

Despite an Overall Decline in U.S. Infant Mortality Rates, the Black/White Disparity Persists: Recent Trends and Future Projections

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Abstract This paper has two objectives. First, we examine the Black–White disparity in the U.S. infant mortality rate (IMR) between 1995 and 2009, and explore the influence of socioeconomic characteristics (e.g., marital status, education, and prenatal care) on this racial gap. Second, we calculate projected IMRs and compare these results to the objectives of the Healthy People 2020 program. Descriptive statistics were calculated and linear regression models were conducted using data from the Centers for Disease Control and Prevention’s linked birth and infant death files. Between 1995 and 2009, the IMR declined by 11.9 % for White mothers and 15.3 % for Black mothers. Among unmarried mothers, there was a 19.6 % decline for Whites and a 15.2 % reduction for Blacks. In comparison, among married mothers, there was a 19.3 % decline for Whites and an 18.1 % reduction for Blacks. For both Blacks and Whites, the largest percent declines occurred among women with the lowest and highest levels of education. For both racial groups, those with no prenatal care had the highest IMRs. Despite these significant declines, educated White women are the only group predicted to reach the Healthy People 2020 objective of an IMR lower than 6.0 infant deaths per 1,000 live births. The predicted IMR for highly educated Black

women in 2020 is 10.6, and the projected rates for Black mothers with low education levels are even higher. Although the IMR has declined since 1995, the racial disparity between Blacks and Whites will most likely persist through 2020. Whereas educated White mothers are projected to meet the Healthy People 2020 IMR goal, other groups will fall short. The racial disparity persists even when mothers are grouped by marital status, educational attainment, and access to care. Future policies and prevention programs should address these racial disparities.

Keywords Infant mortality rate · Race · Socioeconomic status · Health disparities · United States

Introduction

Racial disparities in the U.S. infant mortality rate (IMR) remain large, and thus problematic [1]. Although the overall IMR has improved significantly in recent years—a decline of 12 % from 2005 to 2011 [2]—the Black–White disparity persists [3]. In 1995, Whites experienced 6.3 infant deaths per 1,000 live births while Black women experienced 14.7, resulting in a 2.3-fold difference between the two racial groups [4]. By 2009, the most recent year for which data are available, the IMR had fallen to 5.5 for Whites and 12.4 for Blacks. Thus, although the IMR for both groups dropped dramatically (14.3 %), the gap between Blacks and Whites remained the same. Healthy People 2020 identified reducing racial gaps in the IMR as a critical objective; specifically, the program established a national goal of all racial groups having an IMR below 6.0 infant deaths per 1,000 live births [5]. The plan’s main focus is decreasing the IMR among Blacks and other racial/ethnic minority groups. However,

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given past trends, it is unclear whether certain groups will reach this goal.

The expansive literature on the factors associated with an increased risk of poor birth outcomes has shown that marital status, educational attainment, and access to prenatal care are strongly associated with racial disparities in IMR. Most research has shown that marital status acts as a protective factor, decreasing the risk of adverse pregnancy outcomes [6–10]. The empirical evidence suggests that, compared to single women, married women have more psychosocial support (as a result of relational stability), decreased exposure to health-eroding behaviors that increase the risk of infant mortality (e.g., smoking, alcohol, drugs), and lower levels of maternal stress [6, 7, 11, 12]. In addition, Black women have historically had lower rates of marriage and higher rates of divorce than White women [13]. As a result of these racial differences in marriage rates, Black mothers are almost twice as likely as White mothers to be unmarried at the time of birth—65 % compared to 33 % [14].

While most studies have found that lower educational attainment is associated with poorer pregnancy outcomes [15–19], there is some evidence that the impact of education on IMR may differ across racial groups. MacMahon [15] was among the first scholars to note that education influenced the IMR among Whites and Blacks differently. For Whites, the IMR declined sharply as educational attainment increased, while for Blacks the IMR declined at a slower rate as educational attainment increased [15, 19]. More recently, [20] used data from the 2001 U.S. national linked birth–death files for Blacks, Whites, and Mexican Americans to confirm that increases in education had a stronger positive influence on Whites than Blacks.

Access to prenatal care is another important determinant of successful pregnancy outcomes [21–24]. Inadequate prenatal care, which can be defined as a lack of care [25], late-onset prenatal care [26], or negative patient-provider interactions [27], is associated with a higher risk of infant mortality. Although most women receive at least some prenatal care through workforce benefits or government-supported programs such as Medicaid [28, 29], access to care differs by race. Black women are more likely than White women to have inadequate prenatal care [24], and this discrepancy contributes to a higher rate of poor pregnancy outcomes among this population.

Although recent studies have explored disparities in IMRs by marital status, educational level, and access to prenatal care [6, 22–24], few studies have examined how these factors have influenced the U.S. IMR over time. Studies that use past trends to generate future projections are even less common [19]. This paper has two objectives. First, we use data from the Centers for Disease Control and

Prevention's (CDC) linked birth–death files from 1995 to 2009 to examine the Black–White disparity in the IMR in the United States, and we explore the influence of socio-economic factors (marital status, education, and prenatal care) on this racial gap. Second, we calculate projected IMRs and compare these results with the Healthy People 2020 objectives.

Methods

This study uses data from the CDC's linked birth and infant death file from the years 1995 through 2009. Data for Black and White women in all 50 U.S. states were included in the analysis; data from the three U.S. territories (Puerto Rico, Guam, the Virgin Islands) were not included. The aggregated data (through 2006) are organized into three time periods: 1995–1998, 1999–2002, and 2003–2006; because data for 2010 has not yet been released, aggregate data for the next period (2007–2010) is unavailable.

This study focuses on three risk factors for infant mortality: marital status, maternal education, and prenatal care. Respondents' marital status was categorized as married or unmarried; all results coded as “don't know” or “missing” were excluded, while other types of relationships such as cohabitation and/or domestic partnerships were included in the unmarried category. Maternal education responses were divided into four categories: less than a high school (HS) degree (0–8 years), some HS (9–11 years), HS degree (12 years), some college (13–15 years), and college degree or higher (16+ years). In the models predicting percent decline in the IMR, education was dichotomized into lower educational attainment levels (less than a high school degree) and higher levels of education (high school degree or higher). Prenatal care was operationalized as the trimester in which care began: first (1–3 months), second (4–6 months), or third (7–9 months). The infant mortality rate was obtained in the public data files.

We present descriptive statistics to evaluate trends in IMR by race, marital status, maternal education, and prenatal care. Next, we use aggregated data and linear regression models to predict future IMRs and determine whether the 2020 Healthy People objective will be met; we predicted the IMR for four periods: 2007–2010, 2011–2014, 2015–2018, and 2019–2022. Results for the final period (2019–2022) are used as a proxy for the projected 2020 IMRs, and are compared to the Healthy People 2020 objective. Individual-year data from 1995 to 2009 were used to calculate projected IMRs. All analyses were conducted using SPSS Statistics version 19.0.

Results

Descriptive Statistics

Data used in the analyses are based on 54,052,724 live births (of these mothers, 17 % are Black and 83 % are White) and 379,288 infant deaths (32 % Black and 68 % White) (Table 1). Between 1995 and 2009, the IMR declined by 11.9 % for Whites and 15.3 % for Blacks. Although the decline was greater among Black women than among their White counterparts, in 2009 the IMR among Black women was still 2.2 times greater than the rate among White women.

Declines varied by marital status, maternal education, and prenatal care. The overall IMR for married women fell more sharply (18.4 %) than the rate for unmarried women (16.9 %); however, this decline differed somewhat by race—the IMR for unmarried Blacks declined by 15.2 % compared to a 19.6 % reduction among unmarried Whites, while the IMR for married Black women declined by 18.1 % and the rate fell by 19.3 % among married White women. With regard to maternal education, the largest percent reductions occurred among those with the lowest level of education (a 36.2 % decline) and the highest level of education (a 26.1 % decline). Among those with the least education, Blacks mothers experienced a 33.2 % decline, whereas Whites experienced a 40.6 % decline. For those with the highest levels of education, the IMR declined more sharply among Blacks (28.1 %) than among Whites (21.1 %). Black mothers with no prenatal care experienced a larger percent decline in IMR (21.1 %) than their White counterparts (11.8 %). Among women who received care in the first trimester, Blacks had a 14.9 % decline in the IMR and Whites had a 17.8 % decline; among those who received care in the second trimester,

Table 1 Descriptive statistics of births and infant deaths: 1995–2009

	Births (n = 54,052,724) (%)	Infant deaths (n = 379,288) (%)
Race		
White	83.0	68.0
Black	17.0	32.0
Marital status		
Yes	65.1	50.7
No	34.9	49.3
Education		
0–8 years	4.1	5.5
9–11 years	15.5	19.3
12 years	28.4	30.9
13–15 years	19.6	16.8
16+ years	20.5	12.7

Blacks saw a reduction of 18.2 % compared to 21.1 % for Whites; finally, for women who did not receive care until the third trimester, Blacks had a 19.3 % decline in IMR compared to a 22.4 % decline for Whites (Table 2).

Predictions of IMRs Through 2022

Table 3 presents predicted IMRs through 2020 based on linear regression results. The results indicate that the overall IMR will reach 5.4 infant deaths per 1,000 live births (95 %CI 6.0–6.5) in 2020. For Whites, the estimated IMR will average 5.1 (95 %CI 5.5–5.7) and for Blacks the rate is projected to be 11.8 (95 %CI 12.8–13.4). Whites with less than a HS education are expected to have an IMR of 6.4 (95 %CI 6.14–6.75) and the rate for their Black counterparts is predicted to be 12.5 (95 %CI 12.36–12.97). Whites who have a HS education or higher will reach an IMR of 3.9 (95 %CI 3.68–4.29) and the IMR for Black

Table 2 Annual rates of decline in IMRs, NCHS, from 1995 to 2007

Variable	White			Black		
	1995	2009	% decline	1995	2009	% decline
Race	6.3	5.5	11.9	14.7	12.4	15.4
Marital status						
Married	5.4	4.4	19.3	12.5	10.3	18.1
Unmarried	9.6	7.7	19.6	15.6	13.2	15.2
Educational attainment						
0–8 years	11.8	7.0	40.6	16.8	11.2	33.2
9–11 years	10.3	9.3	9.3	15.7	13.7	12.9
12 years	6.7	6.7	0.7	14.6	12.2	16.7
13–15 years	5.2	4.6	10.4	12.4	10.9	12.1
16+ years	4.2	3.3	21.1	11.4	8.2	28.1
Month received prenatal care						
None	32.9	29.0	11.8	51.0	40.3	21.1
1st month	5.9	6.8	−15.4	13.9	15.2	−9.9
2nd month	5.2	4.2	19.1	12.7	10.9	14.1
3rd month	5.4	4.4	19.5	11.8	9.7	18.3
4th month	7.2	5.2	27.1	11.8	9.9	16.7
5th month	7.9	6.9	13.1	11.7	10.0	14.5
6th month	7.6	6.7	12.1	10.1	7.2	28.5
7th month	6.5	4.9	23.9	8.7	7.6	12.9
8th month	7.2	5.7	20.7	8.4	7.8	7.5
9th month	7.9	5.8	26.2	11.7	n/a	n/a
Trimester received care						
1st trimester (1–3 months)	5.5	4.5	17.8	12.7	10.8	14.9
2nd trimester (4–6 months)	7.5	5.9	21.1	11.5	9.4	18.2
3rd trimester (7–9 months)	6.9	5.4	22.4	9.0	7.2	19.3

Table 3 Predictions of IMRs by race and educational attainment, NCHS, 2007–2022

Variable	Projected IMRs per 1,000 live births				95 % CI
	2007–2010	2011–2014	2015–2018	2019–2022	
Blacks	12.4	11.8	11.2	10.7	10.6–11.3
Low education	13.4	13.1	12.8	12.5	12.4–13.0
High education	10.0	9.4	8.8	8.3	8.3–8.9
Whites	5.3	5.0	4.8	4.5	4.3–4.9
Low education	6.7	6.6	6.5	6.4	6.1–6.8
High education	4.2	4.1	4.0	3.9	3.7–4.3
Both races combined	6.5	6.2	5.9	5.6	5.4–6.0

women with the same level of education is projected to fall to 8.3 (95 %CI 8.25–8.85).

Discussion

The analyses reveal that from 1995 to 2009 the IMR declined more sharply among Black mothers than among White mothers. However, significant racial and socioeconomic disparities in the IMR remain, and projections indicate that the racial disparity will persist through 2020, when the IMR for Blacks will still be about twice as high as the rate for Whites. [30] and [31] asserted that difference in patterns between Black and White women are the result of socioeconomic gradients in health. Specifically, Whites have more socioeconomic resources [31]—higher levels of educational attainment, income [31], and employment—than Blacks. Similarly, compared to Black mothers, White mothers are more likely to own a car and report safer neighborhood living conditions [31]. Higher socioeconomic status reduces stress, and thus reduces infant mortality. Whereas White mothers who have more than a high school education are predicted to reach the goal established by Healthy People 2020 (6.0 infant deaths per 1,000 live births), the projections suggest that other groups, such as all Black women (regardless of education level) and Whites with low educational attainment, will not meet the goal.

Among Whites, unmarried and married women experienced similar percent reductions from 1995 to 2009. For Blacks, however, married women saw a higher percent reduction (18.1 %) than unmarried women (15.2 %). Women who are married receive spousal support, which decreases stress and provides access to additional financial resources [11, 32]. The association between IMR and marital status among Black women might also be attributed to different levels of available resources.

For both racial groups, the largest declines occurred among women with the lowest and highest education levels. Among those with the least education, the IMR declined 40.6 % among Whites and 33.2 % among Blacks. Among those with the highest educational levels, the

declines were 21.1 and 28.1 % for Whites and Blacks, respectively. When the two racial groups were combined, the largest declines in the IMR among women with the least education. In 1995, for those with less than 9 years of education, the IMR was 11.8 for Whites and 16.8 for Blacks; by 2009, these rates had declined to 7.0 and 11.2, respectively. In addition, women with lower levels of educational attainment may have had more access to available resources such as Medicaid, and thus have been better able to afford health coverage. Large declines among women with higher educational attainment might be related to financial stability during this period, which allowed greater access adequate health care [23, 29].

The results for prenatal care were similar to those found in previous studies, which have found that prenatal care is essential to healthier pregnancy outcomes. Prenatal care allows mothers-to-be to receive important medical advice, facilitates proper monitoring of the fetus, and leads to early detection and treatment if necessary [33, 34]. For mothers in both racial groups, the IMR was about four times higher among those who did not receive care than among those who had some access to care. However, several aspects of the findings concerning prenatal care require additional consideration. Whereas among Black women there was a larger percent reduction in the IMR for women who did not receive any prenatal care than for those who did, Whites experienced greater reductions for each trimester in which care was received.

Limitations

The current study has two primary limitations. First, vital statistics data categorize individuals as either unmarried or married, and do not consider other relationship types (e.g., cohabitation or common-law marriage) that could potentially affect infant mortality. Just as there are racial differences in marriage patterns [35], there are racial differences in relationship types [11, 36]; future research should explore these differences. Second, data for the most recent period were unavailable. The study should be replicated once the 2010 data are available.

Despite these limitations, the study has several strengths. First, the use of U.S. linked birth–death files means that the data were collected via probability sampling. Second, the database includes relevant health, demographic, and socioeconomic characteristics that allows to explore different groups. Third, the long series of U.S. linked birth–death files allow for the analysis over time and to use past information to project future trends.

The study has several significant implications for policy implementation. Although the recent and predicted future declines are promising, a racial disparity remains and will likely persist through 2020. Researchers and policy makers must continue to monitor declines in IMRs, and must also focus on reducing key differences between Blacks and Whites that will narrow the racial gap in IMRs. In addition, a focus on access to and quality of care must be emphasized and prioritized. Access to prenatal care is a necessity and thus there is a need to encourage physicians to practice in medically underserved areas. The results of this study predict that declines in IMRs will continue, but the racial gap will remain persistent and thus future research should focus on narrowing this gap.

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