		Perinatal definition I <sup>2</sup>		Perinatal definition II <sup>3</sup>	
	Number of deaths <sup>4</sup>	Mortality rate <sup>5</sup>	Number of deaths <sup>4</sup>	Mortality rate <sup>5</sup>	Number of deaths <sup>4</sup>	Mortality rate <sup>5</sup>
Total . . . . .	23,595	5.96	24,622	6.24	39,489	9.98
Alabama . . . . .	521	8.88	499	8.54	844	14.38
Alaska . . . . .	57	4.96	51	4.44	87	7.56
Arizona . . . . .	505	5.86	491	5.72	797	9.26
Arkansas . . . . .	248	6.51	283	7.45	419	11.00
California . . . . .	2,557	5.14	2,760	5.56	4,205	8.46
Colorado . . . . .	335	5.13	375	5.75	575	8.80
Connecticut . . . . .	196	5.40	193	5.33	314	8.65
Delaware . . . . .	65	5.97	74	6.81	113	10.37
District of Columbia . . . . .	90	9.60	70	7.51	134	14.29
Florida . . . . .	1,527	7.04	1,417	6.56	2,395	11.04
Georgia . . . . .	1,154	8.88	957	7.41	1,773	13.65
Hawaii . . . . .	114	5.97	128	6.72	201	10.52
Idaho . . . . .	107	4.76	146	6.50	188	8.36
Illinois . . . . .	936	5.93	994	6.32	1,574	9.97
Indiana . . . . .	491	5.87	570	6.84	876	10.48
Iowa . . . . .	171	4.36	185	4.72	276	7.03
Kansas . . . . .	176	4.51	258	6.62	345	8.84
Kentucky . . . . .	346	6.18	376	6.73	565	10.08
Louisiana . . . . .	289	4.55	386	6.10	611	9.62
Maine . . . . .	62	4.83	79	6.17	117	9.11
Maryland . . . . .	553	7.63	504	6.98	880	12.14
Massachusetts . . . . .	334	4.63	365	5.07	556	7.71
Michigan . . . . .	575	5.04	723	6.35	1,118	9.80
Minnesota . . . . .	350	5.04	409	5.90	603	8.68
Mississippi . . . . .	345	8.85	307	7.92	570	14.62
Missouri . . . . .	411	5.43	473	6.27	741	9.79
Montana . . . . .	57	4.58	66	5.32	93	7.48
Nebraska . . . . .	135	5.15	140	5.35	231	8.81
Nevada . . . . .	223	6.33	202	5.75	351	9.96
New Hampshire . . . . .	44	3.54	72	5.79	93	7.48
New Jersey . . . . .	693	6.71	585	5.68	1,020	9.88
New Mexico <sup>6</sup> . . . . .	78	2.95	133	5.04	181	6.85
New York . . . . .	1,740	7.29	1,386	5.83	2,569	10.76
North Carolina . . . . .	759	6.34	900	7.54	1,360	11.36
North Dakota . . . . .	56	5.26	70	6.59	106	9.95
Ohio . . . . .	888	6.35	1,059	7.60	1,612	11.53
Oklahoma . . . . .	273	5.09	309	5.77	485	9.04
Oregon . . . . .	224	4.94	254	5.61	383	8.44
Pennsylvania . . . . .	880	6.21	1,007	7.12	1,559	10.99
Rhode Island . . . . .	73	6.71	76	7.01	119	10.94
South Carolina . . . . .	445	7.77	429	7.52	706	12.33
South Dakota <sup>6</sup> . . . . .	64	5.20	79	6.43	112	9.10
Tennessee . . . . .	569	7.06	558	6.95	902	11.20
Texas . . . . .	1,905	4.89	2,238	5.76	3,420	8.79
Utah . . . . .	294	5.74	295	5.77	477	9.31
Vermont . . . . .	27	4.50	32	5.34	46	7.66
Virginia . . . . .	652	6.34	650	6.35	1,103	10.73
Washington . . . . .	520	5.97	451	5.20	784	9.00
West Virginia . . . . .	102	4.87	112	5.37	196	9.37
Wisconsin . . . . .	343	5.12	411	6.15	642	9.58
Wyoming . . . . .	37	4.82	35	4.57	60	7.81
Guam . . . . .	42	12.62	39	11.77	59	17.73
Puerto Rico . . . . .	412	11.17	275	7.51	587	15.91

<sup>1</sup>Fetal deaths with stated or presumed period of gestation of 20 weeks or more.

<sup>2</sup>Infant deaths at less than 7 days and fetal deaths with stated or presumed period of gestation of 28 weeks or more. Fetal deaths with not-stated gestational age are proportionally distributed to 20–27 weeks and 28 weeks or more.

<sup>3</sup>Infant deaths at less than 28 days and fetal deaths with stated or presumed period of gestation of 20 weeks or more.

<sup>4</sup>Numbers may not exactly add to totals due to rounding of proportionally distributed fetal deaths or weighted infant deaths.

<sup>5</sup>Rate per 1,000 live births and specified fetal deaths.

<sup>6</sup>State reports only fetal deaths of 500 grams or more; data for fetal and perinatal definition II are not comparable with data from other states.

NOTES: Data not shown for American Samoa and the Northern Marianas, due to small numbers of fetal deaths. Data not shown for the Virgin Islands due to unavailability of data for 2013.

SOURCE: CDC/NCHS, National Vital Statistics System.

## Technical Notes

### Definition of fetal death

“Fetal death” means death prior to the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy and which is not an induced termination of pregnancy. The death is indicated by the fact that after such expulsion or extraction, the fetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.

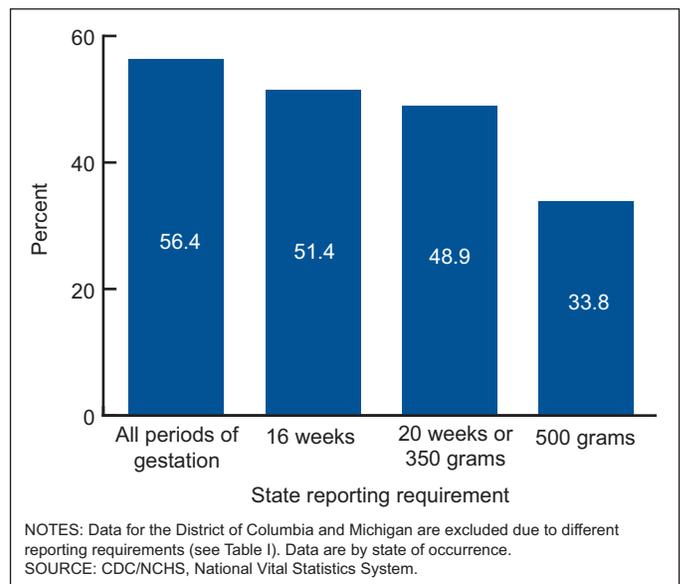
This definition (55) has been adopted by the Centers for Disease Control and Prevention’s (CDC) National Center for Health Statistics (NCHS) as the nationally recommended standard and is based on the definition published by the World Health Organization in 1950 and revised in 1988. The term “fetal death” is defined on an all-inclusive basis to end confusion arising from the use of such terms as stillbirth, spontaneous abortion, and miscarriage. All U.S. states and registration areas have definitions similar to the standard definition, except for Puerto Rico and Wisconsin, which have no formal definition (56). Fetal deaths do not include induced terminations of pregnancy.

### Reporting requirements for fetal death data

Reporting requirements for fetal deaths vary by state, and these differences have important implications for comparisons of fetal and perinatal mortality rates by state. [Table I](#) shows the period of gestation at which fetal death reporting is required for each reporting area. Since the publication of the 2006 fetal and perinatal mortality report (57), two states have made changes to how their data are reported. From 2001 to 2006, although Georgia law required the reporting of all fetal deaths at all periods of gestation, only data for those at 20 weeks or greater were sent to NCHS. From 2007 onward, Georgia has sent data on fetal deaths of all periods of gestation to NCHS. Additionally, since July 1, 2010, Tennessee has required the reporting of fetal deaths of 20 weeks of gestation or more, or 350 grams birthweight or more. Previously, Tennessee had only required reporting of fetal deaths with birthweights of 500 grams or more.

The majority of states require reporting of fetal deaths at 20 weeks of gestation or more, or a minimum of 350 grams birthweight (roughly equivalent to 20 weeks), or some combination of the two. However, seven states and the Virgin Islands require reporting of fetal deaths at all periods of gestation (although two of these do not send data for fetal deaths at less than 20 weeks to NCHS), whereas one state requires reporting beginning at 16 weeks of gestation. At the other end of the spectrum, two states (New Mexico and South Dakota) require reporting of fetal deaths with birthweights of 500 grams or more (roughly equivalent to 22 weeks of gestation). Lack of full reporting for these states leads to a slight underestimate of the U.S. fetal mortality rate, although the rates are not significantly different. For example, when data for these two states are excluded, the fetal mortality rate was 5.99 in 2013, compared with 5.96 for all states combined.

There is substantial evidence that not all fetal deaths for which reporting is required are reported (9,10). Underreporting of fetal deaths is most likely to occur in the earlier part of the required reporting period for each state. This is illustrated in the [Figure](#), which



**Figure. Percentage of fetal deaths at 20–27 weeks of gestation among all fetal deaths at 20 weeks or more, according to state reporting requirements, 2013**

compares the percentage of fetal deaths at 20 weeks or more that are at 20–27 weeks of gestation by state reporting requirements. In general, fetal deaths tend to be somewhat underreported near the lower limit of the reporting requirement. For those states requiring reporting of fetal deaths at all periods of gestation, 56.4% of fetal deaths at 20 weeks of gestation or more were at 20–27 weeks, whereas for states requiring reporting of fetal deaths of 500 grams or more, only 33.8% were at 20–27 weeks, thus indicating substantial underreporting of early fetal deaths.

Variations in fetal death reporting requirements and practices have implications for comparing fetal and perinatal mortality rates among states. Because reporting is generally incomplete near the lower limit of the reporting requirement, states that require reporting of all fetal deaths at any gestational age are likely to have more complete reporting of fetal deaths at 20 weeks or more than those states that do not. The larger number of fetal deaths reported for these “all periods” states may result in higher perinatal mortality rates than those rates reported for states whose reporting is less complete. Accordingly, reporting completeness may account in part for differences in fetal and perinatal mortality rates among states. To promote the comparability of data by year and by state while including as much meaningful data as possible, this report presents data on fetal deaths with a stated or presumed period of gestation of 20 weeks or more (6).

### Percentage of unknown responses, by characteristics

[Table II](#) shows the percentage of unknown responses for particular variables shown in this report, in the fetal death file, and for U.S. live births. In general, percentages of unknown responses are considerably higher for fetal deaths than for live births, and among fetal deaths the percentage unknown is higher for fetal deaths that occur earlier in the gestational period. In the tables in

**Table I. Period of gestation and weight minimums at which fetal death reporting is required, by reporting area: United States, 2013**

Area	All periods of gestation	16 weeks	20 weeks	20 weeks or 350 grams	20 weeks or 400 grams	20 weeks or 500 grams	5 months	350 grams	500 grams
Alabama	...	...	X	...	...	...	...	...	...
Alaska	...	...	X	...	...	...	...	...	...
Arizona	...	...	...	X	...	...	...	...	...
Arkansas	<sup>1</sup> X	...	...	...	...	...	...	...	...
California	...	...	X	...	...	...	...	...	...
Colorado	<sup>1</sup> X	...	...	...	...	...	...	...	...
Connecticut	...	...	X	...	...	...	...	...	...
Delaware	...	...	...	...	...	...	...	<sup>2</sup> X	...
District of Columbia	...	...	...	...	...	X	...	...	...
Florida	...	...	X	...	...	...	...	...	...
Georgia	X	...	...	...	...	...	...	...	...
Hawaii	X	...	...	...	...	...	...	...	...
Idaho	...	...	...	X	...	...	...	...	...
Illinois	...	...	X	...	...	...	...	...	...
Indiana	...	...	X	...	...	...	...	...	...
Iowa	...	...	X	...	...	...	...	...	...
Kansas	...	...	...	...	...	...	...	X	...
Kentucky	...	...	...	X	...	...	...	...	...
Louisiana	...	...	...	X	...	...	...	...	...
Maine	...	...	X	...	...	...	...	...	...
Maryland	...	...	<sup>3</sup> X	...	...	...	...	...	...
Massachusetts	...	...	...	X	...	...	...	...	...
Michigan	...	...	...	...	X	...	...	...	...
Minnesota	...	...	X	...	...	...	...	...	...
Mississippi	...	...	...	X	...	...	...	...	...
Missouri	...	...	...	X	...	...	...	...	...
Montana	...	...	...	...	...	...	...	<sup>2</sup> X	...
Nebraska	...	...	X	...	...	...	...	...	...
Nevada	...	...	X	...	...	...	...	...	...
New Hampshire	...	...	...	X	...	...	...	...	...
New Jersey	...	...	X	...	...	...	...	...	...
New Mexico	...	...	...	...	...	...	...	...	X
New York	X	...	...	...	...	...	...	...	...
New York (excluding New York City)	X	...	...	...	...	...	...	...	...
New York City	X	...	...	...	...	...	...	...	...
North Carolina	...	...	X	...	...	...	...	...	...
North Dakota	...	...	X	...	...	...	...	...	...
Ohio	...	...	X	...	...	...	...	...	...
Oklahoma	...	...	X	...	...	...	...	...	...
Oregon	...	...	X	...	...	...	...	...	...
Pennsylvania	...	X	...	...	...	...	...	...	...
Rhode Island	X	...	...	...	...	...	...	...	...
South Carolina	...	...	...	X	...	...	...	...	...
South Dakota	...	...	...	...	...	...	...	...	X
Tennessee	...	...	...	X	...	...	...	...	...
Texas	...	...	X	...	...	...	...	...	...
Utah	...	...	X	...	...	...	...	...	...
Vermont	...	...	<sup>4</sup> X	...	...	...	...	...	...
Virginia	X	...	...	...	...	...	...	...	...
Washington	...	...	X	...	...	...	...	...	...
West Virginia	...	...	X	...	...	...	...	...	...
Wisconsin	...	...	...	X	...	...	...	...	...
Wyoming	...	...	X	...	...	...	...	...	...
Guam	...	...	...	X	...	...	...	...	...
Puerto Rico	...	...	...	...	...	...	X	...	...

... Category not applicable.

<sup>1</sup>Although state law requires the reporting of fetal deaths at all periods of gestation, only data for fetal deaths at 20 weeks of gestation or more are provided to NCHS.<sup>2</sup>If weight is unknown, 20 completed weeks of gestation or more.<sup>3</sup>If gestational age is unknown, weight of 500 grams or more.<sup>4</sup>If gestational age is unknown, weight of 400 grams or more (15 ounces or more).

SOURCE: CDC/NCHS, National Vital Statistics System.

**Table II. Percentage of unknown responses for selected variables for fetal deaths and live births: United States, 2013**

Variable	Fetal deaths			Live births <sup>2</sup>
	Total <sup>1</sup>	20–27 weeks	28 weeks or more	
Marital status <sup>3</sup> .....	3.59	4.18	2.84	0.05
Hispanic origin .....	3.62	4.28	2.81	0.70
Period of gestation .....	0.57	...	...	0.09
Birthweight .....	9.12	11.89	6.09	†0.02

... Category not applicable.

<sup>1</sup>For the linked file, not-stated birthweight is imputed for records with known period of gestation; the percentage of unknown responses before imputation is 0.11.

<sup>2</sup>Includes fetal deaths with stated or presumed period of gestation of 20 weeks or more.

<sup>3</sup>Based on the denominator file for the linked file. Figures for the linked file differ slightly from the natality file.

<sup>4</sup>For fetal deaths, excludes data for residents of California and New York, which did not report marital status on the fetal death report. For live births, excludes data for Upstate New York (but includes data for New York City), which did not report marital status on the birth certificate. For births only, marital status was inferred for nonreporting states, and not-stated marital status was imputed in reporting states (15).

SOURCE: CDC/NCHS, National Vital Statistics System.

this report, unknown responses are shown in frequencies tables but are excluded from the computation of percent distributions and fetal and perinatal mortality rates. Thus, rates published in this report by variables with a substantial percentage of unknown responses (such as birthweight) may understate the true rates of fetal mortality for that characteristic.

## The 1989 and 2003 revisions of the U.S. Standard Certificates and Reports

For the United States, this report includes data for 35 states (Arizona, California, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Washington, Wisconsin, and Wyoming), the District of Columbia, and New York City, which implemented the 2003 revision of the U.S. Standard Report of Fetal Death on or before January 1, 2013 (revised). Data from all other areas are based on the 1989 revision (unrevised).

For live births, 41 states (Alaska, California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York [including New York City], North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming) and the District of Columbia implemented the 2003 revision of the U.S. Standard Certificate of Birth by January 1, 2013. One additional state, Maine, implemented the revised birth certificate in 2013, but after January 1. Data from all other areas are based on the 1989 revision.

For infant deaths included in perinatal mortality rates, 40 states (Arizona, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, North Dakota, New Hampshire, New Jersey, New Mexico, New York [including New York City], Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, Wyoming) and the District of Columbia implemented the 2003 revision of the U.S. Standard Certificate of Death as of January 1, 2013. One additional

state, Wisconsin, implemented the revised death certificate in 2013, but after January 1. Data from all other areas are based on the 1989 revision. The 2003 revision of the U.S. Standard Certificates and Reports is described in detail elsewhere (52). Because the variables included in this report are comparable between the 1989 and 2003 revisions, these changes had little effect on the data included here.

## Change in fetal and perinatal mortality rates for 2003 and 2004

As noted in the 2006 fetal and perinatal mortality report (57), 2003 and 2004 fetal and perinatal mortality data shown in earlier publications (58,59) were corrected to fix a programming error that led to the misclassification of some fetal death records with not-stated gestational ages (57). The 2003 and 2004 data by race and Hispanic origin of the mother shown in Table C of this report have been further revised from those data published in the 2006 report (57) to exclude some fetal death records with a state of residence of Oklahoma, which did not begin reporting Hispanic origin data until 2005.

## Computation of rates

Fetal mortality rates in this report are computed as the number of fetal deaths at 20 weeks of gestation or more per 1,000 live births and fetal deaths at 20 weeks or more. Perinatal mortality rates are computed in a similar fashion, as shown below. The denominators for all fetal and perinatal mortality rates are live births plus fetal deaths in the specified gestational age group, thus representing the population at risk of the event.

$$\text{Fetal mortality rate} = \frac{\text{Fetal deaths at 20 weeks of gestation or more}}{\text{Live births and fetal deaths at 20 weeks or more}} \times 1,000$$

$$\text{Perinatal mortality rate, definition I} = \frac{\text{Fetal deaths at 28 weeks or more and infant deaths under 7 days}}{\text{Live births and fetal deaths at 28 weeks or more}} \times 1,000$$

$$\text{Perinatal mortality rate, definition II} = \frac{\text{Fetal deaths at 20 weeks or more and infant deaths under 28 days}}{\text{Live births and fetal deaths at 20 weeks or more}} \times 1,000$$

In each case, the fetal deaths included in the denominator of each rate mirror the fetal deaths included in the numerator. A previous NCHS report (60) contains information on the historical development of various perinatal measures. In tables, an asterisk (\*) is shown in place of any rate based on fewer than 20 fetal or perinatal deaths in the numerator.

### Prospective fetal mortality rate

When fetal mortality is examined at a given gestational age, the prospective fetal mortality rate may provide a more appropriate indication of the population at risk of fetal death because the denominator for this rate is all of the women who are still pregnant at that gestational age. The prospective fetal mortality rate is computed as the number of fetal deaths at a given gestational age (in single weeks) per 1,000 live births and fetal deaths at that gestational age or greater. Records with not-stated gestational age are excluded from totals before computations are begun.

Prospective fetal mortality rate<sub>w</sub> =

$$\text{Fetal deaths}_w / (\sum_w^{\text{max}} \text{fetal deaths} + \sum_w^{\text{max}} \text{live births}) \times 1,000$$

where *w* is specific gestational age in weeks and max is highest gestational age in weeks.

### Multiple-race data

Beginning in 2003, some states revised their race reporting to allow respondents to select one or more race categories, to comply with the current (1997) Office of Management and Budget (OMB) standards (61). For fetal deaths, the 35 revised states, the District of Columbia, and New York City reported multiple-race data in 2013. For 2013 births, 44 states (the 41 states revised as of January 1, 2013, Maine [revised after January 1, 2013], and Hawaii and Rhode Island, which used the 1989 revision) and the District of Columbia reported multiple-race data. Eventually, all U.S. states will report multiple-race data; in the interim, however, the numerators for fetal mortality rates are incompatible with the denominators (births). To compute rates, it is necessary to “bridge” data for multiple-race persons to single-race categories, using methods described elsewhere (62–65). This has been done for fetal and perinatal mortality rates by race presented in this report. Once all states revise their registration systems to be compliant with the current OMB standards, the use of bridged data can be discontinued.

### Period of gestation

The primary measure used to determine the gestational age of the fetus is the interval between the first day of the mother’s last normal menstrual period (LMP) and the date of delivery. It is subject to error for several reasons, including imperfect maternal recall or misidentification of the LMP because of postconception bleeding, delayed ovulation, or intervening early miscarriage. These data are edited for LMP-based gestational ages that are clearly inconsistent with birthweight and plurality, but reporting problems for this item persist. If the date of LMP is not reported, or the computed period

of gestation is inconsistent with birthweight, the clinical or obstetric estimate of gestation is used (17.9% of fetal death records and 5.5% of live birth records in 2013). These procedures are described in more detail elsewhere (15,66).

Beginning with the 2014 data year, NCHS will be transitioning to the use of the obstetric estimate of gestation at delivery (OE) as the primary measure for estimating gestational age (32). This transition is being made because of the increasing evidence of the greater validity of the OE compared with the LMP-based measure (32).

### Gestational age not stated

Fetal deaths with not-stated gestational age are presumed to be 20 weeks of gestation or more if the state requires reporting of all fetal deaths at 20 weeks or more, or if the fetus weighed 500 grams or more in those states requiring reporting of all fetal deaths regardless of gestational age. Furthermore, in Tables A, B, 1, and 3, fetal deaths with not-stated gestational age are allocated to the 20–27 week and 28 weeks or more categories according to the proportion of fetal deaths with stated gestational age that fall into each category (proportional distribution). Similarly, for Table F, fetal deaths with not-stated gestational age are proportionally distributed into the 20–23 week and 24 weeks or more categories. Proportional distribution is not performed for data in tables that show more detailed gestational age categories (Table 2). The allocation of not-stated gestational age for fetal deaths is made individually for each maternal age group, race and Hispanic origin group, and state.

### Random variation in fetal and perinatal mortality

The number of fetal deaths, perinatal deaths, and live births reported for an area represent complete counts of such events. As such, they are not subject to sampling error, although they are subject to nonsampling error in the registration process. However, when the figures are used for analytic purposes, such as the comparison of rates over time, for different areas, or among different subgroups, the number of events that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances (67). As a result, numbers of births, fetal deaths, perinatal deaths, and fetal and perinatal mortality rates are subject to random variation. The probable range of values may be estimated from the actual figures according to certain statistical assumptions.

In general, distributions of vital events may be assumed to follow the normal distribution. When the number of events is large, the relative standard error (RSE) is usually small. When the number of events is small (perhaps less than 100) and the probability of such an event is small, considerable caution must be used in interpreting the data. Such infrequent events may be assumed to follow a Poisson probability distribution. Estimates of RSEs and 95% confidence intervals are shown below. In the formulas, *D* is the number of fetal or perinatal deaths and *B* is the number of live births plus fetal deaths used as the denominator in computing fetal and perinatal mortality rates.

The formulas for the two RSEs are as follows:

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

and

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

For example, if for group A the number of fetal deaths was 238, whereas the number of live births plus fetal deaths in the denominator was 32,650, this would yield a fetal mortality rate of 7.29 fetal deaths per 1,000 live births and fetal deaths.

The RSE of the deaths is

$$\text{RSE} = 100 \cdot \sqrt{\frac{1}{238}} = 6.48$$

whereas the RSE for the births plus fetal deaths in the denominator is

$$\text{RSE} = 100 \cdot \sqrt{\frac{1}{32,650}} = 0.55$$

The formula for the RSE of the fetal mortality rate is:

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

Thus, the RSE for the example above is:

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

### Normal distribution

When the number of events is greater than 100, the normal distribution is used to estimate the 95% confidence intervals of a rate,  $R_1$ , as follows:

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

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

Thus, for Group A:

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

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

Therefore, the chances are 95 out of 100 that the true fetal or perinatal mortality rate for Group A lies somewhere in the 6.36–8.22 interval.

### Poisson distribution

$$\text{Lower: } R_1 \cdot L(0.95, D_{\text{adj}})$$

$$\text{Upper: } R_1 \cdot U(0.95, D_{\text{adj}})$$

When the number of events in the numerator is less than 100, the confidence interval for the rate,  $R_1$ , can be estimated based on the Poisson distribution using the values in [Table III](#).

where  $D_{\text{adj}}$  is the adjusted number of fetal or perinatal deaths (rounded to the nearest integer) used to take into account the RSE of the number of deaths in the numerator and the number of live births plus fetal deaths in the denominator, and is computed as follows:

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

where  $L(0.95, D_{\text{adj}})$  and  $U(0.95, D_{\text{adj}})$  refer to the values in [Table III](#) corresponding to the value of  $D_{\text{adj}}$ .

For example, if for Group B the number of fetal deaths was 73, and the number of live births plus fetal deaths in the denominator was 11,422, and the fetal mortality rate was 6.39:

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

and the 95% confidence interval (using the formula in [Table III](#) for 1–99 infant deaths) is

$$\text{Lower: } 6.39 \cdot 0.78384 = 5.01$$

$$\text{Upper: } 6.39 \cdot 1.25735 = 8.03$$

### Comparison of two fetal or perinatal mortality rates

If either of the two rates to be compared is based on fewer than 100 deaths, the confidence intervals for both rates should be computed and checked to see if they overlap. If they do, the difference is not statistically significant at the 95% level. If they do not overlap, the difference is statistically significant. If both the rates to be compared ( $R_1$  and  $R_2$ ) are based on 100 or more deaths, the following  $z$  test should be used to define a significance test statistic:

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

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

**Table III. Values of *L* and *U* for calculating 95% confidence limits for numbers of events and rates when the number of events is less than 100**

<i>N</i>	<i>L</i>	<i>U</i>	<i>N</i>	<i>L</i>	<i>U</i>
1.....	0.02532	5.57164	51.....	0.74457	1.31482
2.....	0.12110	3.61234	52.....	0.74685	1.31137
3.....	0.20622	2.92242	53.....	0.74907	1.30802
4.....	0.27247	2.56040	54.....	0.75123	1.30478
5.....	0.32470	2.33367	55.....	0.75334	1.30164
6.....	0.36698	2.17658	56.....	0.75539	1.29858
7.....	0.40205	2.06038	57.....	0.75739	1.29562
8.....	0.43173	1.97040	58.....	0.75934	1.29273
9.....	0.45726	1.89831	59.....	0.76125	1.28993
10.....	0.47954	1.83904	60.....	0.76311	1.28720
11.....	0.49920	1.78928	61.....	0.76492	1.28454
12.....	0.51671	1.74680	62.....	0.76669	1.28195
13.....	0.53246	1.71003	63.....	0.76843	1.27943
14.....	0.54671	1.67783	64.....	0.77012	1.27698
15.....	0.55969	1.64935	65.....	0.77178	1.27458
16.....	0.57159	1.62394	66.....	0.77340	1.27225
17.....	0.58254	1.60110	67.....	0.77499	1.26996
18.....	0.59266	1.58043	68.....	0.77654	1.26774
19.....	0.60207	1.56162	69.....	0.77806	1.26556
20.....	0.61083	1.54442	70.....	0.77955	1.26344
21.....	0.61902	1.52861	71.....	0.78101	1.26136
22.....	0.62669	1.51401	72.....	0.78244	1.25933
23.....	0.63391	1.50049	73.....	0.78384	1.25735
24.....	0.64072	1.48792	74.....	0.78522	1.25541
25.....	0.64715	1.47620	75.....	0.78656	1.25351
26.....	0.65323	1.46523	76.....	0.78789	1.25165
27.....	0.65901	1.45495	77.....	0.78918	1.24983
28.....	0.66449	1.44528	78.....	0.79046	1.24805
29.....	0.66972	1.43617	79.....	0.79171	1.24630
30.....	0.67470	1.42756	80.....	0.79294	1.24459
31.....	0.67945	1.41942	81.....	0.79414	1.24291
32.....	0.68400	1.41170	82.....	0.79533	1.24126
33.....	0.68835	1.40437	83.....	0.79649	1.23965
34.....	0.69253	1.39740	84.....	0.79764	1.23807
35.....	0.69654	1.39076	85.....	0.79876	1.23652
36.....	0.70039	1.38442	86.....	0.79987	1.23499
37.....	0.70409	1.37837	87.....	0.80096	1.23350
38.....	0.70766	1.37258	88.....	0.80203	1.23203
39.....	0.71110	1.36703	89.....	0.80308	1.23059
40.....	0.71441	1.36172	90.....	0.80412	1.22917
41.....	0.71762	1.35661	91.....	0.80514	1.22778
42.....	0.72071	1.35171	92.....	0.80614	1.22641
43.....	0.72370	1.34699	93.....	0.80713	1.22507
44.....	0.72660	1.34245	94.....	0.80810	1.22375
45.....	0.72941	1.33808	95.....	0.80906	1.22245
46.....	0.73213	1.33386	96.....	0.81000	1.22117
47.....	0.73476	1.32979	97.....	0.81093	1.21992
48.....	0.73732	1.32585	98.....	0.81185	1.21868
49.....	0.73981	1.32205	99.....	0.81275	1.21746
50.....	0.74222	1.31838			

SOURCE: CDC/NCHS, National Vital Statistics System.

## Availability of fetal and perinatal data

Fetal death data files and user's guides are available for downloading from the NCHS website at: [http://www.cdc.gov/nchs/data\\_access/VitalStatsOnline.htm](http://www.cdc.gov/nchs/data_access/VitalStatsOnline.htm). Each data file contains all the variables included in this report plus many additional variables (6). Fetal death data are also available through VitalStats, NCHS' online data tabulation system, at: <http://www.cdc.gov/nchs/VitalStats.htm>. Additional information on fetal and perinatal mortality is available from: <http://www.cdc.gov/nchs>.

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