



Separate and unequal: Structural racism and infant mortality in the US



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ABSTRACT

We examined associations between state-level measures of structural racism and infant mortality among black and white populations across the US. Overall and race-specific infant mortality rates in each state were calculated from national linked birth and infant death records from 2010 to 2013. Structural racism in each state was characterized by racial inequity (ratio of black to white population estimates) in educational attainment, median household income, employment, imprisonment, and juvenile custody. Poisson regression with robust standard errors estimated infant mortality rate ratios (RR) and 95% confidence intervals (CI) associated with an IQR increase in indicators of structural racism overall and separately within black and white populations. Across all states, increasing racial inequity in unemployment was associated with a 5% increase in black infant mortality (RR=1.05, 95% CI=1.01, 1.10). Decreasing racial inequity in education was associated with an almost 10% reduction in the black infant mortality rate (RR=0.92, 95% CI=0.85, 0.99). None of the structural racism measures were significantly associated with infant mortality among whites. Structural racism may contribute to the persisting racial inequity in infant mortality.

1. Introduction

In the US, the black infant mortality rate is more than double the white infant mortality rate (Matthews et al., 2015). This profoundly disturbing racialized patterning of infant mortality has existed for as long as data have been available (MacDorman, 2011), and research has largely centered around individual-level determinants, highlighting differences in the lived experiences and socioeconomic circumstances between black and white women (Geronimus, 1992; Lu et al., 2010). Increasingly, however, efforts aimed at eliminating social inequalities in health have begun to focus on macro-level conditions and societal contexts as explanations behind the persistent difference in rates at the population level (Siddiqi et al., 2016).

Understanding the development of racial inequities in health – including infant mortality – requires historical contextual framing and the identification of the contemporary US as an unequal society (Siddiqi et al., 2016). For centuries, whites in the US have and continue to unfairly benefit from generations of socioeconomic advantage and with it greater opportunities in education and employment, healthier

neighborhood environments, higher quality health care and greater political power (Feagin and Bennefield, 2014). The creation and perpetuation of this inequitable system of opportunity and privilege constitutes structural racism (Aspen Institute, 2013).

A growing body of research is beginning to reveal how structural racism divides the health of the nation along racial lines (Feagin and Bennefield, 2014; Jee-Lyn Garcia and Sharif, 2015; Krieger, 2008; Lukachko et al., 2014; Williams and Collins, 2001). Structural racism restricts access for people of color to health-promoting factors (i.e. wealth, income, safe housing, quality education and health care). The result is a health disadvantage among socially-marginalized groups who lack resources to prevent and treat disease (Link and Phelan, 1995). For pregnant women, the consequences of structural racism may be transgenerational, increasing their own risk during pregnancy and the likelihood of their infant's morbidity and mortality.

Socioeconomic gradients in health, irrespective of race, have been well documented (Adler and Ostrove, 1999). Infant mortality risk decreases as income and educational levels increase *within* black and white women, (Goza et al., 2007) although the effects of socioeconomic

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measures on black women's risk are generally smaller and more variable than among white women (Goza et al., 2007; Messer et al., 2008). Previous research has not examined the health impact of relative measures on infant mortality, i.e., the unequal distribution of income, employment, education, and the denial of opportunities (incarceration) *between* black and white populations. These relative measures represent novel metrics of structural racism for exploration of its impact on black infant mortality.

The present study seeks to explore the extent to which state-level racial inequities in societal conditions – proxy for social policies that dictate distribution and redistribution of resources and opportunities – are associated with state-level racial inequities in infant mortality (Siddiqi et al., 2016). We focus on the state level as many social policies are legislated and implemented by the state governments with substantial variation across the country. We hypothesize that states with a high degree of structural racism (i.e. large racial inequalities in income, employment, education and judicial treatment) have larger racial inequities in infant mortality. First we examine how these factors impact infant mortality overall, and separately within white and black women. Second, we examine how inequities in these factors (black relative to white population measures) are associated with infant mortality and whether they differentially predict infant mortality separately within black and white populations. Following theories and earlier research on structural racism (Feagin and Bennefield, 2014; Lukachko et al., 2014; Schnittker et al., 2011; Subramanian et al., 2009; Uggan and Manza, 2002), we hypothesize that inequities in these factors will be associated with higher infant mortality rates among blacks but not whites. It may be that whites in fact experience a health benefit (lower infant mortality rates) associated with greater racial inequity that results from the privilege of greater individual and societal resources (money, knowledge, political and commercial power) (Phelan and Link, 2015). Our large dataset of national vital records provides geographic representation across all 50 states for a comprehensive examination of contextual variation.

2. Methods

2.1. Outcome

The National Center for Health Statistics (NCHS) provided annual linked birth/infant death files from 2010 to 2013, inclusive, including geographic identifiers for maternal state of residence for all 50 states and the District of Columbia. The linked birth/infant death data sets consists of a numerator file containing death records for all infant deaths occurring in a given calendar year linked to their corresponding birth certificates, whether the birth occurred in the same or previous year, for all instances where both the birth and the death occurred in the 50 states and the District of Columbia. The denominator file contains all birth certificates for infants born in the given calendar year, for the purposes of computing infant mortality ratios per 100,000 live births. In some states, incomplete linkage of all infant deaths to their corresponding birth record results in a small number of unlinked infant deaths. Therefore a weight is added to the linked numerator file to correct in part for biases in the percent of records linked by major characteristic. Accounting for weighted data, we computed the 4-year infant mortality rate (deaths per 1000 live births) for the total population (n=95,554 deaths), and separately for infants born to self-reported non-Hispanic (NH) black and NH white women in each state.

2.2. Exposures

Structural racism in each state was characterized as the degree of racial inequality across socioeconomic and judicial domains. State-level indicators included prison incarceration and juvenile custody rates; educational attainment (proportion of the population age 25 and older with a Bachelor's degree or higher); unemployment (proportion of the

civilian labor force not currently employed); professional occupation status (proportion of the civilian employed population in management, business, science, and arts occupations); and median household income (2013 inflation-adjusted dollars). Structural racism was operationalized as the ratio of black to white population values for each indicator.

Data on the indicators came from several sources and were linked to vital records by state Federal Information Processing Standard code. The Sentencing Project (Sentencing Project, 2016) provided 2013 estimates of prison incarceration and juvenile custody rates by race and state, based on data reported by the US Bureau of Justice Statistics and the US Office of Juvenile Justice and Delinquency Prevention. Data on the remaining indicators came from the US Census Bureau's American Community Survey 3-year estimates 2011–2013 for each state, within the total population and separately among black and white populations. All indicators were scaled to their interquartile range (IQR). IQR scaling enables interpretation of the resulting regression coefficients as a comparison of infant mortality rates in state with typically high values of the indicator variable to rates in states with typically low values.

2.3. Statistical analysis

Descriptive statistics characterized infant mortality rates and all contextual indicators across jurisdictions for the total population and separately among NH black and NH white populations, where sample size permitted (the ACS suppresses population counts where there are no or too few observations to compute a reliable estimate). Poisson regression with robust standard errors first estimated associations for an IQR increase in the absolute level of each indicator (i.e. incarceration rate, unemployment rate, educational attainment, etc.) and infant mortality rates for the total state population. In order to control for differences in states' racial compositions and economic conditions, rate ratios (RR) and 95% confidence intervals (CI) associated with an IQR increase were adjusted for the proportion of births that were among black women and the state poverty level (American Community Survey 2011–2013 3-year estimate of the percent of state population living below the Federal Poverty Level). Second, we estimated the same associations among black and white populations separately, adjusting only for the state poverty level. Third, we estimated RRs and 95% CI associated with an IQR increase in relative levels of each indicator (i.e. the ratio of black to white incarceration rates, unemployment rates, etc.) for the total population infant mortality rate adjusting for the state poverty level and proportion of births to black women, and again separately among black and white women adjusting for the state poverty level only. In order to isolate the effect of *racial inequity* in socioeconomic and criminal justice conditions independent of the state's overall level of socioeconomic and criminal justice conditions, we additionally adjusted the relative measures for the absolute level within the state. For example, RR associated with racial inequity in unemployment was adjusted for the state's overall unemployment rate.

3. Results

From 2010–2013, overall infant mortality averaged approximately 6 deaths per 1000 live births across all 50 states and DC ranging from a low of 4.26 in Massachusetts to a high of 9.37 in Mississippi (Table 1). Nationally, black infant mortality averaged 7.57 per 1000 live births and exceeded the estimate among whites in every state.

The rate of imprisonment among black residents was on average 6.2 times higher than the white imprisonment rate, and the custody rate among black juveniles was more than 7 times the white juvenile custody rate. Unemployment rates were double, and median household incomes only two-thirds on average among black residents compared to whites. The proportion of black residents with a Bachelor's degree or higher and the proportion employed in professional or managerial

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