Persistent Racial Disparities in US Infant Mortality, 1995-2017

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Abstract. In the United States, black babies are significantly more likely to die at birth than white babies. In order to determine the relationship between the risk of neonatal death and race, this research conduct a national-based study of 89.7 million live singleton births between 1995 and 2017. We assessed whether the racial/ethnic disparity in infant mortality narrowed, persisted, or widened over these years, which coincides with a period of substantial improvements in neonatal care. Our study contributes to a growing literature on racial disparities in infant mortality.

Keywords: Infant mortality; US; Racial disparities; Mortality rates.

1. Introduction

Between 2005 and 2014, infant mortality decreased by 15%, from 6.8 deaths per 1000 live births in 2005 to 5.8 deaths per 1000 live births in 2014.[1] Over this time period, black infants experienced persistently higher mortality rates compared to white infants.[2,3] Moreover, the mortality rate for Non-Hispanic blacks decreased only through 2012 and then increased through 2015.[2] In contrast, the mortality rate for Non-Hispanic whites consistently decreased.[2] This persistent gap in infant mortality occurred across broad causes of death (e.g., congenital malformations and sudden infant death syndrome).[2] Black infants also experienced persistently higher mortality rates across all gestational age categories, especially among preterm infants.[4] Hispanic infants, on the other hand, have historically experienced approximately equal mortality rates compared to non-Hispanic whites.[5]

Although we know the observed disparity in infant mortality persisted between Non-Hispanic black and non-Hispanic white infants, we do not know if this disparity existed once we account for differences in gestational age, birth weight, and maternal characteristics. We also do not know if a similar gap existed between Hispanic and Non-Hispanic white infants and, if so, how this gap changed over time once accounting for these birth and maternal characteristics.

To address this research gap, we conduct a national-based study of 89.7 million live singleton births between 1995 and 2017. We assessed whether the racial/ethnic disparity in infant mortality narrowed, persisted, or widened over these years, which coincides with a period of substantial improvements in neonatal care.[6]

2. Methods

Data. This cohort study analyzed US birth certificate data from January 1, 1995 to December 31, 2017, collected by the National Center for Health Statistics as part of the National Vital Statistics System. The data used were de-identified and publicly available. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline. We included all live singleton births that occurred in US states and the District of Columbia. Still births were not included. We also excluded births among mothers <15 years old (0.15%).

Outcomes. The outcome was death within the first year of life among infants who were born alive.

Covariates. Sociodemographic characteristics of expectant mothers included their age at delivery (15-19, 20-24, 25-29, 30-34, 35-39, 40+ years) and race/ethnicity (Hispanic, non-Hispanic black, non-Hispanic white, or non-Hispanic other race/ethnicity). Infant characteristics included gestational age (under 37 weeks, 37 weeks and over), small for gestational age (SGA), and year of birth (from 1995 to 2017). SGA was calculated as at or below the 10th percentile of birth weight for each gestational age.[7] The proportion of births with missing data on any of these covariates ranged between 0.0% and 0.7% (eTable 2 in the Supplement).

Statistical Analysis. We performed a multistep analysis. First, we assessed the distribution of maternal sociodemographic characteristics and infant characteristics. Second, we calculated the infant mortality rate by maternal race/ethnicity across years. The infant mortality rate equaled the number of deaths within the first year of life among infants who were born alive per 1000 live births.[23] Third, we calculated the infant mortality rate ratio ($IMR_{\text{Non-Hispanic black}}/IMR_{\text{Non-Hispanic white}}$) across years. Fourth, we fit a multivariable logistic regression model to identify the association between maternal race/ethnicity, year of birth, and their interaction and infant mortality. The outcome of the model was infant mortality. Other covariates included maternal age at delivery, premature birth, SGA.

Throughout the analysis, statistical significance was assessed at 2-sided $P < .05$. All statistical calculations were done with R, version 4.4.1 (R Project for Statistical Analysis). We conducted data analysis from August 2024 to October 2024.

3. Results

Study Sample. Between 1995 and 2017, there were N=89,775,189 million live singleton births in the US (Table 1). The number of births increased from 3.8 million in 1995 to a peak level of 4.2 million in 2007 and subsequently decreased to 3.7 million in 2017. The modal maternal age was 25-29 years old. Fifty-six percent of births occurred among Non-Hispanic White mothers, 23% among Hispanic mothers, and 15% among non-Hispanic Black mothers. Finally, 10% of births occurred at <37 weeks gestation and 10% of babies were small for gestational age.

Infant Mortality Rate. For non-Hispanic Blacks, IMR decreased from 13.0 deaths per 1000 live births in 1995 to 9.6 deaths per 1000 live births in 2017 (Figure 1). For non-Hispanic Whites, IMR decreased from 5.4 deaths per 1000 live births in 1995 to 4.2 deaths per 1000 live births in 2017. The ratio of IMR for non-Hispanic Black to IMR for non-Hispanic Whites was nearly constant over the time period between 2.2 and 2.5 (Figure 2).

Regression Analysis. The odds of infant mortality were lower for maternal ages of 30-34 years and 35-39 years compared to 25-29 years (Appendix, Table 1). The odds were higher for premature infants compared to term infants (adjusted odds ratio [aOR]:14.02; 95% confidence interval [CI]: 13.94 to 14.11). Similarly, the odds were higher for SGA infants (aOR: 3.03; 95% CI: 3.01 to 3.05). The odds of infant mortality for Non-Hipanic blacks expectant mothers were 1.41 times higher (aOR 95% CI: 1.37 to 1.45) in 1995 (Figure 3). The odds increased to a peak value of 1.58 times higher (aOR 95% CI: 1.53 to 1.63) in 2004. In 2017, the odds were 1.49 times higher (aOR 95% CI: 1.44 to 1.55).

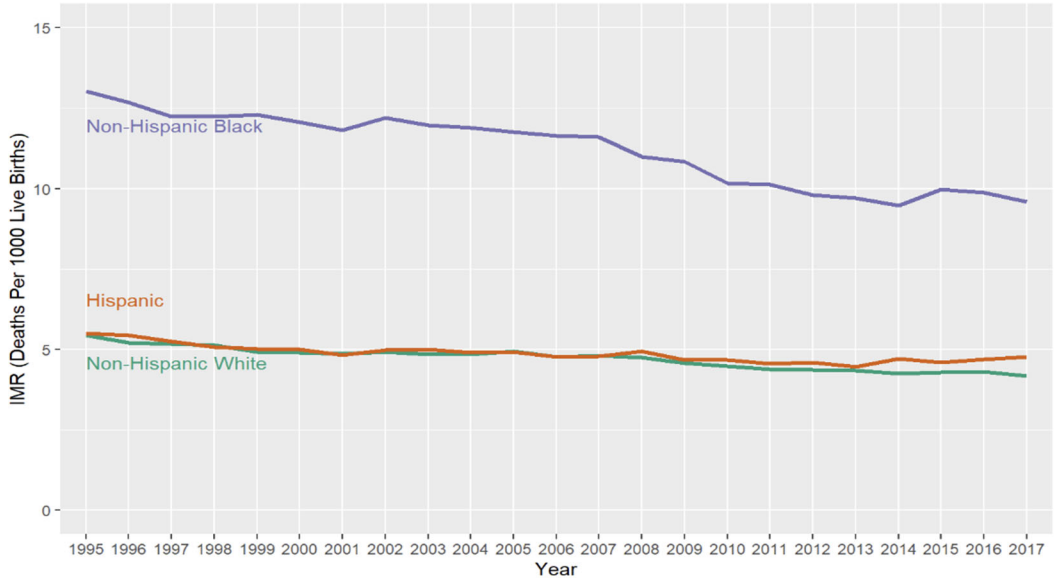


Figure 1. IMR (Deaths per 1000 live births)

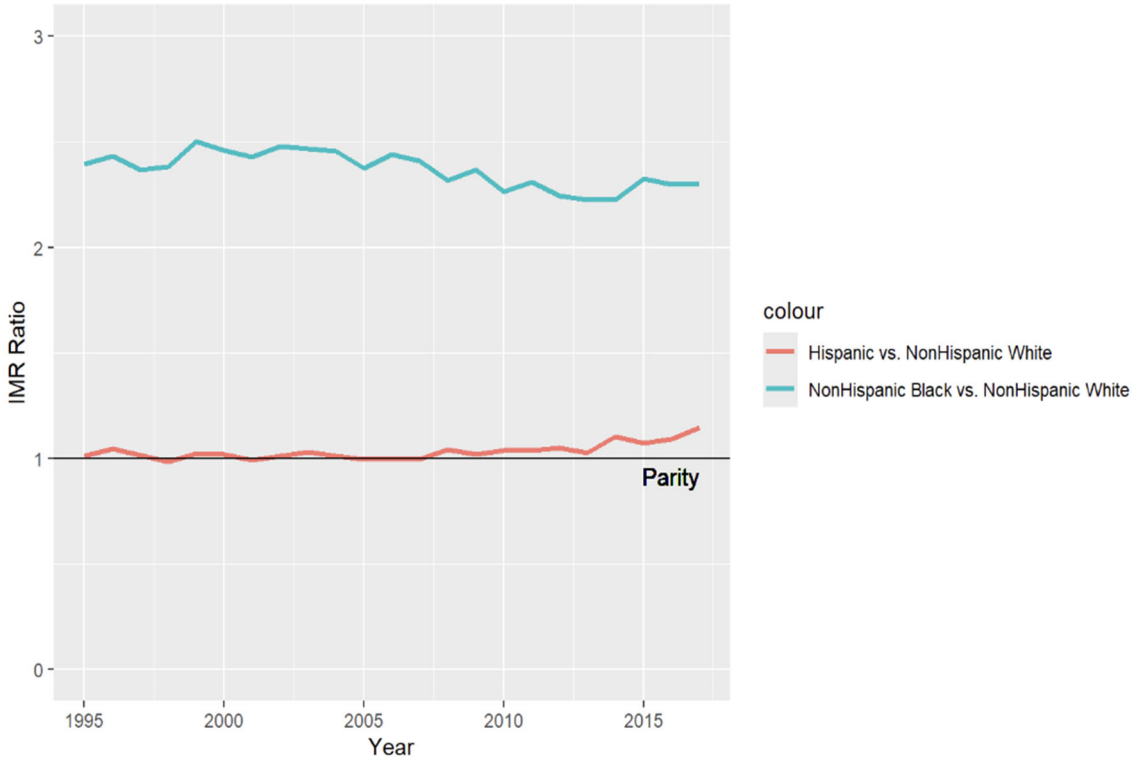


Figure 2. IMR Ratio

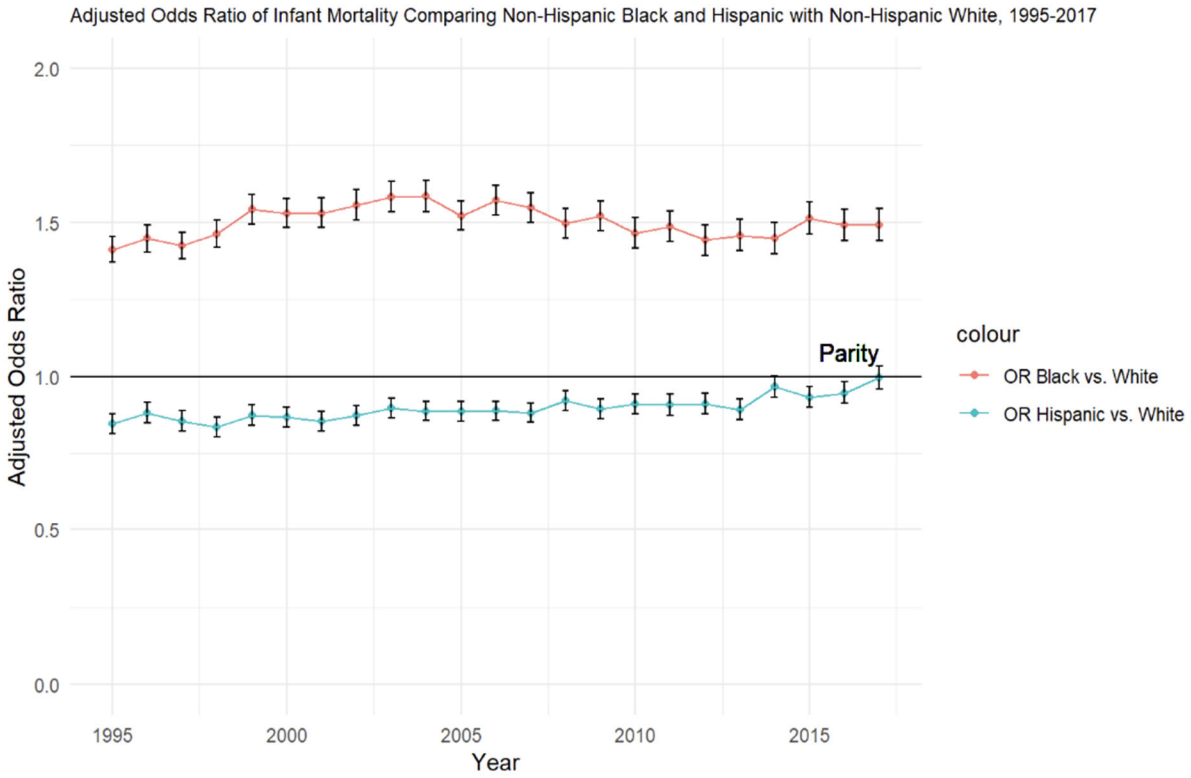


Figure 3. Adjusted Odds Ratio of infant Mortality Comparing Non-Hispanic Black and Hispanic with Non-Hispanic White, 1995-2017

Table 1. Data

Characteristic	**N = 89,775,189**[1]
Year	
1995	3,804,859 (4.2%)
1996	3,791,596 (4.2%)
1997	3,776,693 (4.2%)
1998	3,830,106 (4.3%)
1999	3,844,905 (4.3%)
2000	3,940,726 (4.4%)
2001	3,906,040 (4.4%)
2002	3,897,992 (4.3%)
2003	3,962,675 (4.4%)
2004	3,982,399 (4.4%)
2005	4,009,102 (4.5%)
2006	4,132,577 (4.6%)
2007	4,181,582 (4.7%)
2008	4,113,284 (4.6%)
2009	3,997,124 (4.5%)
2010	3,871,700 (4.3%)
2011	3,827,019 (4.3%)
2012	3,827,209 (4.3%)
2013	3,806,006 (4.2%)
2014	3,860,446 (4.3%)
2015	3,853,681 (4.3%)
2016	3,822,704 (4.3%)
2017	3,734,764 (4.2%)
Maternal Age Category (Years)	
15-19 years	8,785,581 (9.8%)
20-24 years	21,727,225 (24%)
25-29 years	24,998,941 (28%)
30-34 years	21,532,806 (24%)
35-39 years	10,314,426 (12%)
40+ years	2,273,580 (2.5%)
Maternal Race/Ethnicity	
Non-Hispanic White	49,918,192 (56%)
Hispanic	20,244,798 (23%)
Non-Hispanic Black	13,133,552 (15%)
Non-Hispanic Other	5,810,811 (6.5%)
Gestational Age (Weeks)	
37 weeks and over	80,119,713 (90%)
Under 37 weeks	9,156,156 (10%)
Small for Gestational Age	9,179,894 (10%)

[1]n (%)

Table 2. Missing Values by Covariate

Covariates	Number of NAs
BDeath	0 (0%)
MAge	0 (0%)
MRace	667836 (0.7%)
GesAge	499320 (0.6%)
Year	0 (0%)
SmallForGesAge	0 (0%)

Table 3. Data

Characteristics	Odds Ratio	CI
Maternal Age		
15-19 years	1.30	(1.29, 1.31)
20-24 years	1.18	(1.17, 1.19)
30-34 years	0.91	(0.9, 0.91)
35-39 years	0.95	(0.94, 0.96)
40+ years	1.16	(1.14, 1.18)
Gestational Age		
Under 37 weeks	14.02	(13.94, 14.11)
Small for Gestational Age		
	3.03	(3.01, 3.05)
Maternal Race/Ethnicity		
Hispanic	0.85	(0.81, 0.88)
Non-Hispanic Black	1.41	(1.37, 1.46)
Non-Hispanic Other	0.86	(0.81, 0.93)
Year		
1996	0.96	(0.93, 0.98)
1997	0.94	(0.91, 0.96)
1998	0.92	(0.89, 0.94)
1999	0.87	(0.85, 0.9)
2000	0.87	(0.85, 0.9)
2001	0.86	(0.83, 0.88)
2002	0.86	(0.84, 0.89)
2003	0.84	(0.82, 0.86)
2004	0.83	(0.81, 0.85)
2005	0.84	(0.82, 0.86)
2006	0.81	(0.78, 0.83)
2007	0.82	(0.8, 0.85)
2008	0.83	(0.8, 0.85)
2009	0.81	(0.79, 0.83)
2010	0.80	(0.78, 0.82)
2011	0.79	(0.77, 0.82)
2012	0.80	(0.78, 0.82)
2013	0.81	(0.78, 0.83)
2014	0.79	(0.77, 0.82)
2015	0.80	(0.78, 0.83)
2016	0.80	(0.78, 0.83)
2017	0.77	(0.75, 0.79)
Interactions		
Hispanic:1996	1.04	(0.99, 1.1)
Non-Hispanic Black:1996	1.03	(0.98, 1.07)
Non-Hispanic Other:1996	1.06	(0.96, 1.17)
Hispanic:1997	1.01	(0.96, 1.07)
Non-Hispanic Black:1997	1.01	(0.97, 1.05)
Non-Hispanic Other:1997	0.97	(0.88, 1.07)
Hispanic:1998	0.99	(0.94, 1.05)
Non-Hispanic Black:1998	1.04	(0.99, 1.08)
Non-Hispanic Other:1998	1.09	(0.99, 1.2)
Hispanic:1999	1.03	(0.98, 1.09)
Non-Hispanic Black:1999	1.09	(1.05, 1.14)
Non-Hispanic Other:1999	1.06	(0.96, 1.16)
Hispanic:2000	1.03	(0.97, 1.08)
Non-Hispanic Black:2000	1.08	(1.04, 1.13)
Non-Hispanic Other:2000	1.05	(0.96, 1.16)
Hispanic:2001	1.01	(0.96, 1.07)

Non-Hispanic Black:2001	1.08	(1.04, 1.13)
Non-Hispanic Other:2001	1.07	(0.97, 1.17)
Hispanic:2002	1.03	(0.98, 1.09)
Non-Hispanic Black:2002	1.10	(1.06, 1.15)
Non-Hispanic Other:2002	1.03	(0.94, 1.13)
Hispanic:2003	1.06	(1.01, 1.12)
Non-Hispanic Black:2003	1.12	(1.07, 1.17)
Non-Hispanic Other:2003	1.09	(0.99, 1.19)
Hispanic:2004	1.05	(0.99, 1.11)
Non-Hispanic Black:2004	1.12	(1.07, 1.17)
Non-Hispanic Other:2004	1.05	(0.96, 1.15)
Hispanic:2005	1.05	(0.99, 1.1)
Non-Hispanic Black:2005	1.08	(1.03, 1.13)
Non-Hispanic Other:2005	1.05	(0.96, 1.16)
Hispanic:2006	1.05	(1, 1.11)
Non-Hispanic Black:2006	1.11	(1.07, 1.16)
Non-Hispanic Other:2006	1.04	(0.95, 1.14)
Hispanic:2007	1.04	(0.99, 1.1)
Non-Hispanic Black:2007	1.10	(1.05, 1.15)
Non-Hispanic Other:2007	1.07	(0.98, 1.17)
Hispanic:2008	1.09	(1.03, 1.15)
Non-Hispanic Black:2008	1.06	(1.01, 1.11)
Non-Hispanic Other:2008	1.07	(0.97, 1.17)
Hispanic:2009	1.06	(1, 1.11)
Non-Hispanic Black:2009	1.08	(1.03, 1.13)
Non-Hispanic Other:2009	1.03	(0.94, 1.13)
Hispanic:2010	1.08	(1.02, 1.14)
Non-Hispanic Black:2010	1.04	(0.99, 1.09)
Non-Hispanic Other:2010	1.01	(0.92, 1.11)
Hispanic:2011	1.07	(1.02, 1.13)
Non-Hispanic Black:2011	1.05	(1.01, 1.1)
Non-Hispanic Other:2011	1.02	(0.93, 1.12)
Hispanic:2012	1.08	(1.02, 1.14)
Non-Hispanic Black:2012	1.02	(0.98, 1.07)
Non-Hispanic Other:2012	1.00	(0.91, 1.09)
Hispanic:2013	1.05	(1, 1.11)
Non-Hispanic Black:2013	1.03	(0.99, 1.08)
Non-Hispanic Other:2013	0.94	(0.86, 1.03)
Hispanic:2014	1.14	(1.08, 1.21)
Non-Hispanic Black:2014	1.03	(0.98, 1.07)
Non-Hispanic Other:2014	0.94	(0.85, 1.03)
Hispanic:2015	1.10	(1.04, 1.16)
Non-Hispanic Black:2015	1.07	(1.02, 1.12)
Non-Hispanic Other:2015	1.01	(0.92, 1.11)
Hispanic:2016	1.12	(1.06, 1.18)
Non-Hispanic Black:2016	1.06	(1.01, 1.11)
Non-Hispanic Other:2016	0.97	(0.88, 1.06)
Hispanic:2017	1.18	(1.11, 1.24)
Non-Hispanic Black:2017	1.06	(1.01, 1.11)
Non-Hispanic Other:2017	1.03	(0.94, 1.13)

4. Discussion

Two central findings emerged from this national study of infant mortality. First, the infant mortality rate for non-Hispanic blacks was always more than twice that for non-Hispanic whites

between 1995 and 2017. Second, accounting for birth and maternal characteristics, racial disparities in infant mortality remained nearly constant over time.

Our study contributes to a growing literature on racial disparities in infant mortality.[4,8] In 2020, the mortality rate was higher for non-Hispanic Black infants compared to non-Hispanic white infants for the five leading causes of death: low birthweight, congenital malformations, sudden infant death syndrome, accidents, and maternal complications.[9] For example, the mortality rate due to low birthweight was 214 deaths per 1000 live births for the former compared to 56 deaths per 1000 live births for the former. Many factors interact leading to persistent racial disparities including societal factors (e.g., institutional racism, crime, segregation, built-environment, and area deprivation), maternal factors (e.g., teen birth, cigarette smoking), and healthcare-related factors (e.g., health insurance).[10–12] A national study of 743 neonatal intensive care units (NICUs) found Black infants received care at lower-quality NICUs compared to White infants as quantified by a composite measure of care (Baby-MONITOR scores).[13]

Infant mortality was substantially higher across gestational age for non-Hispanic Black infants compared to non-Hispanic White infants.[4] This disparity widened with higher gestational age. We found persistently higher infant mortality across time for both preterm and full-term infants. Among periviable infants born between 22 and <26 weeks gestation, Black infants were less likely than White infants to receive active life-saving treatment (e.g., surfactant therapy, assisted ventilation immediately following delivery).[14]

We note several limitations in the present analysis. First, we were not able to account for maternal smoking immediately prior to pregnancy or during pregnancy as this information was missing for 26.9% of expectant mothers. Maternal smoking, which is associated with an increased risk of infant mortality, was more prevalent among non-Hispanic whites than non-Hispanic blacks.[15,16] Second, we were also not able to account for Apgar score as this information was missing for 11.3% of expectant mothers. Apgar score is inversely associated with the risk of infant mortality.[17]

5. Conclusion

In conclusion, the racial disparity in infant mortality neither narrowed or widened between 1995 and 2017. Rather, it remained relatively constant, accounting for maternal and birth characteristics.

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