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Maternal Characteristics and Infant Outcomes in Appalachia and the Delta

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Abstract

Objectives—This report compares maternal characteristics and outcomes for infants born to mothers in Appalachia, the Delta, and the rest of the United States.

Methods—The 2017 vital statistics natality file and the 2016–2017 linked birth/infant death data files were used to compare maternal characteristics (e.g., race and Hispanic origin, age, and marital status) of women who gave birth in Appalachia, the Delta, and the rest of the United States. Comparisons of infant outcomes (preterm, low birthweight, and infant mortality) across the three regions were made overall and within categories of these maternal characteristics.

Results—Characteristics of women who gave birth differed across the three regions. Women in the Delta were most likely to be teenagers, unmarried, and not have a college degree, followed by women in Appalachia, and then by women in the rest of the United States. Overall and within most categories of maternal characteristics, infants born in the Delta were more likely to be preterm (12.37%) or low birthweight (10.75%) and were more likely to die in their first year of life (8.17 infant deaths per 1,000 live births) than those born in Appalachia (10.75%, 8.87%, and 6.82, respectively), while those born in the rest of the United States were the least likely (9.78%, 8.14%, and 5.67, respectively).

Conclusions—Maternal characteristics associated with poor infant outcomes are most common among women who give birth in the Delta, followed by women in Appalachia, and then the rest of the United States. Within most categories of these maternal characteristics, infants born in the Delta have the worst outcomes, followed by those born in Appalachia, and then those born in the rest of the United States.

Keywords: region • infant mortality • low birthweight • preterm birth

Introduction

Economic distress and disadvantage varies across the United States. Two regions, Appalachia and the Delta, are among the most economically disadvantaged in the country. Poverty rates in each region are consistently higher than the U.S. average (1,2). Poverty level has been associated with a higher risk of infant death (3). However, there is little surveillance data on infant outcomes and infant mortality in either of these regions.

The Delta Regional Authority (DRA), established by Congress in 2000, encompasses 9.8 million people in 252 counties and parishes in eight states (Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee) (Figure 1). The region defined by DRA is hereafter referred to as "the Delta." The Delta makes up the most economically depressed area of the country. In the Delta counties of these states, poverty rates range from 20.6% in Tennessee to 27.5% in Alabama in 2010–2014 compared with 15.6% for the United States (1). During the same period, 20.5% of Delta residents aged 25 and over had at least a bachelor's degree compared with 29.3% in the United States overall (1).

The Appalachian Regional Commission (ARC), established by an act of Congress in 1965, is a regional economic development agency that represents a partnership of federal, state, and local governments. The legislation defined the counties included in the Appalachian Region, which includes all of West Virginia and parts of 12 other states (Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia) (Figure 1) (4). The region defined by ARC is hereafter referred to as "Appalachia." The region includes 420 counties and 26.0 million people. In the Appalachian counties of these states, poverty rates ranged from 14.3% in Maryland to 25.8% in West Virginia in 2011-2015 compared with 15.5% for the United States (5). During the same period, 22.6% of adults in Appalachia aged 25 and over had completed at least a bachelor's degree compared with 29.8% in the United States overall (5).







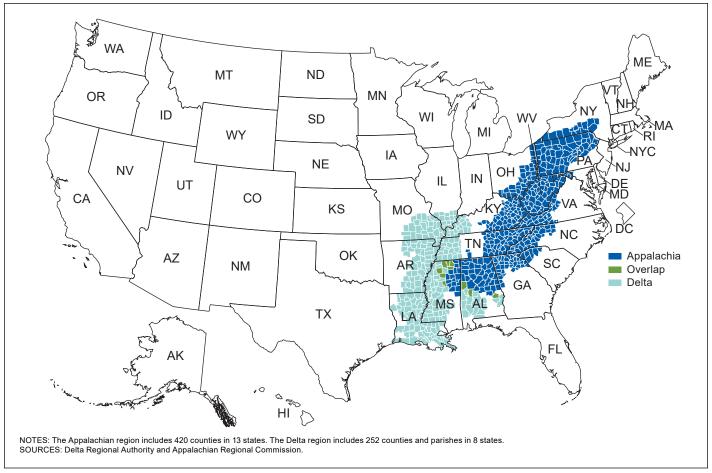


Figure 1. Appalachian and Delta regions and the rest of the United States

This study compares differences in maternal characteristics among the Delta, Appalachia, and the rest of the United States. The analyses also compare infant outcomes for the three regions overall and within categories of these characteristics, and provide information on variation in infant outcomes across the regions by maternal characteristics.

Methods

The analyses used 2017 birth certificate data and 2016–2017 linked birth/infant death data from the National Vital Statistics System. Birth certificate data are based on 100% of births registered in the 50 states and the District of Columbia (6). The linked data are based on 99.5% of infant deaths occurring in the United States in 2016 and 2017 where the death certificate could be matched to the infant's birth certificate (7). Two years of infant mortality data were used to increase statistical power by increasing the numbers of infant cases in maternal characteristic categories for comparison across regions.

Infants are categorized and analyzed based on their mother's county and state of residence in Appalachia, the Delta, or the rest of the United States. Ten counties are included in both the Delta and Appalachia. These 10 counties account for 2.0% of births in the Delta and 0.9% of births in Appalachia. To compare distributions of maternal characteristics and infant outcomes

between the two regions, a corrected z test statistic designed to account for overlapping samples was used to compare Appalachia and the Delta (8). Each region is also compared with the rest of the United States using z tests of statistical significance. Maternal characteristics and birth outcomes were compared between the Delta and Appalachia, between the Delta and the rest of the United States, and between Appalachia and the rest of the United States. Differences referred to as one group "followed" by another indicate that they were statistically significant in the order they are described. All differences noted in the text are statistically significant. National Center for Health Statistics standards for data presentation were applied to all analyses of proportions (9). The tables present 95% confidence intervals for infant outcome measures.

Three infant outcomes are examined: preterm birth, low birthweight, and infant mortality. The preterm birth rate is the percentage of births delivered at less than 37 completed weeks of gestation based on the obstetric estimate of gestation. The low birthweight rate is the percentage of infants born at less than 2,500 grams. The infant mortality rate is defined as deaths within 1 year of birth per 1,000 births. Supplemental tables present additional detail on these outcomes: early and late preterm (less than 34 weeks and 34–36 weeks), very and moderately low birthweight (less than 1,500 grams and 1,500–2,499 grams), and neonatal and postneonatal death (before 28 days and 28–364 days).

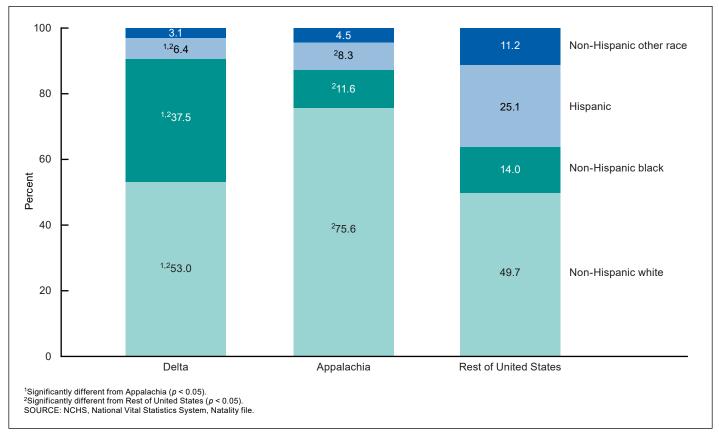


Figure 2. Distribution of births, by maternal race and Hispanic origin: Delta, Appalachia, and the rest of the United States, 2017

Infant outcomes are examined by maternal race and Hispanic origin (non-Hispanic white, non-Hispanic black, and Hispanic), age, education, marital status, whether the mother received Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) benefits during pregnancy, source of payment for the delivery, tobacco use during pregnancy, prepregnancy body mass index (BMI), and initiation of prenatal care. These characteristics have been shown to be associated with infant outcomes.

Marital status is categorized as married, unmarried with paternity acknowledgment, and unmarried with no paternity acknowledgment. Due to restrictions on the availability of marital status data from California for 2017, marital status calculations for the Rest of the United States category exclude California (6). The results of analyses of 2016 data, which contain marital status information for California, that compare the rest of the United States with both the Delta and Appalachia do not differ in the significance of differences for these comparisons from analyses using 2017 data.

Eligibility for Medicaid during pregnancy, one of the sources of payment for the delivery, varies by state from 138% through 380% of the federal poverty level (FPL) (10). Women who have income below 185% FPL and are at nutritional risk are eligible to receive WIC benefits while pregnant (11).

Results

Distribution of maternal characteristics

The 399,540 births to women in the Delta and Appalachia accounted for 1 in 10 (10.4%) births in the United States in 2017. The 124,047 births to women who lived in the Delta accounted for 3.2% of births nationwide, and the 275,493 births to women who lived in Appalachia accounted for 7.2% of all births.

Race and Hispanic origin—Slightly more than one-half (53.0%) of women giving birth in 2017 in the Delta were non-Hispanic white; 37.5% were non-Hispanic black (Table 1, Figure 2). In comparison, approximately three in four (75.6%) women in Appalachia were non-Hispanic white and 11.6% were non-Hispanic black. In the rest of the United States, about one-half (49.7%) of women were non-Hispanic white and 14.0% were non-Hispanic black. The percentage of Hispanic women was lower in both the Delta (6.4%) and Appalachia (8.3%) than in the rest of the United States (25.1%).

Age—Higher percentages of births to women in the Delta were to teenagers and younger women (under age 20 and 20–24) than in Appalachia, followed by women in the rest of the United States (Table 1, Figure 3). Lower percentages of women giving birth in the Delta were aged 30 and over than in Appalachia, followed by women in the rest of the United States.

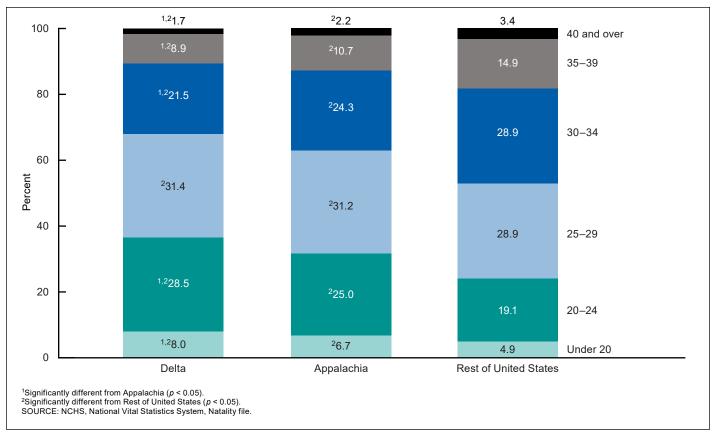


Figure 3. Distribution of births, by maternal age: Delta, Appalachia, and the rest of the United States, 2017

Marital status and paternity acknowledgment—Women in the Delta were the least likely to be married (46.6%) and most likely to be unmarried with no paternity acknowledgment (18.8%), followed by Appalachia (57.7% and 12.4%, respectively), and then the rest of the United States (60.7% and 11.2%, respectively) (Table 1).

Education—Among women aged 25 and over, those in the Delta were more likely to have a high school education or less (36.0%) than women in Appalachia (32.4%); women in the rest of the United States were least likely (29.2%) (Table 1). Women in the Delta were the least likely to have a bachelor's degree or higher (31.2%), followed by women in Appalachia (36.7%) and women in the rest of the United States (42.4%).

WIC receipt—About one-half (49.5%) of women in the Delta received WIC during pregnancy, a higher rate than in Appalachia (42.6%); both regions had a higher rate than the rest of the United States (37.4%) (Table 1).

Source of payment for delivery—Deliveries in the Delta were most likely to be covered by Medicaid (59.7%), followed by Appalachia (46.2%), and then the rest of the United States (42.2%). Deliveries in the Delta were the least likely to be covered by private health insurance (36.1%), followed by Appalachia (47.0%), and then the rest of the United States (49.7%) (Table 1).

Smoking—The rate of smoking during pregnancy was highest in Appalachia (15.2%), followed by the Delta (10.2%); the smoking rate was lowest in the rest of the United States (6.1%) (Table 1).

Body mass index—Women in Appalachia (3.9%) were most likely to be underweight (BMI less than 18.5), followed by women in the Delta (3.7%), and then women in the rest of the United States (3.3%). Women in the Delta (37.8%) were least likely to be normal weight (BMI of 18.5–24.9), followed by women in Appalachia (40.6%), and then women in the rest of the United States (43.7%) (Table 1). Women in the Delta (33.5%) were most likely to be obese (BMI greater than or equal to 30.0), followed by women in Appalachia (30.4%), and then women in the rest of the United States (26.6%).

Timing of prenatal care—Women in the Delta were less likely to begin prenatal care in the first trimester of pregnancy (74.9%) than those in Appalachia (77.2%) and the rest of the United States (77.4%) (Table 1). They were also more likely to have late (beginning in the third trimester) or no prenatal care (7.3%) than those in Appalachia (6.1%) and the rest of the United States (6.2%).

Infant outcomes overall and by maternal characteristics

Preterm births

Infants born to women living in the Delta were more likely to be preterm (12.37%) than those born to women in Appalachia (10.75%); infants born to women in the rest of the United States were the least likely (9.78%) (Table 2).

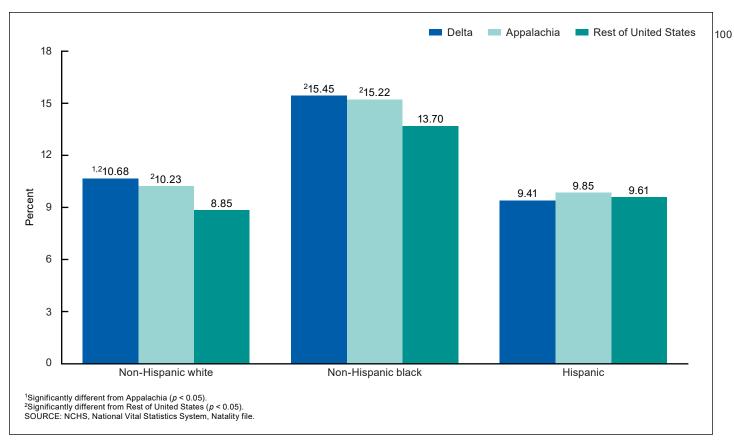


Figure 4. Preterm births, by maternal race and Hispanic origin: Delta, Appalachia, and the rest of the United States, 2017

With a few exceptions (noted later) within categories of maternal demographic and health or behavioral characteristics, infants born in the Delta were still most likely to be preterm, followed by those born in Appalachia, and then those born in the rest of the United States (Table 2, Figures 4–6).

There were no differences among the three regions in preterm birth rates for infants of Hispanic women. In addition, preterm rates for infants born to non-Hispanic black women did not differ between Appalachia and the Delta.

There was no difference in preterm rates between infants in the Delta and Appalachia for those born to unmarried mothers with no paternal acknowledgment and those whose mothers received no or late prenatal care. Infants born in the Delta to women who smoked during pregnancy had higher preterm rates than those born in Appalachia and the rest of the United States, but there was no difference between infants in Appalachia and the rest of the United States.

Birthweight

Infants born to women in the Delta had the highest rates of low birthweight (10.75%), followed by those in Appalachia (8.87%), and then infants born to women in the rest of the United States (8.14%) (Table 3).

With a few exceptions (noted later) within categories of maternal demographic and health or behavioral characteristics, infants born to women in the Delta were more likely to be low birthweight than those born to women in Appalachia; those born to women in the rest of the United States were the least likely (Table 3).

Non-Hispanic black and non-Hispanic white women in both the Delta and Appalachia were more likely to have low birthweight infants than their counterparts in the rest of the United States, but there was no difference in low birthweight rates between infants born in these two regions (Table 3). There was no significant difference in the rates of low birthweight among infants of Hispanic women across the three regions (7.35–7.48).

Across all sources of payment, infants born in the Delta had higher rates of low birthweight than those born in Appalachia and the rest of the United States (Table 3). However, low birthweight rates did not differ among infants born to women in Appalachia and the rest of the United States for whom private insurance or self-pay was the principal source of payment for the delivery.

Infant mortality

Infants born to women in the Delta had the highest infant mortality rate (8.17 infant deaths per 1,000 births), followed by infants born to women in Appalachia (6.82), and then by infants born to women in the rest of the United States (5.67) (Table 4). This pattern was true for many categories of maternal demographic and health or behavioral characteristics. Exceptions to this pattern are described later.



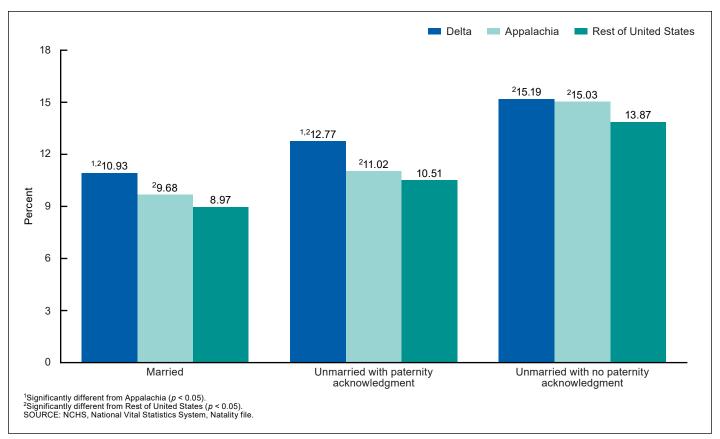


Figure 5. Preterm births, by marital status: Delta, Appalachia, and the rest of the United States, 2017

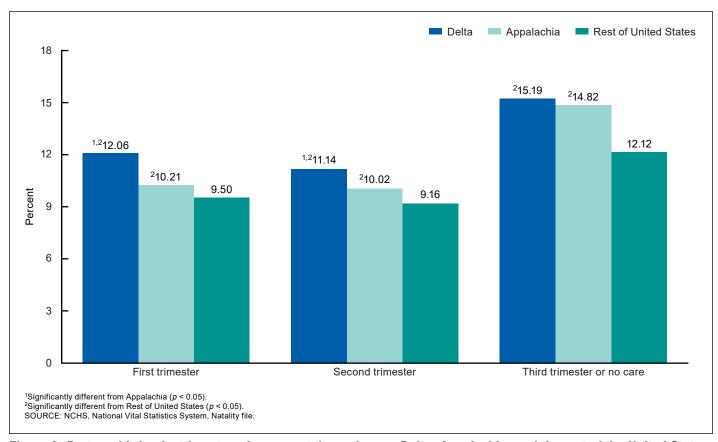


Figure 6. Preterm births, by trimester when prenatal care began: Delta, Appalachia, and the rest of the United States, 2017

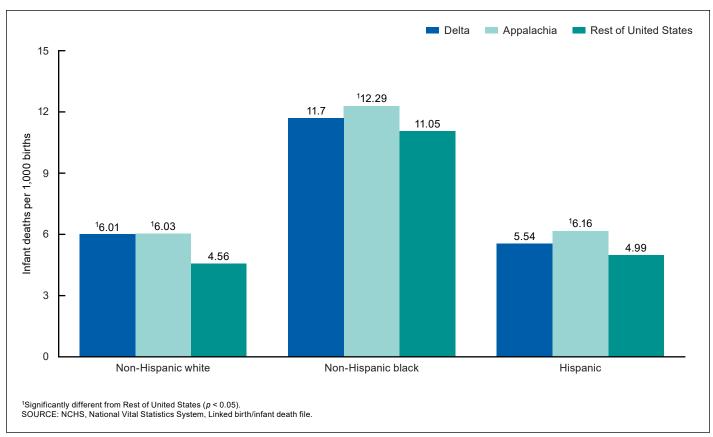


Figure 7. Infant mortality, by maternal race and Hispanic origin: Delta, Appalachia, and the rest of the United States, 2016–2017

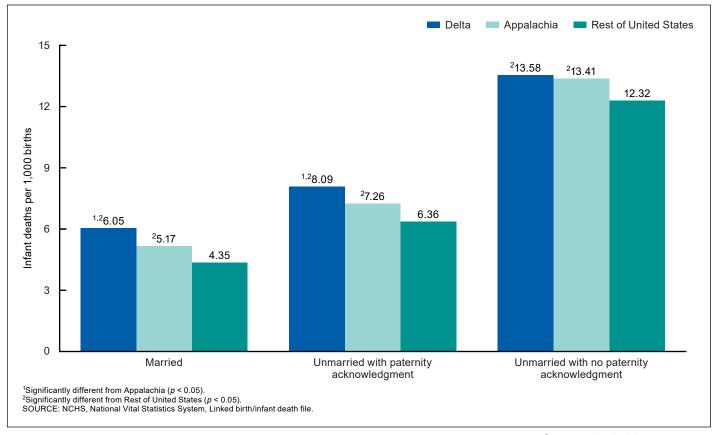


Figure 8. Infant mortality, by marital status: Delta, Appalachia, and the rest of the United States, 2016–2017

Infant mortality rates did not differ for any of the race and Hispanic-origin groups between infants born to women in the Delta and Appalachia. Among infants born to Hispanic and non-Hispanic black women, there were also no differences between infants born to women in the Delta and the rest of the United States. Among infants born to non-Hispanic white women, those in the Delta and Appalachia had higher mortality rates than those born in the rest of the United States (Table 4, Figure 7).

Among women under age 20 and aged 40 and over, the observed differences in infant mortality rates between Appalachia and the Delta were not significant. There were no mortality rate differences between infants in Appalachia and the Delta among those born to unmarried women without a paternity acknowledgment (Figure 8) or women who received WIC during pregnancy, although both regions were higher than the rest of the United States. There were also no differences in mortality rates between infants born to women in Appalachia and the Delta for those with less than a high school education or an associate's degree or higher.

Discussion

Maternal characteristics vary among the Delta, Appalachia, and the rest of the United States. Women in the Delta were generally more likely to have characteristics associated with poor birth outcomes, such as lower educational attainment, compared with women in Appalachia and the rest of the United States.

Overall, infants born to mothers in the Delta were most likely to be low birthweight, preterm, and to die in their first year, followed by infants born to mothers in Appalachia, and then infants born to mothers in the rest of the United States. Within maternal characteristic categories, with some exceptions, birth outcomes for infants born to women in the Delta were worse than for infants born to women in Appalachia, which were, in turn, worse than for those born to women in the rest of the United States. This pattern generally held regardless of whether the category was associated with higher risk of poor infant outcomes, such as low education, or lower risk of poor outcomes, such as not smoking during pregnancy. This pattern suggests that additional factors influence the disparities in infant outcomes, in addition to the differences in distributions of maternal characteristics discussed previously.

For example, among married women, low birthweight, preterm birth, and infant mortality rates were highest in the Delta, followed by those in Appalachia, followed by those in the rest of the United States; the same pattern was found for unmarried women with a paternity acknowledgment. The same patterns were found for the infants of women with the most and least education, with and without prenatal WIC, with Medicaid and with private health insurance, with early and late prenatal care, and who were non-Hispanic black or non-Hispanic white as well as for almost all age categories.

The results of this study are consistent with previous research on health among the population of the Delta and Appalachia. In general, people living in the Delta or Appalachia

have worse health and health outcomes than those living in the rest of the United States (2,12–14). For example, rates of obesity and diabetes, as well as teen birth rates, are higher in these regions than in the rest of the United States (1,2).

In summary, infants born to women in the Delta have worse birth outcomes, as measured by rates of preterm birth, low birthweight, and infant mortality, than those born to women in Appalachia who, in turn, have worse outcomes than those born to women in the rest of the United States. These adverse outcomes have been shown to be associated with higher levels of teen childbearing, lower educational attainment, and less timely or no prenatal care (15–18). However, even within categories of several of these characteristics, infants born in the Delta have worse outcomes than those born in Appalachia who, in turn, have worse outcomes than those born in the rest of the United States.

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Table 1. Maternal characteristics, by region: Delta, Appalachia, and the rest of the United States, 2017

Characteristic	Delta (N = 124,047)		Appalachia (N = 275,493)		Rest of United States $(N = 3,458,479)$		
Race and Hispanic origin ¹	Percent (95% CI)						
Non-Hispanic white	^{2,3} 53.0	(52.7-53.3)	³ 75.6	(75.4–75.8)	49.7	(49.6-49.8)	
Non-Hispanic black	^{2,3} 37.5	(37.2-37.8)	³ 11.6	(11.5-11.7)	14.0	(14.0-14.0)	
Hispanic ⁴	^{2,3} 6.4	(6.3-6.5)	³ 8.3	(8.2–8.4)	25.1	(25.1–25.1)	
Age							
Under 20	^{2,3} 8.0	(7.8-8.2)	³ 6.7	(6.6-6.8)	4.9	(4.9-4.9)	
20–24	^{2,3} 28.5	(28.2–28.8)	³ 25.0	(24.8–25.2)	19.1	(19.1–19.1)	
25–29	³ 31.4	(31.1–31.7)	³ 31.2	(31.0–31.4)	28.9	(28.9–28.9)	
30–34	^{2,3} 21.5	(21.3–21.7)	³ 24.3	(24.1–24.5)	28.9	(28.9–28.9)	
35–39	^{2,3} 8.9	` (8.7–9.1)	³ 10.7	(10.6–10.8)	14.9	(14.9–14.9)	
40 and over	^{2,3} 1.7	(1.6–1.8)	³ 2.2	(2.1–2.3)	3.4	(3.4–3.4)	
Marital status ⁵							
Married	^{2,3} 46.6	(46.3-46.9)	³ 57.7	(57.5–57.9)	60.7	(60.6–60.8)	
Unmarried, paternity	^{2,3} 34.6	(34.3–34.9)	³ 29.9	(29.7–30.1)	28.1	(28.0–28.2)	
Unmarried, no paternity	^{2,3} 18.8	(18.6–19.0)	³ 12.4	(12.3–12.5)	11.2	(11.2–11.2)	
Education ⁶							
Less than high school	^{2,3} 11.0	(10.8–11.2)	39.9	(9.8–10.0)	10.0	(10.0–10.0)	
High school graduate or GED	^{2,3} 25.0	(24.7–25.3)	³ 22.5	(22.3–22.7)	19.2	(19.2–19.2)	
Some college	^{2,3} 22.5	(22.2–22.8)	³ 19.8	(19.6–20.0)	19.1	(19.1–19.1)	
Associate's degree	^{2,3} 10.4	(10.2–10.6)	³ 11.2	(11.1–11.3)	9.4	(9.4–9.4)	
Bachelor's degree or higher	^{2,3} 31.2	(30.9–31.5)	³ 36.7	(36.5–36.9)	42.4	(42.3–42.5)	
Received WIC	^{2,3} 49.5	(49.2–49.8)	³ 42.6	(42.4–42.8)	37.4	(37.3–37.5)	
Source of payment for delivery							
Medicaid	^{2,3} 59.7	(59.4-60.0)	³ 46.2	(46.0-46.4)	42.2	(42.1-42.3)	
Private health insurance	^{2,3} 36.1	(35.8–36.4)	³ 47.0	(46.8–47.2)	49.7	(49.6–49.8)	
Self-pay	^{2,3} 1.8	(1.7–1.9)	4.2	(4.1–4.3)	4.2	(4.2–4.2)	
Other	^{2,3} 2.4	(2.3–2.5)	³ 2.5	(2.4–2.6)	4.0	(4.0–4.0)	
Smoked during pregnancy	^{2,3} 10.2	(10.0–10.4)	³ 15.2	(15.1–15.3)	6.1	(6.1–6.1)	
Body mass index							
Underweight (less than 18.5)	^{2,3} 3.7	(3.6-3.8)	³ 3.9	(3.8-4.0)	3.3	(3.3-3.3)	
Normal weight (18.5–24.9)	^{2,3} 37.8	(37.5–38.1)	³ 40.6	(40.4–40.8)	43.7	(43.6–43.8)	
Overweight (25.0–29.9)	³ 25.0	(24.8–25.2)	³ 25.2	(25.0–25.4)	26.4	(26.4–26.4)	
Obese (30.0 and over)	^{2,3} 33.5	(33.2–33.8)	³ 30.4	(30.2–30.6)	26.6	(26.6–26.6)	
Timing of prenatal care							
First trimester	^{2,3} 74.9	(74.7–75.1)	³ 77.2	(77.0-77.4)	77.4	(77.4–77.4)	
Second trimester	^{2,3} 17.8	(17.6–18.0)	³ 16.7	(16.6–16.8)	16.4	(16.4–16.4)	
Third trimester or no care	^{2,3} 7.3	(7.2–7.4)	³ 6.1	(6.0–6.2)	6.2	(6.2–6.2)	

¹Race and Hispanic origin are reported separately on birth certificates; persons of Hispanic origin may be of any race. In this table, non-Hispanic women are classified by race. Race categories are consistent with the 1997 Office of Management and Budget standards. Single race is defined as only one race reported on the birth certificate.

²Significantly different from Appalachia (n < 0.05)</sup>

 $NOTES: CI is confidence interval. \ WIC is Special Supplemental \ Nutrition \ Program for \ Women, \ Infants, \ and \ Children.$

SOURCE: NCHS, National Vital Statistics System, Natality.

²Significantly different from Appalachia (ρ < 0.05). ³Significantly different from Rest of United States (ρ < 0.05).

⁴Includes all persons of Hispanic origin of any race.

⁵California not included in Rest of United States category.

⁶Limited to women aged 25 and over.

Table 2. Preterm births, by maternal characteristics and region: Delta, Appalachia, and the rest of the United States, 2017

	Preterm birth ¹						
	Delta (N = 123,927)		Appalachia (N = 275,039)		Rest of United States (N = 3,456,293)		
	Percent (95% CI)						
Total	^{2,3} 12.37	(12.19–12.55)	³ 10.75	(10.63–10.87)	9.78	(9.75–9.81)	
Race and Hispanic origin ⁴							
Non-Hispanic white	^{2,3} 10.68	(10.44-10.92)	³ 10.23	(10.10–10.36)	8.85	(8.81–8.89)	
Von-Hispanic black	³ 15.45	(15.12–15.78)	³ 15.22	(14.83–15.61)	13.70	(13.60–13.80)	
lispanic ⁵	9.41	(8.77–10.05)	9.85	(9.46–10.24)	9.61	(9.55–9.67)	
	• • • • • • • • • • • • • • • • • • • •	(3	0.00	(0.10 1012.)	0.0.	(0.00 0.07)	
Age	2340.00	(44.00.40.00)	340.04	(40.00.44.00)	40.40	(10.00.10.00)	
Inder 20	^{2,3} 12.02	(11.38–12.66)	³ 10.81	(10.36–11.26)	10.16	(10.02–10.30)	
0–24	^{2,3} 11.66	(11.33–11.99)	³ 10.24	(10.01–10.47)	9.38	(9.31–9.45)	
5–29	^{2,3} 12.03	(11.71–12.35)	³ 10.24	(10.04–10.44)	9.09	(9.03-9.15)	
0–34	^{2,3} 12.32	(11.92–12.72)	³ 10.76	(10.52–11.00)	9.44	(9.38–9.50)	
5–39	^{2,3} 15.13	(14.46–15.80)	³ 12.36	(11.98–12.74)	11.14	(11.05–11.23)	
0 and over	^{2,3} 18.73	(17.05–20.41)	³ 15.69	(14.77–16.61)	14.46	(14.26–14.66)	
Marital status ⁶							
1arried	^{2,3} 10.93	(10.68-11.18)	³ 9.68	(9.53 - 9.83)	8.97	(8.93-9.01)	
Inmarried, paternity	^{2,3} 12.77	(12.45–13.09)	³ 11.02	(10.81–11.23)	10.51	(10.44–10.58)	
nmarried, no paternity	³ 15.19	(14.73–15.65)	³ 15.03	(14.65–15.41)	13.87	(13.75–13.99)	
Education ⁷		•				•	
ess than high school	^{2,3} 15.08	(14.32–15.84)	³ 12.89	(12.41–13.37)	11.50	(11.38–11.62)	
ligh school graduate or GED	^{2,3} 14.25	(13.76–14.74)	³ 12.64	(12.32–12.96)	11.14	(11.05–11.23)	
ome college	^{2,3} 13.20	(12.70–14.74)	³ 11.84	(11.51–12.17)	10.73	(10.64–10.82)	
ssociate's degree	^{2,3} 12.93	(12.70–13.70)	³ 10.95	(10.53–12.17)	10.73	(9.94–10.02)	
achelor's degree or higher	^{2,3} 10.19	(9.81–10.57)	³ 8.78	(8.57–8.99)	8.36	(8.31–8.41)	
	10.13	(3.01–10.37)	0.70	(0.37-0.33)	0.50	(0.51-0.41)	
Received WIC			_				
es	^{2,3} 12.53	(12.27–12.79)	³ 11.43	(11.25–11.61)	10.20	(10.15–10.25)	
lo	^{2,3} 12.14	(11.88–12.40)	³ 10.18	(10.03–10.33)	9.49	(9.45–9.53)	
Source of payment for delivery							
ledicaid	^{2,3} 13.39	(13.14-13.64)	³ 12.17	(11.99-12.35)	10.78	(10.73-10.83)	
Private health insurance	^{2,3} 10.64	(10.35–10.93)	³ 9.62	(9.46–9.78)	9.03	(8.99–9.07)	
Self-pay	^{2,3} 12.44	(11.05–13.83)	8.40	(7.89–8.91)	8.55	(8.40-8.70)	
ther	^{2,3} 12.33	(11.14–13.52)	³ 10.49	(9.77–11.21)	9.65	(9.49–9.81)	
Smoked during pregnancy							
es	^{2,3} 14.98	(14.36–15.60)	13.72	(13.39–14.05)	13.86	(13.71–14.01)	
Vo	^{2,3} 12.03	(11.84–12.22)	³ 10.20	(10.08–10.32)	9.49	(9.46–9.52)	
Body mass index		. ,		. ,		, , ,	
	^{2,3} 15.22	(14.16.16.00)	³ 13.35	(10.60, 14.01)	10.01	(10.63–10.99)	
Inderweight (less than 18.5)	^{2,3} 11.68	(14.16–16.28)	³ 9.72	(12.69–14.01)	10.81 8.65	'	
lormal weight (18.5–24.9)	^{2,3} 11.15	(11.39–11.97)		(9.54–9.90)		(8.60–8.70)	
verweight (25.0–29.9)	^{2,3} 13.41	(10.79–11.51) (13.08–13.74)	³ 10.20 ³ 11.87	(9.97–10.43) (11.65–12.09)	9.34 11.45	(9.28–9.40) (11.38–11.52)	
	13.41	(13.00-13.74)	11.01	(11.05-12.08)	11.40	(11.30-11.32)	
Timing of prenatal care			•				
rst trimester	^{2,3} 12.06	(11.85–12.27)	³ 10.21	(10.08-10.34)	9.50	(9.46-9.54)	
econd trimester	^{2,3} 11.14	(10.72–11.56)	³ 10.02	(9.74–10.30)	9.16	(9.08-9.24)	
hird trimester or no care	³ 15.19	(14.43 - 15.95)	³ 14.82	(14.27–15.37)	12.12	(11.98-12.26)	

NOTES: CI is confidence interval. WIC is Special Supplemental Nutrition Program for Women, Infants, and Children.

SOURCE: NCHS, National Vital Statistics System, Natality.

 $^{^1} Less$ than 37 completed weeks of gestation. $^2 Significantly different from Appalachia (<math display="inline">p < 0.05$). $^3 Significantly different from Rest of United States (<math display="inline">p < 0.05$).

ARace and Hispanic origin are reported separately on birth certificates; persons of Hispanic origin may be of any race. In this table, non-Hispanic women are classified by race. Race categories are consistent with the 1997 Office of Management and Budget standards. Single race is defined as only one race reported on the birth certificate.

⁵Includes all persons of Hispanic origin of any race. ⁶California not included in Rest of United States category.

⁷Limited to women aged 25 and over.

Table 3. Low birthweight, by maternal characteristics and region: Delta, Appalachia, and the rest of the United States, 2017

	Low birthweight ¹						
	Delta (N = 123,905)		Appalachia (N = 274,873)		Rest of United States (N = 3,456,239)		
	Percent (95% CI)						
Total	^{2,3} 10.75	(10.58-10.92)	³ 8.87	(8.76-8.98)	8.14	(8.11–8.17)	
Race and Hispanic origin ⁴							
Non-Hispanic white	³ 7.94	(7.73–8.15)	³ 8.00	(7.88-8.12)	6.84	(6.80–6.88)	
Von-Hispanic black	³ 15.36		³ 15.39		13.66	` '	
		(15.03–15.69)		(14.99–15.79)		(13.56–13.76)	
Hispanic ⁵	7.35	(6.77–7.93)	7.48	(7.14–7.82)	7.43	(7.37–7.49)	
Age							
Inder 20	^{2,3} 12.04	(11.40-12.68)	³ 10.40	(9.96-10.84)	9.74	(9.60-9.88)	
20–24	^{2,3} 11.03	(10.70–11.36)	³ 8.92	(8.71–9.13)	8.44	(8.37-8.51)	
25–29	^{2,3} 10.18	(9.88–10.48)	³ 8.34	(8.15–8.53)	7.59	(7.54–7.64)	
30–34	^{2,3} 9.83	(9.47–10.19)	³ 8.53	(8.32–8.74)	7.55	(7.50–7.60)	
5–39	^{2,3} 12.16	(11.55–12.77)	³ 9.45	(9.12–9.78)	8.72	(8.64–8.80)	
10 and over	^{2,3} 14.73	(13.20–16.26)	³ 12.19	(11.36–13.02)	11.43	(11.25–11.61)	
	5	(.5.25 .5.25)	.20	(11.10	(2561)	
Marital status ⁶	222.5	(7.07.5.11)	2	(7.04 - 5-)		/O 27 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	
Married	^{2,3} 8.19	(7.97–8.41)	³ 7.14	(7.01–7.27)	7.01	(6.97-7.05)	
Inmarried, paternity	^{2,3} 11.94	(11.63–12.25)	³ 10.09	(9.88-10.30)	9.35	(9.29–9.41)	
Inmarried, no paternity	^{2,3} 14.87	(14.41–15.33)	³ 13.94	(13.57–14.31)	12.99	(12.88–13.10)	
Education ⁷							
ess than high school	^{2,3} 13.47	(12.75–14.19)	³ 11.19	(10.73-11.65)	9.34	(9.23-9.45)	
ligh school graduate or GED	^{2,3} 12.41	(11.95–12.87)	³ 10.94	(10.64–11.24)	9.35	(9.27–9.43)	
ome college	^{2,3} 11.14	(10.68–11.60)	³ 9.33	(9.03–9.63)	8.57	(8.49–8.65)	
Associate's degree	^{2,3} 9.82	(9.17–10.47)	³ 8.20	(7.83–8.57)	7.75	(7.64–7.86)	
Bachelor's degree or higher	^{2,3} 7.43	(7.10–7.76)	³ 6.43	(6.25–6.61)	6.70	(6.65–6.75)	
acheror's degree or higher	-,-1.43	(7.10-7.70)	-0.43	(0.25-0.01)	0.70	(0.05-0.75)	
Received WIC							
/es	^{2,3} 11.78	(11.52–12.04)	³ 10.15	(9.98-10.32)	8.88	(8.83-8.93)	
lo	^{2,3} 9.65	(9.42 - 9.88)	³ 7.86	(7.73-7.99)	7.66	(7.62-7.70)	
Source of payment for delivery							
Nedicaid	^{2,3} 12.42	(12.18-12.66)	³ 10.83	(10.66-11.00)	9.48	(9.43-9.53)	
Private health insurance	^{2,3} 7.94	(7.69–8.19)	7.18	(7.04–7.32)	7.13	(7.09–7.17)	
Self-pay	^{2,3} 10.94	(9.63–12.25)	6.73	(6.27–7.19)	7.00	(6.87–7.13)	
Other	^{2,3} 10.83	(9.71–11.95)	³ 8.82	(8.15–9.49)	7.71	(7.57–7.85)	
Smoked during pregnancy							
es	^{2,3} 15.59	(14.96–16.22)	³ 14.71	(14.37–15.04)	14.17	(14.02–14.32)	
Vo	^{2,3} 10.13	(9.96–10.31)	³ 7.81	(7.70–7.92)	7.73	(7.71–7.76)	
	10.10	(0.00 .0.01)	7.07	(0 1.02)	7.70	(
Body mass index	2247.65	(15.00.10.11)	245.60	(44.70.40.40)	40.00	(40.04.46.55)	
Inderweight (less than 18.5)	^{2,3} 17.00	(15.89–18.11)	³ 15.49	(14.79–16.19)	12.20	(12.01–12.39)	
Jormal weight (18.5–24.9)	^{2,3} 10.90	(10.61–11.19)	³ 8.76	(8.59–8.93)	7.85	(7.81–7.89)	
Overweight (25.0–29.9)	^{2,3} 9.44	(9.11–9.77)	³ 7.94	(7.73–8.15)	7.48	(7.43 - 7.53)	
Obese (30.0 and over)	^{2,3} 10.47	(10.17–10.77)	³ 8.55	(8.36–8.74)	8.37	(8.31–8.43)	
Timing of prenatal care							
irst trimester	^{2,3} 10.20	(10.00-10.40)	³ 8.11	(7.99-8.23)	7.69	(7.66–7.72	
Second trimester	^{2,3} 11.00	(10.58–11.42)	³ 9.80	(9.52–10.08)	8.63	(8.56–8.70)	
Third trimester or no care	^{2,3} 13.08	(12.37–13.79)	³ 12.20	(11.70–12.70)	10.13	(10.00–10.26)	

NOTES: CI is confidence interval. WIC is Special Supplemental Nutrition Program for Women, Infants, and Children.

SOURCE: NCHS, National Vital Statistics System, Natality.

 $^{^1} Less$ than 2,500 grams. $^2 Significantly different from Appalachia (<math display="inline">p < 0.05$). $^3 Significantly different from Rest of United States (<math display="inline">p < 0.05$).

ARace and Hispanic origin are reported separately on birth certificates; persons of Hispanic origin may be of any race. In this table, non-Hispanic women are classified by race. Race categories are consistent with the 1997 Office of Management and Budget standards. Single race is defined as only one race reported on the birth certificate. ⁵Includes all persons of Hispanic origin of any race.

⁶California not included in Rest of United States category.

⁷Limited to women aged 25 and over.

Table 4. Infant mortality, by maternal characteristics and region: Delta, Appalachia, and the rest of the United States, 2016–2017

Characteristic	Delta Appalachia		Rest of United States				
	Deaths per 1,000 live births (95% CI)						
Total	1,28.17	(7.91-8.52)	² 6.82	(6.60-7.04)	5.67	(5.61-5.73)	
Race and Hispanic origin ³							
Von-Hispanic white	² 6.01	(5.78-6.43)	² 6.03	(5.79-6.27)	4.56	(4.49-4.63)	
Non-Hispanic black	11.70	(10.87–12.40)	² 12.29	(11.42–13.16)	11.05	(10.84–11.26)	
Hispanic ⁴	5.54	(4.44–6.83)	² 6.16	(5.43–6.89)	4.99	(4.89–5.09)	
Age		,		,		` '	
Jnder 20	² 10.53	(9.42-11.94)	9.20	(8.23–10.17)	8.70	(8.39-9.01)	
20–24	1,28.78	(8.26–9.47)	² 7.77	(7.31–8.23)	6.88	(6.74–7.02)	
25–29	1,27.72	(7.26–8.34)	² 6.19	(5.82–6.56)	5.43	(5.33–5.53)	
30–34	^{1,2} 7.31	(6.80–8.04)	² 5.92	(5.51–6.33)	4.68	(4.59–4.77)	
	² 6.87	,	² 6.53			,	
35–39		(6.18–7.96)		(5.87–7.19)	5.20	(5.06–5.34)	
40 and over	² 12.53	(9.36–16.43)	² 9.19	(7.44–10.94)	6.92	(6.58–7.26)	
Marital status ⁵			_				
Married	^{1,2} 6.05	(5.76-6.50)	² 5.17	(4.92-5.42)	4.35	(4.28-4.42)	
Unmarried, paternity	^{1,2} 8.09	(7.63 - 8.69)	² 7.26	(6.85-7.67)	6.36	(6.24-6.48)	
Unmarried, no paternity	² 13.58	(12.70-14.64)	² 13.41	(12.54–14.28)	12.32	(12.06–12.58)	
Education ⁶							
Less than high school	² 11.05	(9.91-12.62)	² 9.70	(8.70-10.70)	7.03	(6.80-7.26)	
High school graduate or GED	^{1,2} 9.28	(8.57–10.24)	² 8.02	(7.41–8.63)	6.86	(6.70-7.02)	
Some college	^{1,2} 8.26	(7.52–9.21)	6.48	(5.90–7.06)	5.94	(5.79–6.09	
Associate's degree	² 6.19	(5.36–7.40)	5.10	(4.42–5.78)	4.77	(4.58–4.96	
Bachelor's degree or higher	² 4.33	(3.97–4.91)	² 4.00	(3.67–4.33)	3.22	(3.15–3.29)	
Received WIC							
Yes	² 7.74	(7.37 - 8.23)	² 7.27	(6.93-7.61)	5.83	(5.74-5.92)	
No	1,28.07	(7.71–8.58)	² 6.18	(5.90–6.46)	5.34	(5.27–5.41)	
Source of payment for delivery							
Medicaid	1,29.32	(8.93-9.82)	² 8.60	(8.24-8.96)	7.19	(7.09–7.29)	
Private health insurance	^{1,2} 5.76	(5.44–6.26)	² 4.89	(4.62–5.16)	4.24	(4.17–4.31)	
Self-pay	^{1,2} 11.83	(8.91–15.40)	² 8.04	(6.86–9.22)	6.50	(6.21–6.79)	
Other	² 8.17	(6.02–10.83)	² 7.26	(5.83–8.69)	5.57	(5.29–5.85)	
Smoked during pregnancy		,		,		,,	
Yes	² 12.44	(11.64–13.81)	11.07	(10.36–11.78)	10.60	(10.29–10.91)	
No	^{1,2} 7.50	(7.22–7.86)	² 5.95	(5.73–6.17)	5.26	(5.20–5.32)	
Body mass index		•		,			
Underweight (less than 18.5)	² 10.26	(8.26–12.60)	² 8.43	(7.17–9.69)	5.51	(5.21–5.81)	
Normal weight (18.5–24.9)	^{1,2} 6.51	(6.14–7.03)	² 5.57	(5.26–5.88)	4.49	(4.41–4.57)	
Overweight (25.0–29.9)	1,27.45	(6.94–8.14)	² 6.31	(5.88–6.74)	5.17	(5.06–5.28)	
Obese (30.0 and over)	^{1,2} 9.45	(8.92–10.12)	² 7.79	(7.35–8.23)	7.14	(7.02–7.26)	
Timing of prenatal care		,		,		. ,	
First trimester	^{1,2} 6.81	(6.53-7.20)	² 5.44	(5.22-5.66)	4.78	(4.72-4.84)	
Second trimester	² 8.15	(7.55–9.00)	² 7.96	(7.37–8.55)	6.06	(5.92–6.20)	
Third trimester or no care	² 15.95	(14.45–17.87)	² 13.77	(12.48–15.06)	10.35	(10.04–10.66)	
THIRU UTITIESTER OF NO CARE	£15.95	(14.45-17.87)	£13.//	(12.48-15.06)	10.35	(10.04-10.66	

NOTES: CI is confidence interval. WIC is Special Supplemental Nutrition Program for Women, Infants, and Children.

SOURCE: NCHS, National Vital Statistics System, Linked birth/infant death file.

¹Significantly different from Appalachia (ρ < 0.05).
²Significantly different from Rest of United States (ρ < 0.05).
³Race and Hispanic origin are reported separately on birth certificates; persons of Hispanic origin may be of any race. In this table, non-Hispanic women are classified by race. Race categories are consistent with the 1997 Office of Management and Budget standards. Single race is defined as only one race reported on the birth certificate.

4Includes all persons of Hispanic origin of any race.

⁵California not included in Rest of United States category.

⁶Limited to women aged 25 and over.

Technical Notes

Data sources

Birth data shown in this report for 2017 are based on 100% of the birth certificates filed in all states and the District of Columbia (D.C.) (6). The linked birth/infant death data for 2016 and 2017 each include two data files. The first file includes all U.S. infant deaths that occurred in the given data year linked to their corresponding birth certificates, whether the birth occurred in that year or the prior year—this is referred to as the numerator file. The second file is the National Center for Health Statistics (NCHS) natality file for the United States for the given year, which is used to provide denominators for rate computations (7). The data are provided to NCHS through the Vital Statistics Cooperative Program.

Weighting

The number of infant deaths in the linked file for the 50 states and D.C. was weighted to equal the sum of the linked plus unlinked infant deaths by state of occurrence of birth and age of death (less than 7 days, 7–27 days, and 28 days to under 1 year). The addition of the weight reduced the potential for bias in comparing infant mortality rates by characteristics. In 2016, 0.5% of infant death records could not be linked to their corresponding birth certificates. In 2017, 0.4% of infant death records could not be linked to their corresponding birth certificates.

Marital status

Due to state statutory restrictions, beginning in 2017, California no longer provides record-level data on the marital status of the mother for births occurring in California to California residents and nonresidents (6).

Hispanic origin and race

Hispanic origin and race are reported separately on the birth certificate. This report presents data on race and Hispanic origin based on the 1997 Office of Management and Budget standards (6). The 2003 revision of the U.S. Standard Certificate of Live Birth allows the reporting of the five race categories either alone (i.e., single race) or in combination (i.e., more than one race or multiple races). Single-race categories are reported.

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