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Declines in Infant Mortality in Appalachia and the Delta: 1995–1996 Through 2017–2018

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Abstract

Objective—This report compares trends in infant mortality rates in Appalachia and the Delta with the rest of the United States and assesses the role of maternal demographic changes in these rates between 1995–1996 and 2017–2018.

Methods—The analyses used 1995–2018 linked birth/infant death data from the National Vital Statistics System. Infant mortality rates in Appalachia and the Delta from 1995–1996 through 2017–2018 were compared with the rest of the United States, as were age and race and Hispanic origin distributions of women giving birth in 1995–1996 and 2017–2018. Decomposition analysis was used to estimate the proportion of the change in overall infant mortality rates due to changes in each region in maternal age and race and Hispanic origin distributions and in age- and race-specific mortality rates.

Results—From 1995–1996 through 2017–2018, Appalachia and the Delta consistently had higher infant mortality rates than the rest of the United States. Rates declined 20% in Appalachia and 23% in both the Delta and the rest of the United States from 1995–1996 through 2017–2018. Changes in maternal age distributions accounted for about one-fifth of the decline in infant mortality rates in all three regions; changes in maternal age-specific infant mortality rates accounted for the balance of the decline. Changes in the race and Hispanic origin distributions alone did not account for any of the decline in infant mortality rates in Appalachia or the rest of the United States but accounted for 8.6% of the decline in the Delta; changes in race-specific mortality rates accounted for all of the balance of the declines in infant mortality rates in each region.

Conclusion—Infant survival improved in Appalachia, the Delta, and the rest of the United States from 1995–1996 through 2017–2018. Nevertheless, infant mortality rates in both regions remain higher than in the rest of the United States.

Keywords: infant mortality rates • trends • region • National Vital Statistics System

Introduction

Economic hardship and disadvantage vary across the United States. Two regions, Appalachia and the Delta, have historically been among the most economically disadvantaged in the country. Poverty rates in both regions are consistently higher than the U.S. average (1,2). Poverty has been associated with a higher risk of infant death; however, there has been limited research on infant mortality in these regions (3).

The Delta Regional Authority (DRA) was established by Congress in 2000; it encompasses 9.8 million people in 252 counties and parishes in eight states (Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee). The region defined by the DRA will hereafter be referred to as "the Delta." The Delta is the most economically depressed region of the United States. In Delta counties, poverty rates ranged from 20.6% in Tennessee to 27.5% in Alabama in 2010–2014 compared with 15.6% for the United States (1). During this 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 Appalachian Region 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) (4). The region defined by ARC will hereafter be referred to as "Appalachia." The region includes 420 counties and 25.7 million people. In the Appalachian counties of these states, poverty rates ranged from 13.0% in Pennsylvania to 25.3% in Kentucky in 2014–2018 compared with 14.1% for the United States (5). During this period, 24.2% of adults in Appalachia aged 25 and over had completed at least a bachelor's degree compared with 31.5% of adults in the United States overall (5).

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In recent decades, the demographics of women who have given birth in the United States have changed, as has the infant mortality rate. The national infant mortality rate has declined from 7.57 deaths per 1,000 births in 1995 to 5.67 in 2018 (6). Infant mortality rates have always varied geographically. For example, for combined years 1996–1998, rates for U.S. jurisdictions ranged from 4.5 in New Hampshire to 13.8 in the District of Columbia (7); in 2018, state rates ranged from 3.5 in New Hampshire to 8.4 in Mississippi (6).

Mean maternal age at birth has risen over the past 50 years (8,9). Women have been increasingly less likely to be in their teens and early 20s and more likely to be in their late 20s, 30s, and 40s when giving birth. The magnitude of increases in mean maternal age at birth vary by state and urbanicity (8,10). These changes impact the overall infant mortality rate because the risk of infant death varies by maternal age: Infants born to women in the youngest (under 20) and oldest (40 and over) age groups have the highest mortality rates (1).

The racial and ethnic makeup of the U.S. population has also changed in recent decades (11–13), as has the racial and ethnic composition of women giving birth. Nationally, the non-Hispanic white population has grown more slowly than the Hispanic and non-Hispanic Asian populations, while the non-Hispanic black share of the population has remained steady (14). These patterns, however, vary by state and region (15).

This report examines infant mortality trends in Appalachia, the Delta, and the rest of the United States and compares the patterns and magnitudes of change of both Appalachia and the Delta with the rest of the United States. It also examines changes in maternal age and race and Hispanic origin patterns in each region for 2017–2018 compared with 1995–1996. It then examines how these changes contributed to declines in infant mortality rates.

Methods

The analyses used 1995–2018 linked period birth/infant death data from the National Vital Statistics System (16). Linked data are based on all infant deaths in the United States where the death certificate could be matched to the infant's birth certificate. During 1995–2018, linkage rates ranged from 97.7% to 99.6%. The infant mortality rate is defined as the number of deaths per 1,000 births.

Infants were categorized by region based on their mother's county and state of residence: Appalachia, the Delta, or the rest of the United States. For each analysis, Appalachia and the Delta were compared with the rest of the United States.

Trends in infant mortality rates from 1995–1996 through 2017–2018 were calculated for combined 2-year time points (e.g., 1995–1996, 1997–1998) to ensure sufficient statistical power for trend analysis in each region. Trends were evaluated using the National Cancer Institute's Joinpoint Regression Program (17). Default settings allowed for as few as three observed time points in each line segment, including the joinpoints. Using these settings, a maximum of three joinpoints were searched for using the grid search algorithm and permutation test and an overall alpha level of 0.05. The statistical significance of differences between rates in 1995–1996 and 2017–2018 were determined using *z* and *t* tests.

The next analysis compared maternal age distributions and race and Hispanic origin distributions for the first (1995–1996) and last (2017–2018) time points. Six maternal age categories were used: under 20, 20–24, 25–29, 30–34, 35–39, and 40 and over. Before 2018, not all states had adopted the 2003 revised certificate of birth, which collects race and ethnicity data according to 1997 Office of Management and Budget (OMB) standards. Therefore, to ensure consistency with race and ethnicity measurements over the time period, four bridged race and Hispanic origin categories were used, based on the 1977 OMB standards used in vital statistics collection and reporting before the revised certificate: non-Hispanic white, non-Hispanic black, non-Hispanic other, and Hispanic. Non-Hispanic other includes Asian or Pacific Islander and American Indian or Alaska Native women who were non-Hispanic; this category was only used to compute race and Hispanic origin distribution totals.

Absolute and percent changes in infant mortality rates between 1995–1996 and 2017–2018 were calculated for each region and for maternal age and race and Hispanic origin categories. These two approaches to measuring change provide complementary information about the differences in rates between the two time points. Absolute change is not affected by the original rate, whereas percent change is a function of both the absolute change and the original rate.

Additionally, comparisons of infant mortality rates were made for 1995–1996 and 2017–2018 between both Appalachia and the Delta and the rest of the United States. Absolute differences between these two regions and the rest of the United States were calculated for maternal age and race and Hispanic origin categories for both time points. The absolute difference is the size of the difference between infant mortality rates in Appalachia and the Delta and rates in the rest of the United States.

Kitagawa decomposition analysis was then used to separately and independently estimate the contribution of two sets of components, maternal age and race and Hispanic origin, to the decline in the infant mortality rates for each region between 1995–1996 and 2017–2018. Decomposition analysis corresponds to direct standardization in which, for example, the age distribution of each year is applied to standard age-specific mortality rates (ASMRs) or the race and Hispanic origin distribution of each year is applied to standard race-specific mortality rates (RSMRs). It also corresponds to indirect standardization in which maternal age or race and Hispanic origin is held constant over time, and year-specific ASMRs and RSMRs are applied to this standard to calculate annual age- or race-standardized rates (18). The 1995–1996 maternal age and race and Hispanic origin distribution and ASMRs and RSMRs were used as the standards for this analysis.

The formula developed by Kitagawa (18,19) is used to carry out the decomposition analysis:

$$N_2 - N_1 = \sum_i \frac{(R_{1i} + R_{2i})}{2}(F_{2i} - F_{1i}) + \sum_i \frac{(F_{1i} + F_{2i})}{2}(R_{2i} - R_{1i})$$

where N_1 and N_2 denote infant mortality rates in 1995–1996 and 2017–2018, R_1 and R_2 refer to age- or race-specific infant

mortality rates in 1995–1996 and 2017–2018, and F_1 and F_2 refer to maternal age or race and Hispanic origin distributions in 1995–1996 and 2017–2018. Summing the two components over all maternal age categories (i) produces the total mortality rate difference due to each component. Together, they add to the overall differences in rates over time.

Results

Trends in infant mortality rates, 1995–1996 through 2017–2018

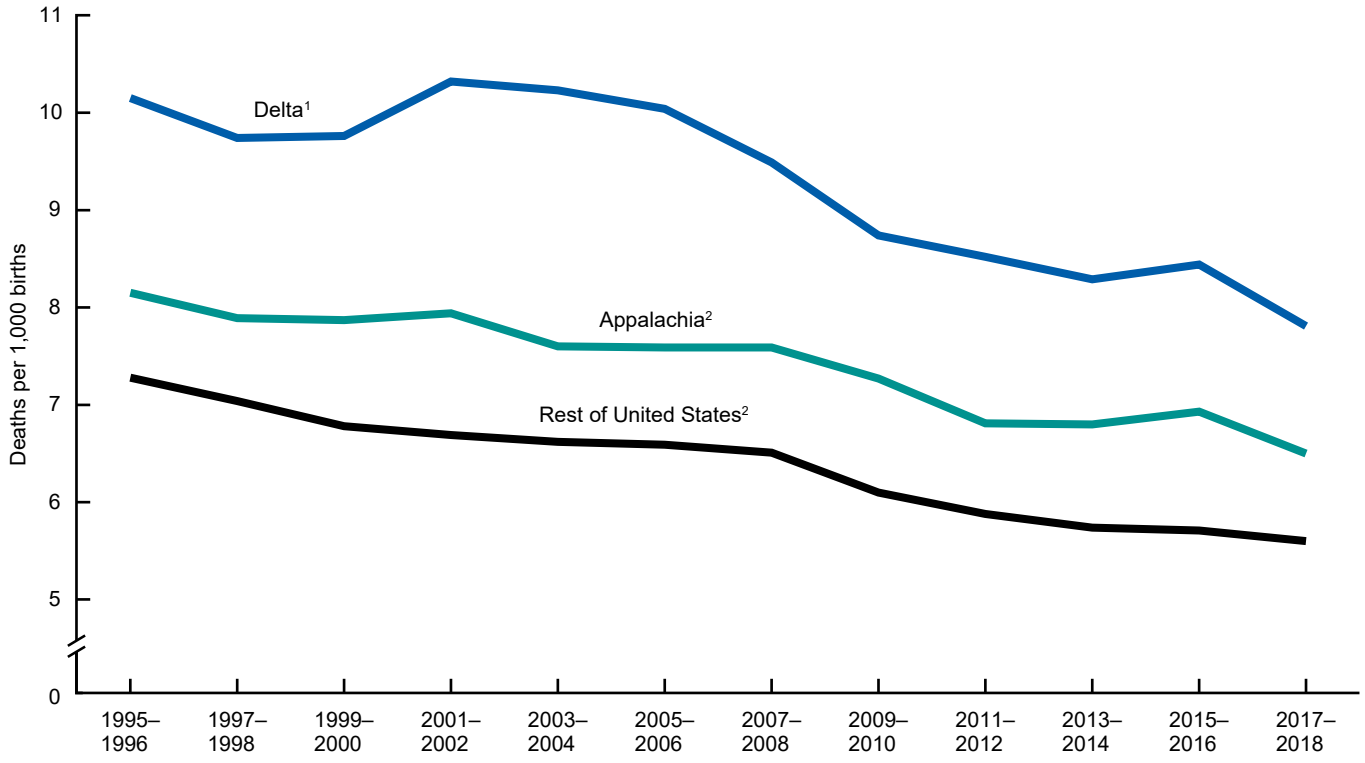
From 1995–1996 through 2017–2018, Appalachia and the Delta consistently had higher infant mortality rates than the rest of the United States (Figure 1). The rates declined in each region during this period, but the magnitude and pattern of the declines varied by region. In Appalachia, the rate declined by an average of 1.9% annually from 1995–1996 through 2017–2018, for a total decline of 20% (from 8.15 to 6.50 deaths per 1,000 births) (Table 1). In the Delta, there was no significant change in the rate from 1995–1996 to 2003–2004. It then declined by an average of 3.7% annually through 2017–2018, for a 23% decline (from 10.15 in 1995–1996 to 7.81 in 2017–2018). In the rest of the United States, the infant mortality rate declined by an average of 2.4% annually from 1995–1996 through 2017–2018, for a 23% decline (from 7.28 to 5.60).

Maternal age and race and Hispanic origin distributions, 1995–1996 and 2017–2018

The maternal age distribution in 2017–2018 was different from the 1995–1996 distribution in all three regions (Table 2, Figure 2). In all regions, the percentage of births to women under age 20 declined by more than one-half; the percentage of births to those aged 20–24 also declined but by smaller percentages (Appalachia: 12% decline from 28.1% to 24.7%; Delta: 9% decline from 30.9% to 28.1%; rest of the United States: 22% decline from 24.0% to 18.8%). The percentage of births to women in each age group 25 and over increased between 1995–1996 and 2017–2018 in each region. The percentage increase rose with age for all regions. In Appalachia, the increase in births ranged from 13% for women aged 25–29 (from 27.7% to 31.3%) to 69% for women aged 40 and over (from 1.3% to 2.2%). The increases in births to women in the Delta ranged from 27% (from 24.9% to 31.5%) for women aged 25–29 to 55% (from 1.1% to 1.7%) for women aged 40 and over. The increases in births to women in the rest of the United States ranged from 5% (from 27.5% to 28.8%) for women aged 25–29 to 79% (from 1.9% to 3.4%) for women aged 40 and over. For both time points, the percentages of births to women under age 20 in the Delta and Appalachia were higher than in the rest of the United States.

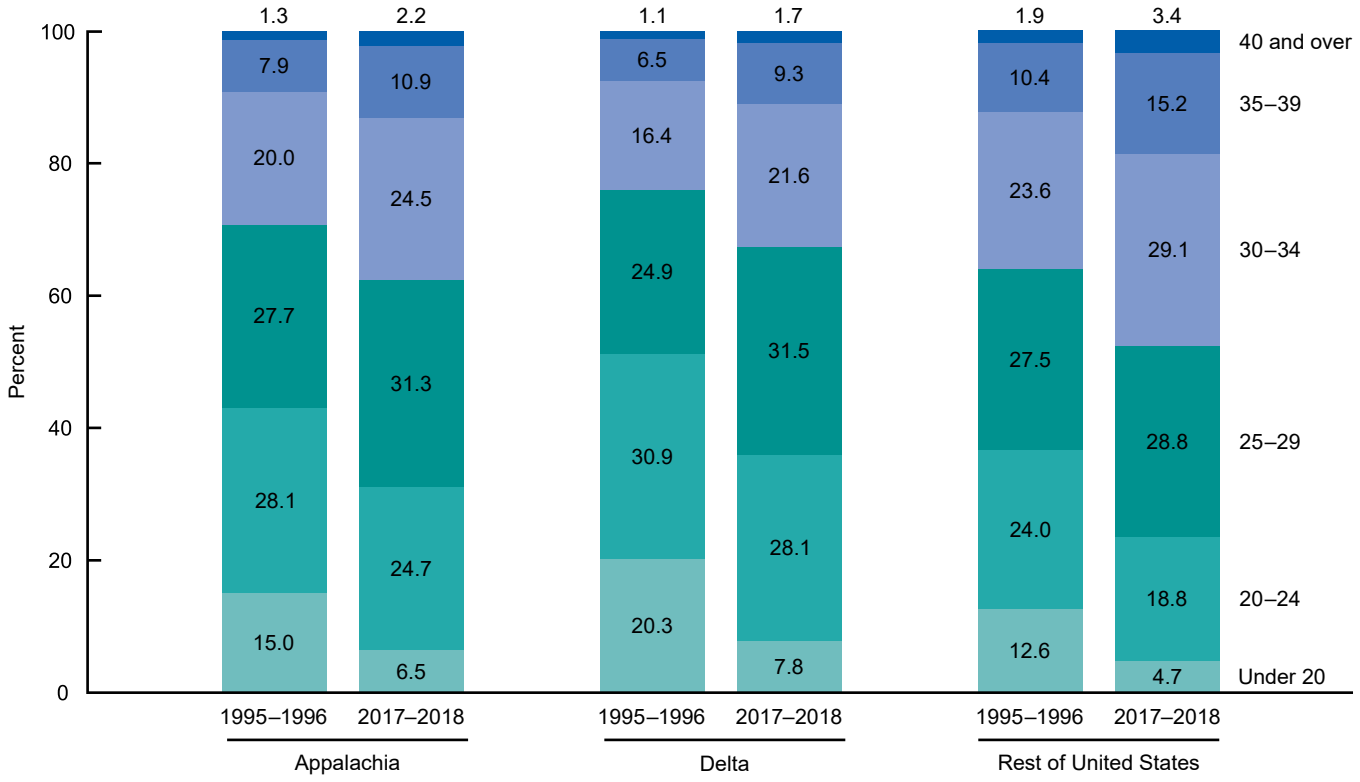
The distributions of births by maternal race and Hispanic origin changed between 1995–1996 and 2017–2018 in each region (Table 2, Figure 3). In all three regions, the percentage of births to non-Hispanic white women declined (by 11%, from

Figure 1. Infant mortality rate, by region: 1995–1996 through 2017–2018



[1]Stable trend from 1995–1996 to 2003–2004; significant decreasing trend from 2003–2004 through 2017–2018 ($p < 0.05$).
[2]Significant decreasing trend from 1995–1996 through 2017–2018 ($p < 0.05$).
SOURCE: National Center for Health Statistics, National Vital Statistics System, Linked birth/infant death file.

Figure 2. Maternal age distribution, by region: 1995–1996 and 2017–2018



NOTES: Percentages may not add to 100 due to rounding. All percentages were significantly different between 1995–1996 and 2017–2018 ($p < 0.05$).
SOURCE: National Center for Health Statistics, National Vital Statistics System, Natality file.

86.1% to 76.8% in Appalachia; by 5%, from 56.3% to 53.5% in the Delta; and by 15%, from 60.1% to 51.2% in the rest of the United States), and the percentage of births to Hispanic women increased (by 337%, from 1.9% to 8.3% in Appalachia; by 364%, from 1.4% to 6.5% in the Delta; and by 28%, from 19.9% to 25.4% in the rest of the United States). The percentage of births to non-Hispanic black women increased in Appalachia (by 12%, from 10.0% to 12.2%) and the rest of the United States (by 2%, from 14.5% to 14.8%) but declined in the Delta (by 7%, from 41.1% to 38.1%).

Compared with the rest of the United States for both time points, Appalachia had a higher percentage of non-Hispanic white women (76.8% compared with 51.2% in 2017–2018), and the Delta had a higher percentage of non-Hispanic black women (38.1% compared with 14.8% in 2017–2018). Appalachia and the Delta had lower percentages of Hispanic women (8.3% and 6.5%, respectively, in 2017–2018) than the rest of the United States (25.4% in 2017–2018) at both time points.

Changes in infant mortality rates, by maternal age and race and Hispanic origin

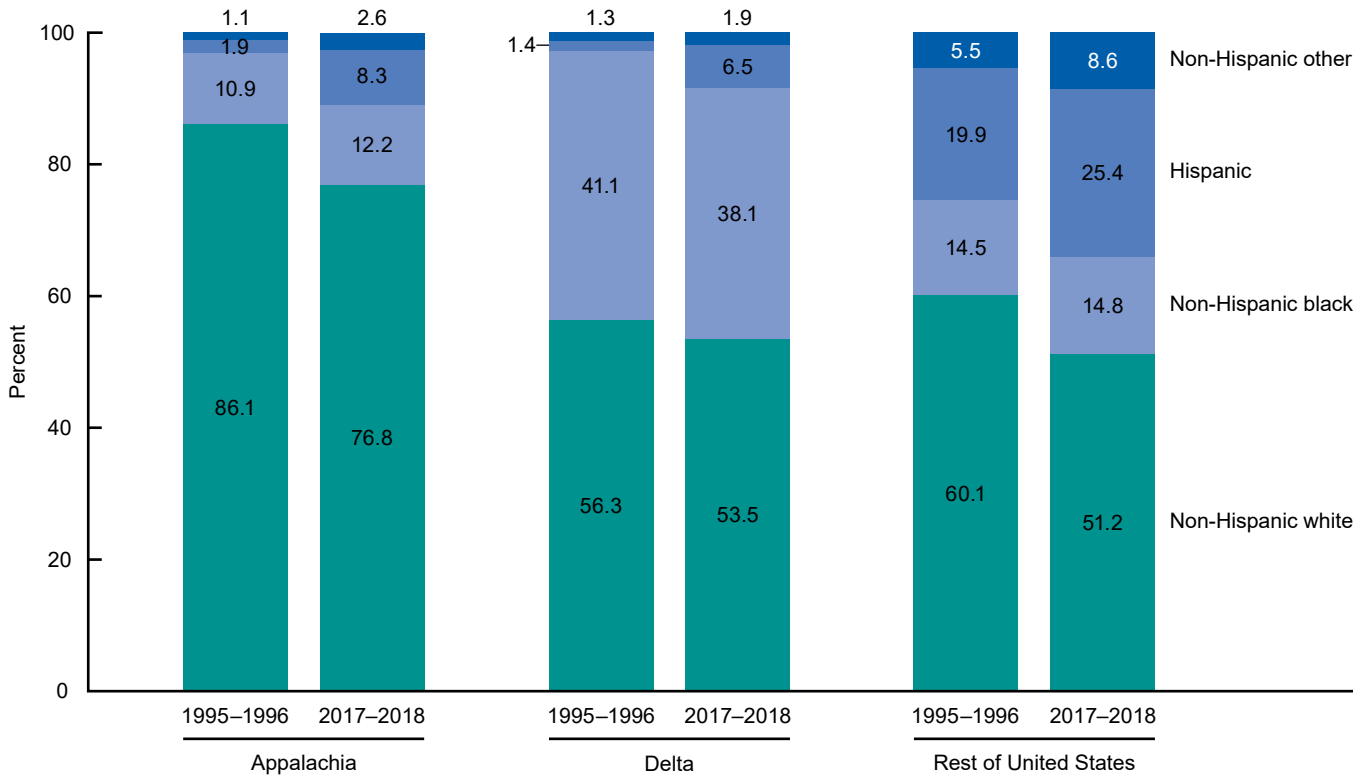
Infant mortality rates declined for most maternal age and race and Hispanic-origin groups across regions between 1995–1996 and 2017–2018 (Table 1). In Appalachia, rates declined for infants of women under 35, ranging from 13% (from 6.91 to 6.04) for women aged 25–29 to 20% (from 9.04 to 7.26) for women aged 20–24. In the Delta, rates declined for infants of women aged 20–39, with the largest decline for women aged 35–39 (40%, from 10.86 to 6.50) followed by women aged 20–24 (23%, from 10.47 to 8.08). In the rest of the United States, rates declined for infants of women of all ages, ranging from 13% (from 6.27 to 5.45) for women aged 25–29 to 26% (from 6.89 to 5.09) for women aged 35–39.

Mortality rates declined for infants born to non-Hispanic white and black women in Appalachia and the Delta but did not significantly change for Hispanic women. Rates in the rest of the United States declined for all three groups. In Appalachia and the Delta, the infants of non-Hispanic black women had the largest percentage decline (by 32%, from 16.30 to 11.13 in Appalachia; by 23%, from 14.40 to 11.08 in the Delta). In the rest of the United States, infants of non-Hispanic white and black women had similar percentage declines, 25% (from 6.01 to 4.50) and 26% (from 14.34 to 10.69), respectively, followed by infants of Hispanic women (20%, from 6.15 to 4.95).

Infant mortality rate comparisons of Appalachia and the Delta with the rest of the United States

The absolute difference in the overall mortality rate between Appalachia and the rest of the United States increased from 0.87 deaths per 1,000 births in 1995–1996 (Appalachia: 8.15; rest of United States: 7.28) to 0.90 in 2017–2018 (Appalachia: 6.50; rest of United States: 5.60), whereas the absolute difference between

Figure 3. Race and Hispanic origin distribution, by region: 1995–1996 and 2017–2018



NOTES: Percentages may not add to 100 due to rounding. All percentages were significantly different between 1995–1996 and 2017–2018 ($p < 0.05$).
SOURCE: National Center for Health Statistics, National Vital Statistics System, Natality file.

the Delta and the rest of the United States declined from 2.87 in 1995–1996 (Delta: 10.15; rest of United States: 7.28) to 2.21 in 2017–2018 (Delta: 7.81; rest of United States: 5.60) (Table 3). Absolute differences between Appalachia and the rest of the United States increased from 1995–1996 through 2017–2018 for infants of women aged 30–34 and 35–39; differences narrowed for infants of women in other age groups (Table 3). Absolute differences between the Delta and the rest of the United States increased for infants born to women under age 20 (2.02 to 2.70) and those aged 30–34 (2.18 to 2.34) but declined for all other age groups.

Absolute differences in mortality rates between Appalachia and the rest of the United States increased from 1.15 in 1995–1996 to 1.32 in 2017–2018 for infants born to non-Hispanic white women (Appalachia: from 7.16 to 5.82; rest of United States: from 6.01 to 4.50) and declined from 1.96 to 0.44 for infants born to non-Hispanic black women (Appalachia: from 16.30 to 11.13; rest of United States: from 14.34 to 10.69) and from 0.96 to 0.89 for Hispanic women (Appalachia: from 7.11 to 5.84; rest of United States: from 6.15 to 4.95) (Tables 1 and 3). Absolute differences between the Delta and the rest of the United States increased from 1.15 to 1.39 for infants of non-Hispanic white women (Delta: 5.89) and from 0.06 to 0.39 for non-Hispanic black women (Delta: 11.08) but decreased from 1.28 to 0.49 among infants of Hispanic women (Delta: 5.44).

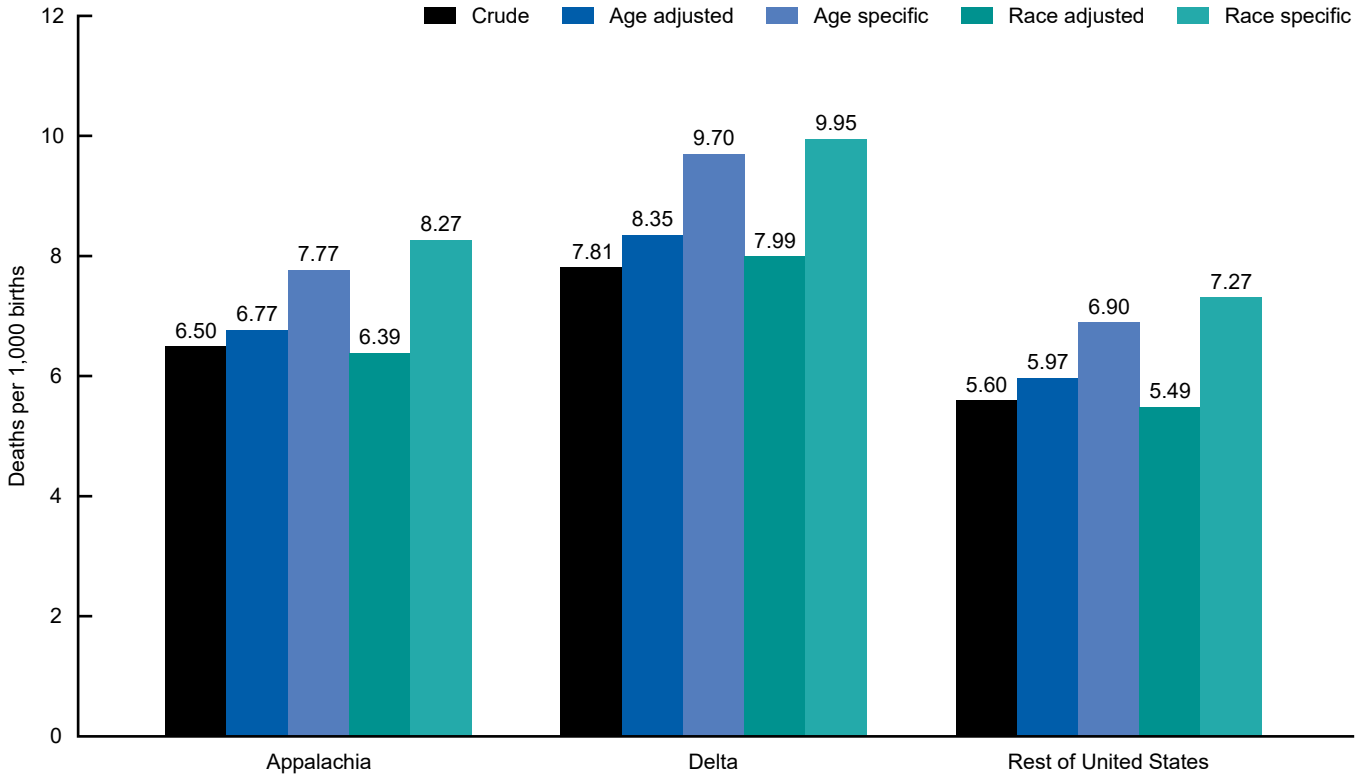
Contributions of changes in distribution of maternal age and changes in ASMRs

In all three regions, if maternal age distributions had not changed between 1995–1996 and 2017–2018, infant mortality rates would have been higher in 2017–2018. Likewise, if the ASMRs of 1995–1996 had not changed, the rates in 2017–2018 would have been higher in all three regions (Table 4, Figure 4).

In all three regions, changes in maternal age distribution between 1995–1996 and 2017–2018 accounted for about one-fifth of the difference in infant mortality rates for these time points (19.6% of the difference for Appalachia, 21.4% in the Delta, and 22.5% in the rest of the United States) (Table 4). In each region, the percentage of women under age 20, whose infants have relatively high mortality rates, declined substantially from 1995–1996 through 2017–2018, while the percentages of women aged 30–34 and 35–39, whose infants had the lowest rates, increased (Table 2). This shift explains the role of changes in age distribution in the decline in crude infant mortality rates.

Changes in the ASMRs accounted for the balance of the difference in each region. In Appalachia, this effect was the result of declines in ASMRs among women under age 35, who represent more than four in five women in the region. In the Delta, mortality rates declined for infants born to women aged 20–39. Rates also declined for women under age 20 and 40 and over, but the declines were not significant. In the rest of the United States, mortality rates declined for infants born to women

Figure 4. Crude and adjusted infant mortality rates, by region: 2017–2018



NOTES: Age-adjusted rate is based on 1995–1996 age distribution. Race-adjusted rate is based on 1995–1996 race distribution.
SOURCE: National Center for Health Statistics, National Vital Statistics System, Linked birth/infant death file.

in all age groups, with the largest declines generally seen among those aged 30 and over (Table 1).

Contributions of changes in distribution of maternal race and Hispanic origin and changes in RSMRs

If the race distributions of 1995–1996 had not changed, infant mortality rates in 2017–2018 would have been lower in Appalachia and the rest of the United States but higher in the Delta. If the RSMRs of 1995–1996 had not changed, the rates in 2017–2018 would have been higher in all three regions (Table 4, Figure 4). In all three regions, changes in RSMRs alone accounted for most or all of the differences in infant mortality rates between 1995–1996 and 2017–2018 (Table 4).

For births to women in Appalachia, changes in the RSMRs accounted for all (104.8%) of the decline in rates. Infants of Hispanic and non-Hispanic white women had nearly equal mortality rates at both time points (e.g., 5.82 for non-Hispanic white women and 5.84 for Hispanic women in 2017–2018) (Table 1). Thus, the decline in the proportion of births to non-Hispanic white women and the increase in the proportion to Hispanic women had no effect on the overall rate. This suggests that while the proportion of births to non-Hispanic black women increased from 10.9% to 12.2%, the 32% decline in mortality rates of infants born to non-Hispanic black women (from 16.30 to 11.13) accounted for much of the effect of RSMRs on the decline in mortality rates.

In the Delta, the change in RSMRs accounted for 91.4% of the change in the overall infant mortality rate from 1995–1996 to 2017–2018 (Table 4). Mortality rates for infants of non-Hispanic white and black women, who accounted for more than 9 in 10 births at both time points, declined 18% and 23%, respectively (Table 1). Changes in the maternal race and Hispanic origin distribution only accounted for 8.6% of the decline between the two time points, due to declines in the percentage of infants born to non-Hispanic black women, who had the highest mortality rates at both time points (Table 4).

In the rest of the United States, the change in RSMRs accounted for all (102.1%) of the decline in the infant mortality rate from 1995–1996 through 2017–2018 (Table 4). Thus, change in the race and Hispanic origin distribution did not affect the overall rate. The decline in mortality rates for infants of non-Hispanic black women from 14.34 to 10.69 was a significant factor driving the overall decline in infant mortality (Table 1). RSMRs also declined 25% for infants of non-Hispanic white women, who accounted for one-half of births in 2017–2018 and 20% for infants of Hispanic women, who accounted for one-quarter of births in 2017–2018 (Tables 1 and 2).

Conclusion

Infant mortality rates declined in Appalachia, the Delta, and the rest of the United States between 1995–1996 and 2017–2018. In each region, the age and race distribution of women giving birth also changed between 1995–1996 and 2017–2018, as did infant mortality rates within age and race and Hispanic origin categories, although to varying degrees.

The absolute decline in overall infant mortality rates between the two time points was greatest for the Delta (–2.34 deaths per 1,000 births, from 10.15 to 7.81), followed by the rest of the United States (–1.68, from 7.28 to 5.60), and Appalachia (–1.65, from 8.15 to 6.50). Although infant mortality rates declined in all three regions, the difference between the Delta and the rest of the United States narrowed between 1995–1996 and 2017–2018, while the difference between Appalachia and the rest of the United States increased slightly due to a greater percentage decline in rates in the rest of the United States than in Appalachia (23% compared with 20%).

Crude infant mortality rates are a function of maternal characteristics and mortality rates within categories of these characteristics. Thus, changes in distributions and mortality rates drove the gaps between the two regions and the rest of the United States. The gap between Appalachia and the rest of the United States increased slightly during the study period, a result of increased mortality differences for infants of women aged 30–34 and 35–39 between the two regions. A greater difference in rates for infants of non-Hispanic white women (the largest race and Hispanic-origin group) between the two regions and the rest of the United States contributed to the increased gap. In contrast, the infant mortality gap between the Delta and the rest of the United States declined in 2017–2018. This decline was driven by declines in the differences for infants of women aged 20–24, 25–29, and 35–39 between the Delta and the rest of the United States.

This report further examined the independent roles of changes in both age and race and Hispanic origin distributions and changes in age- and race-specific infant mortality rates. The analysis of age found that changes in the maternal age distributions of the regions accounted for about one-fifth of the declines in each region's infant mortality rate during the time period. The analysis of race and Hispanic origin found that changes in race and Hispanic origin distributions of women giving birth affected differences in infant mortality rates in the Delta only, accounting for 8.6% of the difference in that region. Changes in age- and race-specific infant mortality rates were responsible for most or all of the decline in the overall infant mortality rate in each of the three regions. These results suggest that progress made in lowering infant mortality rates across maternal age and race and Hispanic-origin groups played a greater role in regional improvements in infant mortality than changes in the age and race and Hispanic origin distributions of women giving birth in each region. Despite the improvement in infant survival in both Appalachia and the Delta, infant mortality rates in both of these regions remain higher than those in the rest of the United States.

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List of Detailed Tables

Table 1. Infant mortality rates and absolute and percent change in rates, by age and race and Hispanic origin: Appalachia, Delta, and rest of the United States, 1995–1996 through 2017–2018

	Appalachia		Delta		Rest of United States		Appalachia	Delta	Rest of United States	Appalachia	Delta	Rest of United States
	1995–1996	2017–2018	1995–1996	2017–2018	1995–1996	2017–2018	Change from 1995–1996 to 2017–2018			Percent change from 1995–1996 to 2017–2018		
Total	8.15	6.50	10.15	7.81	7.28	5.60	1.65	2.34	1.68	–20	–23	–23
Age												
Under 20	11.04	8.91	12.51	11.38	10.49	8.68	2.13	1.13	1.81	–19	[1]–9	–17
20–24	9.04	7.26	10.47	8.08	8.09	6.83	1.78	2.39	1.26	–20	–23	–16
25–29	6.91	6.04	8.66	7.46	6.27	5.45	0.87	1.20	0.82	–13	–14	–13
30–34	6.64	5.52	8.15	6.92	5.97	4.58	1.12	1.23	1.39	–17	–15	–23
35–39	7.38	6.41	10.86	6.50	6.89	5.09	0.97	4.36	1.80	[1]–13	–40	–26
40 and over	10.62	8.70	16.37	11.59	8.53	6.81	1.92	4.78	1.72	[1]–18	[1]–29	–20
Race and Hispanic origin[2]												
Non-Hispanic white	7.16	5.82	7.16	5.89	6.01	4.50	1.34	1.27	1.51	–19	–18	–25
Non-Hispanic black	16.30	11.13	14.40	11.08	14.34	10.69	5.17	3.32	3.65	–32	–23	–26
Hispanic	7.11	5.84	7.43	5.44	6.15	4.95	1.27	1.99	1.20	[1]–18	[1]–27	–20

[1]Change from 1995–1996 to 2017–2018 was not significant ($p < 0.05$).

[2]Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Linked birth/infant death file.

Table 2. Maternal age and race and Hispanic origin distribution, by region: 1995–1996 and 2017–2018

	Appalachia			Delta			Rest of United States		
	1995–1996	2017–2018	Percent change	1995–1996	2017–2018	Percent change	1995–1996	2017–2018	Percent change
Age									
Under 20	15.0	6.5	–57	20.3	7.8	–62	12.6	4.7	–63
20–24	28.1	24.7	–12	30.9	28.1	–9	24.0	18.8	–22
25–29	27.7	31.3	13	24.9	31.5	27	27.5	28.8	5
30–34	20.0	24.5	23	16.4	21.6	32	23.6	29.1	23
35–39	7.9	10.9	38	6.5	9.3	43	10.4	15.2	46
40 and over	1.3	2.2	69	1.1	1.7	55	1.9	3.4	79
Race and Hispanic origin[1]									
Non-Hispanic white	86.1	76.8	–11	56.3	53.5	–5	60.1	51.2	–15
Non-Hispanic black	10.9	12.2	12	41.1	38.1	–7	14.5	14.8	2
Hispanic	1.9	8.3	337	1.4	6.5	364	19.9	25.4	28
Non-Hispanic other	1.1	2.6	136	1.3	1.9	46	5.5	8.6	56

[1]Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race.

NOTE: All percentages were significantly different between 1995–1996 and 2017–2018 ($p < 0.05$).

SOURCE: National Center for Health Statistics, National Vital Statistics System, Linked birth/infant death file.

Table 3. Absolute difference in age- and race-specific infant mortality rates between Appalachia and the Delta and the rest of the United States: 1995–1996 and 2017–2018

	Absolute difference from rate for rest of the United States	
	Appalachia	Delta
Total		
1995–1996	0.87	2.87
2017–2018	0.90	2.21
Age		
Under 20		
1995–1996	0.55	2.02
2017–2018	0.23	2.70
20–24		
1995–1996	0.95	2.38
2017–2018	0.43	1.25
25–29		
1995–1996	0.64	2.39
2017–2018	0.59	2.01
30–34		
1995–1996	0.67	2.18
2017–2018	0.94	2.34
35–39		
1995–1996	0.49	3.97
2017–2018	1.32	1.41
40 and over		
1995–1996	2.09	7.84
2017–2018	1.89	4.78
Race and Hispanic origin[1]		
Non-Hispanic white		
1995–1996	1.15	1.15
2017–2018	1.32	1.39
Non-Hispanic black		
1995–1996	1.96	0.06
2017–2018	0.44	0.39
Hispanic		
1995–1996	0.96	1.28
2017–2018	0.89	0.49

[1]Race and Hispanic origin are reported separately on birth certificates. Race categories are consistent with the 1977 Office of Management and Budget standards. Persons of Hispanic origin may be of any race.

NOTES: All 1995–1996 differences in rates between Appalachia and the Delta and the rest of the United States were significantly different from those in 2017–2018 ($p < 0.05$).

SOURCE: National Center for Health Statistics, National Vital Statistics System, Linked birth/infant death file.

Table 4. Crude and adjusted infant mortality rates, 2017–2018, and decomposition of changes in infant mortality rates, by region: United States, 1995–1996 and 2017–2018

	Appalachia	Delta	Rest of United States
Infant mortality rate, 2017–2018	6.50	7.81	5.60
Adjusted rates due to holding constant:			
1995–1996 age distribution	6.77	8.35	5.97
1995–1996 age-specific mortality rate	7.77	9.70	6.90
Percent difference due to change in:			
Age distribution	19.6	21.4	22.5
Age-specific mortality rate	80.4	78.6	77.5
Adjusted rates due to holding constant:			
1995–1996 race distribution	6.39	7.99	5.49
1995–1996 race-specific mortality rate	8.27	9.95	7.27
Percent difference due to change in:			
Race and Hispanic origin distribution	–4.8	8.6	–2.1
Race-specific mortality rate	104.8	91.4	102.1

SOURCE: National Center for Health Statistics, National Vital Statistics System, Linked birth/infant death file.

Technical Notes

Data source

The linked birth/infant death data for 1995 through 2018 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 year before—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 (16). 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 the District of Columbia 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.

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Contents

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