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Exploring the Health Consequences of Majority-Minority Neighborhoods: Minority Diversity and Birthweight among Native-born and Foreign-born Blacks

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Abstract

We examined the association between neighborhood minority diversity and infant birthweight among non-Hispanic US-born black women and foreign-born black women from Sub-Saharan Africa and the non-Spanish speaking Caribbean using 2002–2006 vital statistics birth record data from the state of New Jersey (n=73,907). We used a standardized entropy score to measure the degree of minority diversity (i.e., non-white multiethnic racial heterogeneity) for each census tract where women lived. We distinguished between four levels of minority diversity, with the highest level representing majority-minority neighborhoods. We estimated mean birthweight for singleton births over this 5-year period using linear regression with robust standard errors to correct for clustering of mothers within census tracts. We found significant differences in mean birthweight by mother's country of origin such that infants of US-born black mothers weighed significantly less than the infants of African and Caribbean immigrants (3130 g vs. 3299 g and 3212 g; $p<0.001$). Adjustments for neighborhood deprivation, residential instability, individual-level sociodemographics, maternal health behaviors and conditions, and gestational age did not reduce these origin differences. Minority diversity had a protective effect on black infant health. Women living in low and moderately diverse tracts as well as those in majority-minority neighborhoods had heavier babies (β=26.5, 29.8 and 61.2, respectively, $p<0.001$) on average than women in the least diverse tracts. The results for majority-minority neighborhoods were robust when we controlled for neighborhood- and individual-level covariates.

Keywords

USA; black immigrants; diversity; birthweight; neighborhoods; foreign-born health advantage; health disparities

Introduction

Racial and ethnic differences in birthweight are substantial in the United States (US), with blacks having the least favorable outcomes (Sastry & Hussey, 2003). Racial residential

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segregation and the proportion of blacks in a neighborhood have been associated with poor birth outcomes among non-Hispanic black women (Baker & Hellerstedt, 2006; Grady, 2006; Grady & McLafferty, 2007; Mason et al., 2009; 2010). This literature provides insights into whether and how the geographic separation of racial and ethnic groups and the spatial concentration of blacks in disadvantaged neighborhoods matter for black infant health. Neighborhood racial and ethnic heterogeneity in contrast has received less attention in the literature. Increasingly, however, multiethnic neighborhoods are becoming more prevalent in urban America even amidst continued racial residential segregation, owing at least in part to immigration and a shrinking non-Hispanic white population (Logan & Zhang, 2010; Gould, 2000; Fastenfest, Booza, & Metzger, 2004). Typically these multiethnic neighborhoods are areas where there are few non-Hispanic whites and racial minorities comprise the majority of the residents, hence the term, 'majority-minority.' Yet, we know very little about how this particular form of neighborhood racial heterogeneity is associated with infant health, particularly for blacks. Our study of neighborhood minority diversity and birth outcomes fills this gap.

Much of the literature on neighborhood racial segregation or composition and birth outcomes has focused on non-Hispanic, US-born blacks (i.e., African Americans) (e.g., Bell et al., 2006) or it has not differentiated black women by place of birth (e.g., Masi et al., 2007; Mason et al., 2009; 2011; Reichman, Teitler, & Hamilton, 2009). Even fewer studies have examined the associations between neighborhood conditions and birth outcomes among foreign-born non-Hispanic blacks (hereafter black immigrants). Yet, black immigrants have become an important and growing segment of the US black population. The proportion of black immigrants among all US black residents has increased from less than 1% in 1960 to roughly 8% in 2005 (Kent, 2007). This population growth has important implications for perinatal health given that 13% of black births nationwide in 2004 were to foreign-born black women (Kent, *ibid*.). In some states with large black immigrant populations such as Minnesota and New Jersey, the percentage of births to black immigrant women is even higher (17% in 2000 and 23% in 2003, respectively) (McMurry, 2003; NJ Center for Health Statistics, 2003).

In this paper, we use 2002–2006 vital statistics birth record data from the state of New Jersey to examine the association between neighborhood minority diversity and birthweight among non-Hispanic US-born blacks and black immigrants from Sub-Saharan Africa and the non-Spanish speaking Caribbean. We explicitly focus on non-Hispanic blacks because they experience the greatest spatial separation from non-Hispanic whites in the US (Massey & Denton, 1993). Our focus on birthweight stems from its importance as an indicator of perinatal health, having both short- and long-term consequences for society (Conley & Bennett, 2000). For instance, the risk of death or disability is greater among infants born too small (Institute of Medicine, 2007). And although infants of black women weigh less on average than infants of women of all other races (Martin et al., 2011), birthweight is known to vary among black women by mother's country of birth. Black immigrants typically have heavier infants (Cabral et al., 1990; David & Collins, 1997) and lower risks of underweight babies (Howard et al., 2006) compared to US-born blacks. Some of this nativity differential is attributable to differences in maternal characteristics. However, individual-level attributes alone are insufficient to explain the variation (Singh & Yu, 1996). We extend research on this foreign-born health advantage by examining how features of black immigrants' neighborhoods influence birthweight among foreign-born black women in comparison to US-born black women.

Background

The Healthy Migrant Effect and Neighborhoods

Infants born to immigrants typically have higher mean birthweights (Forna et al., 2003) and lower risks of low birthweight (Acevedo-Garcia, Soobader, & Berkman, 2007) and preterm delivery (Cervantes, Keith, & Wyshak, 1999) compared to babies born to US-born mothers. Similarly foreign-born black women also have more favorable birth outcomes, lower infant mortality (Hummer et al., 1999; Rosenberg, Desai, & Kan, 2002), better health behaviors, and fewer medical risk factors than US-born black women (David & Collins, 1997; Fuentes-Afflick, Hessol, & Perez-Stable, 1998; Howard et al., 2006).

Three theoretical frameworks have been proposed to explain this healthy migrant effect. First, because migration favors the movement of healthy individuals, health selection may account for immigrants' health advantage (Redstone-Akresh & Frank, 2008). Research comparing migrants' health to their non-migrant counterparts indicate that positive selection accounts for at least some of the observed foreign-born health advantages among US adult immigrants (Mehta & Elo, 2012). Second, immigrants may be healthier because of health-promoting cultural practices and norms. Immigrants, particularly those from non-Western, developing countries may adhere to lifestyles that are more health promoting, e.g., diets free of processed foods high in fat and sugar and lower rates of smoking and alcohol consumption (Salant & Lauderdale, 2003). Cultural norms emphasizing family and community cohesion may also produce health benefits via social support (Landale et al., 1999). Third, immigrants' health advantage may stem from the neighborhoods where they live. Migrants tend to reside in homogenous immigrant or ethnic enclaves where there may be dense co-ethnic social networks, protection from discrimination, and availability of healthy ethnic foods (Osypuk et al., 2009). These enclave environments may help reduce stress and provide social support (Eschbach et al. 2004; Osypuk, Bates, & Acevedo-Garcia, 2010).

The enclave hypothesis points to the importance of neighborhood context as a social determinant of immigrant health. However, immigrants vary significantly in terms of the quality and racial makeup of their neighborhoods which can affect the availability of social and institutional resources in the residential environment. Asian and Hispanic immigrants typically live in more advantageous residential environments and have more residential options than black immigrants (Alba & Logan, 1993; Freeman, 2002). In fact, black immigrants seem to be uniquely disadvantaged when it comes to achieving parity in neighborhood quality and spatial mobility with Asian and Hispanic immigrants (Iceland, 2009). Why are black immigrants uniquely disadvantaged when it comes to their neighborhoods? And how might the residential environments of black immigrants influence their birth outcomes?

The Residential Environments of Black Immigrants & Black Birth Outcomes

Black immigrants from the non-Spanish Caribbean and Sub-Saharan Africa face similar residential integration obstacles in the United States as US-born blacks owing to their ascribed racial group membership. Despite efforts by black immigrants to distance themselves socially and spatially from African Americans, race remains a powerful master status limiting their residential options (Waters, 1999). Consequently they often reside in segregated, urban neighborhoods alongside African Americans. For example, in 1990 black immigrants in the New York and Miami metropolitan areas lived in neighborhoods where roughly 40% and 30% of the residents, respectively, were African American (Freeman, 2002). Segregation from non-Hispanic whites across major metropolitan areas is equally high for US-born blacks and black immigrants from the non-Spanish Caribbean and Sub-Saharan Africa (Logan, 2007).

Although spatial separation from whites is similar for US-born and foreign-born blacks, it does not mean that the residential environments of these two black populations are equal in other respects. Research on black immigrants from the West Indies in New York, for example, revealed that segregation from whites did not automatically translate into spatial overlap in the same neighborhoods with US-born blacks. These black immigrants lived in neighborhoods adjacent to neighborhoods occupied by US-born blacks but the immigrant areas were often less socioeconomically depressed than the US-born black areas (Crowder, 1999). Recent studies show similar modest spatial separations between black immigrants from Sub-Saharan Africa and US-born blacks (Logan & Deanne, 2003; Logan, 2007). In Boston, one of the destination cities for black immigrants from Sub-Saharan Africa, African immigrant neighborhoods were also more multiethnic and affluent compared to the neighborhoods occupied by US-born blacks (Vang, 2012). These studies suggest that black immigrants' residential environments may be less advantageous than those of Asian and Hispanic immigrants but are more favorable relative to US-born blacks. Do these moderate differences in neighborhood context between US-born and foreign-born blacks confer health benefits for black immigrants?

Research has only begun to scratch the surface when it comes to examining whether neighborhood context is associated with black immigrants' birth outcomes. The few pioneering studies that have assessed this relationship have mainly focused on residential segregation or ethnic density (Grady, 2006; Grady & McLafferty; Mason et al., 2009; 2010). Our study is the first to explore the association between neighborhood racial diversity and black immigrant perinatal health.

Why Diversity May Be Good or Bad for Infant Health

Neighborhood racial and ethnic diversity has been historically viewed as having a negative effect on residents. Shaw and McKay (1942) argued that ethnic heterogeneity was one of the main causes of crime. Ethnic heterogeneity contributed to the social disorganization of neighborhoods and in doing so weakened primary social control needed to keep crime in check. Ethnic *homogeneity*, in contrast, was hypothesized to strengthen social bonds among residents and therefore reinforce social control over in-group members. A similar line of reasoning can be found in contemporary theorizing about the impact of diversity on social capital. According to Putnam (2007), diversity can actually be harmful in the short run because it reduces social capital (i.e., social relations) both within and between ethnic groups. Putnam's research uncovered a disturbing trend in which residents of diverse neighborhoods were hunkering down and disengaging from community involvement. Trust, friendships, altruism, and community cooperation were all lower among residents who lived in racially and ethnically diverse neighborhoods.

Although Shaw and McKay and Putnam did not examine the association between ethnic diversity and health outcomes their theorizing points to the possibility that ethnic diversity might exhibit a negative association with perinatal health. If diversity is correlated with higher crime then it may be an indirect determinant of poor birth outcomes. Crime can affect reproductive health through physiologic pathways resulting from stressful exposures (Culhane & Elo, 2005). The association between crime and adverse birth outcomes has been documented by prior studies (Morenoff, 2003; Masi et al., 2007). Likewise, if diversity affects social capital then it, too, would have an indirect link with health through psychosocial pathways. Previous research has demonstrated positive associations between both higher individual- and community-level social support and favorable birth outcomes (Buka et al., 2003). Thus, if social capital is diminished in diverse neighborhoods then reproductive health may be compromised. The literature on immigrant enclaves and migrant health would also predict that diversity has a negative association with birth outcomes. Racial and ethnic diversity may undermine the social cohesion and culture of immigrant enclaves.

There are also reasons why diversity may produce health benefits to residents. According to Florida (2005), diverse areas tend to attract the creative class (professionals, highly skilled technicians, and bohemians), an important instigator of economic growth. Once the creative class has moved into a neighborhood and established itself, businesses and social services catering to its members will spring up and in turn generate further economic activity and elevate overall neighborhood socioeconomic status. In this way, diversity may be positively associated with improved birth outcomes through community-level socioeconomic pathways. Of course this is contingent on the creative class not displacing minority residents.

We found only one study that claimed to examine mixed neighborhoods and birth outcomes (Pickett et al., 2005). However, the authors defined mixed neighborhoods simply as the number of Chicago census tracts with less than 90% black residents. They assumed that these tracts were more heterogeneous than the predominantly black tracts. Yet, they never actually measured the degree of racial and ethnic heterogeneity in the mixed tracts. Their results showed mixed census tracts to be wealthier on average than the predominantly black tracts. But, black women living in these wealthy, mixed neighborhoods did not receive health benefits in the form of reduced risk of preterm birth or low birthweight. The authors argued that African Americans in mixed race neighborhoods may be exposed to more racism and racial stigma and therefore, the potential benefits of living in a wealthier neighborhood are offset by stressors associated with racial discrimination. However, given that the researchers did not measure neighborhood racial and ethnic diversity per se, it is difficult to draw any definitive conclusions about the association between racial and ethnic diversity and birth outcomes based on their study.

Methods

Study Area

In 2006, approximately 20% of New Jersey (NJ) residents were foreign-born, making NJ a leading immigrant magnet state (Montalto, 2009). Racial and ethnic disparities in adult health have been studied in NJ (e.g., Acevedo-Garcia, 2001), but to date no study has extensively examined birth outcomes among the state’s black immigrants. Our study thus expands previous research on black immigrant birth outcomes, which has mostly focused on New York (Grady & McLafferty, 2007; Howard et al., 2006; Mason, 2009; Rosenberg, Desai, & Kan, 2000) or mid-western states (e.g., David & Collins, 1997; Flynn, Foster, & Brost, 2011).

Data

This analysis is based on 2002–2006 geocoded vital statistics birth record data, which we received from the State of NJ Department of Health and Senior Services (DHSS). Ethical approval was obtained from the University of Pennsylvania and the NJ DHSS. There were 85,689 births to black women during this 5-year period. We excluded multiple births (n=3,483) and cases where women lived outside NJ but gave birth in the state (n=1,043). An additional 976 observations were dropped because of missing information on the mother’s country of birth. We grouped mother’s birthplace into distinct origin regions based on 2011 United Nations standard geographic classifications. Belize, Guyana, and Suriname were categorized as part of the non-Spanish Caribbean region because these nations are culturally a part of the Caribbean despite their geographic location in Central and South America. Sudan was included in the Sub-Saharan African region. We deleted cases where the mother was born in a country outside of the US, Sub-Saharan Africa and the non-Spanish Caribbean. We thus excluded births to women born in US territories, including Puerto Rico (n=218), North Africa (n=70), the Spanish Caribbean (n=370), and the rest of the world (n=1,595). These exclusions make our black immigrant sample similar to populations examined in previous studies of black immigrant residential attainment (Logan & Deane, 2003; Logan, 2007; Vang, 2012).

We linked the remaining birth records to census tract level demographic and socioeconomic information from the 2000 US census (SF3). We matched over 99% of the records and excluded the remaining unmatched records (n=759). We also dropped births that had an implausible combination of birthweight and gestational age based on sex-parity specific gestational age and birthweight distributions (20–44 weeks) (n=1350, <2%) (Elo et al., 2009). In addition, we deleted records with missing values on our explanatory variables (n=2,111, <3%). Our analytical sample consists of 73,907 singleton births of US-born black women, black women born in Sub-Saharan Africa (hereafter Africa), and black women born in the non-Spanish Caribbean (hereafter Caribbean).

Dependent and Independent Variables

Our dependent variable is birthweight in its continuous form following a number of previous studies (Buka et al., 2002; Cabral et al., 1990; David & Collins, 1997; Morenoff, 2003). We chose this strategy because birthweight is conceptually related to intrauterine growth retardation when adjusted for gestational age (Salihu, Fitzpatrick, & Aliyu, 2005). It also retains power to estimate the associations between our explanatory variables and birthweight more precisely than had we used a dichotomous measure of low birthweight or a small for gestational age birth (Sastry & Hussey, 2003).

We control for sociodemographic characteristics that have been identified as important predictors of adverse birth outcomes in prior studies (Culhane & Elo, 2005). Maternal characteristics include age (0=under 30, 1=30 years or older), educational attainment (0=high school and less, 1= at least some college) and marital status (0=unmarried, 1=married). Alternative specifications of these variables did not change our substantive conclusions. Infant characteristics consist of gender (0=male, 1=female) and birth order (1^{st} (reference), 2^{nd} and 3^{rd}, and 4^{th} or higher). Maternal health behaviors include prenatal care (PC) use (no PC or information missing, began in the 1^{st} trimester, began after 1^{st} trimester (reference)), weight gain (0–14 lbs, 15–24 lbs, 25–35 lbs, and 36+ lbs (reference)), and whether the mother smoked during pregnancy (0=no, 1=yes) or consumed alcoholic beverages (0=no, 1=yes at least one drink per week). We also control for the following maternal health conditions available on the birth certificate: hypertension (0=no, 1=yes), other medical risks (e.g., anemia, cardiac disease, diabetes, genital herpes, eclampsia, etc.) (none (reference), one or more, and missing), and whether the mother had any labor complications (0=no, 1=yes). In our final model we also control for gestational age; this model specification is closer to measuring intrauterine growth retardation and allows us to examine to what extent our primary explanatory variables are mediated by gestational age.

Neighborhood-level Variables

Consistent with prior research (e.g., Grady, 2006; Morenoff, 2003; Pickett et al., 2005), neighborhoods are defined by census tracts. We use a standardized version of the entropy *score* to assess the degree of minority diversity (i.e., mix of non-white racial minorities) across NJ neighborhoods. The entropy score differs from the entropy *index* (also known as Theil's Information index, *H*) (White, 1986), which is a summary measure of segregation

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for an entire study region and is considered a measure of global diversity. Scores on the H index range between 0 and 1, with 1 representing maximum global diversity. In contrast, the entropy score summarizes the racial and ethnic composition of subunits within a study area and is therefore a measure of local diversity. Unlike H, the entropy score does not capture the degree of segregation among racial groups (e.g., the uneven distribution of minorities and whites). However, it is an excellent gauge of spatial variation in neighborhood racial and ethnic heterogeneity (Wong, 2002). Values for the entropy score range between 0 and 1, with higher scores reflecting greater local diversity.

Following Wong (2002), we standardize local diversity by the global diversity for NJ using the following formulas:

$$\hat{E}_j = \frac{-\sum_{m=1}^{M} \frac{\left[\left(\frac{t_{jm}}{\sum_{m=1}^{M} t_{jm}}\right) ln\left(\frac{t_{jm}}{\sum_{m=1}^{M} t_{jm}}\right)\right]}{ln(M)}}{H} \quad \text{(Eq.1)}$$

$$H = \left(\frac{1}{T\sum_{m=1}^{M} \pi_m ln(1/\pi_m)}\right) \sum_{m=1}^{M}\sum_{j=1}^{J} t_j \pi_{jm} ln[\pi_{jm}/\pi_m] \quad \text{(Eq.2)}$$

where M = number of groups, t_j = total population in census tract j, t_{jm} = total population in group m in tract j, T = total population in the state, π_m= proportion in group m in the state, and π_{jm} = proportion in group m in census tract j. Given our interest in majority-minority neighborhoods, the minority groups, M, include non-Hispanic blacks, Asians and Pacific Islanders, Hispanics, Native Americans, and other or mixed race individuals. Global diversity for NJ is H=0.30.

Standardized minority diversity scores range between 0 and 2.9. Scores above 1 denote higher tract level presence of minorities relative to their statewide average. More than 90% of the 1,945 census tracts in NJ have scores greater than 1, indicating a higher presence of minorities in many census tracts than would be expected by the state level measure. We opt for a categorical specification of our diversity indicator because preliminary analysis revealed the association to be nonlinear between minority diversity and birthweight. The four categories are: lowest ($\hat{E}_j \leq 1.0$; 88 census tracts; 18.9% of sample); low, ($1.1 \leq \hat{E}_j \leq 1.9$; 416 census tracts; 36.1% of sample); moderate ($2.0 \leq \hat{E}_j \leq 2.4$; 945 census tracts; 35.3% of sample); and high ($\hat{E}_j \geq 2.5$; 496 census tracts; 9.7% of sample). We consider tracts in the high category as majority-minority neighborhoods because local diversity is at least two and a half times higher than the global diversity score for NJ. In these tracts the residents are predominantly non-whites. Lowest diversity tracts serve as the reference category. These tracts have a high presence of non-Hispanic whites, about 62% on average.

A map of standardized minority diversity scores across NJ census tracts is shown in Figure 1. There are distinct clusters of majority-minority neighborhoods in the northern and central-western parts of the state where NJ borders New York City and Philadelphia, respectively. However, tracts with moderate mixtures of racial minorities are distributed throughout the state as well. The substantial spatial variation in minority diversity underscores the need for analysis at a local (i.e., neighborhood) scale as opposed to a larger geographic scale such as metro area.

We also include two other neighborhood characteristics that may mediate the association between minority diversity and birthweight: residential instability and neighborhood deprivation. A key feature of socially disorganized neighborhoods associated with ethnic heterogeneity and crime is residential instability (Shaw & McKay, 1942). If diverse neighborhoods are places with high population turnover as theorized by Shaw and McKay then residential instability might be a potential mechanism linking minority diversity (and indirectly, crime) to infant health. Residential instability is operationalized as the proportion of residents who reported a move since 1995.

Neighborhood deprivation is conceptualized as a mediating variable between minority diversity and birthweight because it can erode community-level social support and social capital. Neighborhoods that are high in poverty and social exclusion weaken community social support (Cattell, 2001). If ethnic heterogeneity diminishes social capital as Putnam (2007) hypothesized then the loss of health-promoting social relations would be compounded in diverse but impoverished neighborhoods where social support is already low. Our neighborhood deprivation index is based on Messer et al. (2006). Seven items were identified through principal component analysis as belonging to one unique factor for NJ: (1) % households with more than one person per room, (2) % households with incomes less than $30,000 per year, (3) % households in receipt of public assistance, (4) % of individuals whose 1999 income was below the federal poverty level, (5) % females without high school diploma/GED, (6) % female headed households with children under 18, and (7) % unemployed (civilian) men and women (Cronbach's $\alpha = 0.86$). Items were transformed into z-scores and combined to create a factor-based deprivation index. We use the index in its continuous form based on preliminary analysis that indicated its association to be linear with birthweight.

Analytical Strategy

Although our data are hierarchically structured, preliminary analysis revealed the intraclass correlation to be very low, with less than 1% of the total variation in birthweight occurring between census tracts. The low variation in birthweight at the tract level points to the possible importance of individual-level attributes in explaining country of origin differences in infant health for black women in NJ. Thus we model the associations between minority diversity and birthweight using linear regression and Hubert-White sandwich estimator to produce robust standard errors to account for the clustering of mothers within census tracts. In additional analyses not shown here we also estimated random intercept multilevel models but the results were essentially the same.

We estimate eight models. Model 1 assesses baseline country of origin differences in birthweight. Model 2 adds minority diversity. Models 3 and 4 further adjust for neighborhood deprivation and residential instability, respectively. Maternal and infant sociodemographic characteristics are added in Model 5 to account for country of origin differences in sociodemographic characteristics. Health behaviors and maternal health conditions are added in Models 6 and 7, respectively. Finally, we control for gestational age in Model 8. We also estimate whether mother's origin interacts with minority diversity. All models were estimated with STATA 11 (Stata Corporation, 2009).

Results

Descriptive statistics for birthweight and explanatory variables by mother's origin are shown in Table 1. Consistent with previous studies we find a foreign-born health advantage for African and Caribbean immigrants. The infants of US-born black mothers weigh significantly less than the infants of African and Caribbean immigrants (3130 g vs. 3299 g and 3212 g; $p<0.001$). Neighborhood risk environments also vary by origin. Mean minority diversity scores for all origin groups exceed 1, indicating higher racial mixture at the tract level than the state level. Nonetheless, greater proportions of African and Caribbean immigrants live in majority-minority neighborhoods compared to compared to US-born blacks (17.8% and 11.4% compared to 8.6%, $p<0.001$). In contrast, US-born blacks reside in more deprived neighborhoods (a mean deprivation score of 1.0) than African and Caribbean immigrants (mean score of 0.6). On the other hand, all three groups live in tracts with high levels of residential instability (56.9% among US-born blacks vs. 54.6% and 56.2% among African and Caribbean immigrants, respectively). These results confirm previous findings showing somewhat more advantageous residential environments for black immigrants compared to US-born blacks (Crowder, 1999; Vang, 2012).

US-born black women have more individual-level risk factors than their foreign-born counterparts. They are less educated (62.2% have a high school education or less), more likely to be unmarried (only about 25% are married), and they give birth at younger age (70.8% are under age 31) than the black immigrant women. They are also more likely to smoke, gain excess weight (36+ lbs), have hypertension and one or more other medical risk factors. Drinking while pregnant is rare among all black women, albeit higher among US-born blacks. The black immigrant women also differ by region of origin in maternal socio-demographic characteristics. For example, more African than Caribbean immigrants are older at birth (61.1% ≥ age 30 vs. 57.1%), married (67.8% vs. 57.1%) and college educated (58.7% vs. 48.8%). At the same time, there are relatively small differences between the African-born and Caribbean-born women in health behaviors and medical risk factors.

Table 2 shows the mean birthweight by mother's origin and neighborhood minority diversity. Two patterns are noteworthy. First, the foreign-born advantage in mean birthweight is evident at all levels of minority diversity. African-born women have the heaviest babies followed by the Caribbean-born women and the US-born black women. Second, mean birthweight increases across the various levels of minority diversity among US-born blacks such that the lowest mean birthweight is recorded among women who live in tracts with the least diversity and the highest birthweight is recorded in tracts with the most diversity. This same pattern is not evident among the immigrants. For example, the birthweights of infants born to Caribbean immigrants living in tracts with low and moderate levels of minority diversity are similar. Among African immigrants the highest mean birthweight is recorded in tracts with the most diversity, whereas the lowest mean birthweight is found in tracts with moderate diversity. These results point to possible interaction between minority diversity and mother's origin.

Results from our regression models are displayed in Table 3 where all origin groups are pooled together. As seen in Model 1, infants born to African and Caribbean immigrants weigh about 169 and 83 grams more on average than the infants of US-born blacks ($p<0.001$). The babies of African immigrants are significantly heavier than the babies of Caribbean immigrants (F-statistic=67.7, $p<0.001$). This finding is consistent with previous research showing a larger health advantage for black immigrants originating from Africa than from the Caribbean (Howard et al., 2006).

Model 2 assesses the effect of minority diversity on birthweight while adjusting for maternal birthplace. Women living in low and moderately diverse tracts and those in majority-minority neighborhoods have heavier babies (β=26.5, 29.8 and 61.2, respectively, $p<0.001$) on average than women in the least diverse tracts. The introduction of neighborhood deprivation in Model 3 attenuates the coefficients of minority diversity substantially. However, the association between minority diversity and birthweight remains significant for tracts with low diversity and those with majority-minority residents. This suggests that while neighborhood poverty does mediate some of the effects of neighborhood diversity it does not wash away all the salubrious effects of racial heterogeneity. There is still something different about living in a racially mixed neighborhood, even one that is impoverished, that is associated with health benefits among black women. At the same time, higher levels of neighborhood deprivation are associated with a significantly lower birthweight. For example, a one standard deviation increase in the neighborhood deprivation score is associated with about 26-gram reduction in birthweight. Model 4 further adjusts for residential instability, net of maternal birthplace, minority diversity, and neighborhood deprivation. Although residential instability is significantly associated with birthweight ($\beta= -0.6$, $p<0.05$), its inclusion has little impact on the coefficients for minority diversity. Thus, it appears that residential instability is not one of the pathways through which minority diversity influences birthweight.

Overall, the inclusion of neighborhood characteristics has relatively small impact on the coefficients for mother's origin. For example, the coefficient for African immigrants is reduced from 169 grams (Model 1) to 154 grams (Model 4). The respective coefficients for Caribbean immigrants are 83 grams (Model 1) versus 71 grams (Model 4). Thus despite some differences in the residential context of black women, these differences do relatively little to explain the country of origin differences in birthweight.

In contract, the inclusion of maternal and infant characteristics (Model 4 versus Model 7) helps explain an additional 21% (32 grams) of the birthweight advantage of African immigrants compared to the US-born blacks and 37% (26 grams) of the birthweight advantage of Caribbean immigrants versus US-born blacks. At the same time, they reduce the coefficient for neighborhood deprivation by 71% from -27 grams (Model 4) to -8 grams (Model 7) although the association remains statistically significant. Importantly, controlling for maternal and infant characteristics produces relatively small changes in the coefficients for minority diversity. Black women living in the least diverse tracts have the lightest infants and women living in majority-minority neighborhoods have the heaviest babies. Black women living in tracts with intermediate levels of diversity (low and moderate) also have heavier babies than black women living in the least diverse tracts, although the coefficient for moderate diversity is significant only at the 10% level.

In Model 8 we further adjust for gestational age while controlling for maternal birthplace, minority diversity, and all other neighborhood- and individual-level covariates. Including gestational age in the model explains close to 50% of the remaining birthweight advantage of African immigrants (Model 7 versus Model 8) and 34% of the birthweight advantage of Caribbean immigrants relative to US-born blacks. Thus, some of the immigrant advantage in birthweight appears to be related to country of origin differences in gestational age. Nevertheless, African and Caribbean immigrants still have significantly heavier babies than US-born black women and African immigrants also give birth to infants who are significantly heavier (35 grams; F-statistic= 22.0, $p<0.001$) than infants of Caribbean immigrants.

We also find that adjusting for gestational age reduces the associations between neighborhood deprivation and minority diversity and birthweight. Neighborhood deprivation is no longer a significant predictor of birthweight and only women living in majority-minority neighborhoods continue to have significantly heavier babies than women living in tracts with the least diversity. Thus gestational age also mediates the associations between these two neighborhood level characteristics and birthweight.

We also tested whether the association between birthweight and minority diversity varied significantly by mother's origin as suggested by the unadjusted results shown in Table 2. None of the interactions terms nor omnibus tests for joint significance of the interaction terms reached statistical significance at $p<0.05$ level.

Discussion

In this paper, we examined differences in birthweight among US-born, African-born and Caribbean-born black women living in New Jersey and whether neighborhood level minority diversity could help explain these differences. We further tested whether the association between minority diversity and birthweight interacted with the mother's place of birth. We documented significant differences in birthweight among the three origin groups such that infants of the foreign-born women were significantly heavier than the infants of the US-born women. Among the immigrant women, African immigrants had significantly heavier babies than Caribbean immigrants. We found that minority diversity had little impact on these subgroup differences. However, minority diversity showed an independent, positive association with birthweight and this association did not vary by the mother's birthplace. Our results contradict findings of some prior studies that have documented differences in the association between ethnic density (i.e., spatial concentration of a homogenous racial or ethnic group) and birth outcomes among black women by place of birth (Mason, 2010). Ethnic density and minority diversity tap into different dimensions of neighborhood context and is likely to be related to the difference in our findings.

Consistent with previous studies, we could not explain the higher birthweights of infants born to African and Caribbean immigrants than those of US-born black women by information available on the birth certificate or our neighborhood level explanatory variables. Furthermore, we could not account for the higher birthweights of infants of African immigrants compared to Caribbean immigrants. These differences are thus related to unobserved characteristics that are likely to be associated with migrant selectivity or other health-related factors. Although refugee and family class migrants are present in both the foreign-born African and Caribbean populations (Kent, 2007), more migrants in the former group have entered the US through the highly competitive H1-B1 diversity visas or as relatives of such visa recipients (Lobo, 2001). There are significant differences in educational attainment between black immigrants from Africa and those from the Caribbean, with the former being more educated (Dodoo, 1997). Maternal education can affect pregnant women's health, behaviors during pregnancy and medical information and resources available to mothers (Culhane & Elo, 2005). To the extent that education reduces maternal risk factors and enables pregnant women to marshal more resources, African immigrants will be more advantaged relative to Caribbean immigrants even if they live in socioeconomically deprived neighborhoods. Yet, educational differences alone cannot explain the health advantage of African immigrants because controls for maternal sociodemographic characteristics, including education, did not attenuate the country of origin differences in mean birthweight. However, a large percentage of the African immigrants were married and we do not have information on spousal characteristics, including SES, which may be at least a part of the explanation.

Differences in the length of time that African and Caribbean immigrants have been exposed to risky environments in the United States may also in part account for the origin differences in birthweight. According to the weathering hypothesis, long-term exposure to neighborhood disadvantage results in cumulative risks that compromise women's reproductive health (Geronimus, 1996). African immigrants are more recent arrivals (most have arrived since 1990) and therefore may have experienced less cumulative environmental risks. In contrast, immigration from the Caribbean to the US has a longer time span and thus Caribbean immigrant women may have been exposed to the US environment longer on average (Kent, 2007).

An important contribution of our study is the finding that infants born to black women who lived in majority-minority neighborhoods had heavier babies than infants of black women who lived in the least diverse neighborhoods. Women who lived in neighborhoods with low and moderate diversity also had heavier babies than women in the least diverse tracts. These differentials were attenuated with the introduction of controls for neighborhood deprivation and maternal and infant characteristics. The attenuation in this association was most pronounced when we controlled for gestational age. Unlike Pickett and colleagues' (2005) study, we did not find neighborhood diversity to undermine US-born blacks' infant health. Rather, living in predominantly non-white, multiethnic neighborhoods produces health benefits for both black immigrants and US-born blacks alike.

We tested two potential mediating variables that might explain the association between minority diversity and birthweight. Residential instability had no impact on this relationship. Neighborhood deprivation did significantly reduce the coefficients on minority diversity but tracts with some diversity and those where minorities made up the majority of the residents continued to confer health benefits for black women relative to the least diverse tracts. We hypothesized that in the presence of neighborhood poverty, low social capital in diverse neighborhoods may be further weakened. However, we were unable to measure community-level social capital. Hence it is not clear if social capital was indeed the pathway whereby neighborhood deprivation exerted its effect on minority diversity. Other neighborhood characteristics such as crime rates, density of social networks, concentration of the creative class, and economic growth would have been desirable to fully test the mechanisms outlined by social disorganization, social capital, and creative class theses. Thus while our findings show black women to receive health benefits from living in heterogeneous minority neighborhoods, the reasons for this association are not well understood.

This paper has some limitations. First, we are limited by the information available on the birth certificate and thus many potentially relevant factors, e.g., length of US residence, family income and other relevant spousal resources, conditions in the country of origin, et cetera, are unobserved (Elo, Mehta, & Huang, 2011; Viruell-Fuentes, 2007). Second, we were unable to account for the self-selection of women into their neighborhoods which may have underestimated origin differences in risky neighborhood environments. Third, we lacked information on the women's length of residence in the neighborhood where they gave birth. This information together with length of US residence provides important information on women's exposure to place-based disadvantages. The unavailability of temporal variables further point to the limitations of using cross-sectional data to examine dynamic social processes (e.g., cumulative disadvantage) that could only be assessed with longitudinal data. Fourth, our aspatial measure of minority diversity does not take into account the presence of racial minorities in neighboring census tracts. As such, we may have underestimated the true extent of the majority-minority neighborhoods in NJ. Fifth, we have adjusted standard errors for clustering of women within census tracts, but not for clustering by place of birth or possible multiple births per woman, which can result in underestimated standard errors. Finally, our focus on NJ limits the extent to which these findings can be generalized to other immigrant-receiving states. Future research should examine the association between minority diversity and birth outcomes for black immigrants in other states as well as among other immigrant groups such as Asians and Hispanics. Despite these limitations, our research is the only study to date that has investigated the role of neighborhood racial and ethnic heterogeneity and birthweight among black immigrants in an understudied immigrant-receiving state.

Our results reveal that majority-minority neighborhoods are associated with health benefits. It remains to be seen whether or not racially and ethnically heterogeneous neighborhoods will become permanent features of the American urban landscape. Some scholars express skepticism about the stability of racially diverse neighborhoods (Gould, 2000). However, given existing demographic patterns—high immigration from Asia and Latin America and increasing immigration from Africa coupled with low fertility among whites—and continued white flight from urban centers (Logan & Zhang, 2010), it not implausible that stable majority-minority neighborhoods will become the norm in American cities. Such future urban landscapes require further scholarly attention in order to provide a better understanding of how these neighborhoods impact their residents.

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Research Highlights

- We examined associations between minority diversity and birthweight among US-born and foreign-born blacks in New Jersey
- Black immigrants had heavier babies than US-born black women, net of individual and neighborhood risk factors
- Neighborhoods high in minority diversity increased birthweight for black women
- The association between minority diversity and birthweight did not vary by mother’s country of birth

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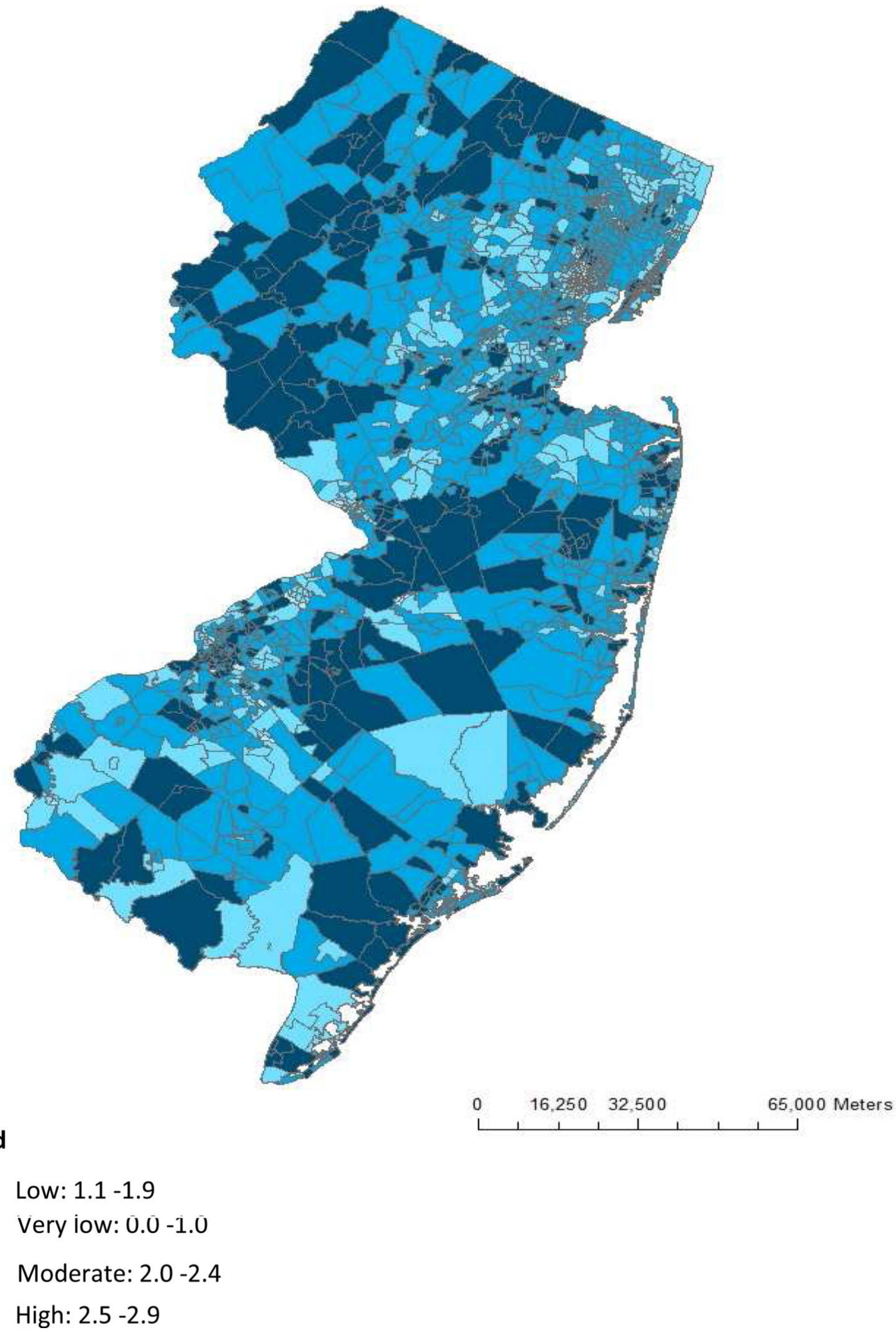

Figure 1.

Standardized Minority Diversity across New Jersey Census Tracts
Source: 2000 US Census, Summary File 3.

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Table 1

Distribution of Neighborhood, Maternal and Infant Characteristics by Mother's Birthplace, New Jersey 2002–2006

	US (N = 58,748)	Africa (N = 6,100)	Caribbean (N = 9,059)	p-value[a]
Birth weight in grams, mean	3129.7 (613.0)	3298.7 (585.4)	3212.3 (603.3)	0.000
Neighborhood characteristics:				
Minority diversity, mean (std dev)	1.7 (0.6)	1.8 (0.6)	1.7 (0.6)	0.000
Very low (reference)	19.7	14.3	16.7	0.000
Low	36.3	31.3	38.4	
Moderate	35.4	36.5	33.5	
High	8.6	17.8	11.4	
Neighborhood deprivation, mean (std dev)	1.0 (1.2)	0.6 (1.0)	0.6 (0.9)	0.000
Residential instability, mean (std dev)	56.9 (9.2)	54.6 (10.7)	56.2 (8.9)	0.000
Maternal & Infant Sociodemographic Characteristics				
Age, %				
Under 30 (reference)	70.8	38.9	46.5	0.000
30+ years	29.2	61.1	53.5	
Education, %				
HS or less (reference)	62.2	41.3	51.2	0.000
Some college or more	37.8	58.7	48.8	
Married, %	25.8	67.8	57.1	0.000
Female infant, %	48.8	49.5	49.0	0.596
Birth order, %				
1st birth (reference)	39.3	34.6	38.1	0.000
2nd to 3rd birth	46.7	52.0	51.5	
4th birth and higher	14.0	13.5	10.4	

	US-born (N = 58,748)	Africa (N = 6,100)	Caribbean (N = 9,059)	p-value[a]
Maternal Health Behaviors				
Weight gain, %				
0–14 lbs	19.4	16.2	17.0	0.000
15–24 lbs	24.3	27.1	26.4	
25–35 lbs	29.6	34.5	32.6	
36 lbs+ (reference)	26.7	22.3	24.0	
Prenatal care, %				
No care/missing	3.7	2.0	1.7	0.000
Began 1st trimester	6.1	6.3	7.7	
Began after 1st trimester (reference)	90.2	91.7	90.6	
Smoked cigarettes while pregnant, %	13.9	0.5	1.4	0.000
Drank alcohol while pregnant, %	1.9	0.5	0.6	0.000
Maternal Health Conditions				

	US-born (N = 58,748)	**Africa (N = 6,100)**	**Caribbean (N = 9,059)**	**p-value[a]**
Hypertension, %	6.5	5.4	5.7	0.001
Other medical risks, %				
No other medical risk (reference)	48.0	52.5	53.2	0.000
1 or more	48.3	44.4	43.9	
Information missing	3.7	3.1	2.9	
Labor complications, %	52.4	56.1	52.5	0.000
Gestational age, mean (std dev)	38.3 (2.6)	38.6 (2.2)	38.4 (2.4)	0.000

Note. Source: New Jersey linked infant birth-death data.

[a]One-way ANOVA used to test differences in group means; χ^2 used to test differences in group proportions.

Note. Source: New Jersey linked infant birth-death data.

[a]One-way ANOVA used to test differences in group means; χ^2 used to test differences in group proportions.

Table 2

Birthweight Differences by Mother's Birthplace across Varying Levels of Minority Diversity, New Jersey 2002–2006

	US (N = 58,748)	Africa (N = 6,100)	Caribbean (N = 9,059)	p-value[a]
Minority diversity				
Very low	3101.5 (621.4)	3285.1 (620.8)	3196.6 (594.3)	0.000
Low	3129.1 (612.6)	3311.6 (580.4)	3213.1 (599.4)	0.000
Moderate	3136.7 (607.9)	3276.6 (588.1)	3213.0 (602.1)	0.000
High	3168.2 (613.9)	3332.5 (557.3)	3230.3 (633.2)	0.000

Note. Standard deviations in parentheses. Source: New Jersey linked infant birth-death data.

[a]One-way ANOVA used to test differences in group means.

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Table 3

Results from Linear Regressions Predicting Birthweight, New Jersey 2002–2006 (N = 73,907)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Maternal Birthplace (reference: US)								
Africa	169.0*** (8.7)	164.4*** (8.7)	155.6*** (8.7)	153.9*** (8.8)	137.9*** (9.0)	127.7*** (8.7)	122.1*** (8.7)	63.7*** (6.3)
Caribbean	82.5*** (7.4)	80.9*** (7.4)	71.4*** (7.5)	70.6*** (7.5)	63.1*** (7.8)	51.7*** (7.7)	44.4*** (7.6)	29.1*** (5.1)
Minority Diversity (reference: lowest)								
Low		26.5*** 7.4)	18.7** (7.0)	16.5* (7.1)	14.6* (6.9)	20.9** (7.2)	18.9** (7.3)	−2.6 (3.9)
Moderate		29.8*** (7.1)	9.6 (7.1)	5.8 (7.2)	4.2 7.0)	16.4* (7.4)	12.2+ (7.5)	−4.6 (4.1)
High		61.2*** (9.4)	24.4** (9.8)	21.1* (9.9)	20.3* (9.6)	27.9** (9.9)	21.8* (9.9)	13.8* (5.7)
Neighborhood Deprivation			−25.5*** (2.3)	−26.7*** (2.4)	−18.0*** (2.4)	−8.0** (2.6)	−7.8** (2.6)	−2.3+ (1.4)
Residential Stability				−0.6* (0.3)	−0.5* (0.3)	−0.2 (0.3)	−0.1 (0.3)	−0.1 (0.2)
<u>Maternal & Infant Sociodemographics</u>								
30 years or older					−70.0*** (5.9)	−50.2*** (5.7)	−32.6*** (5.6)	18.1*** (3.7)
Some college or higher					59.7*** (5.2)	36.9*** (5.1)	36.3*** (5.0)	34.4*** (3.2)
Married					64.8*** (5.8)	47.7*** (5.7)	45.8*** (5.7)	31.8*** (4.0)
Female					−117.5*** (4.6)	−112.9*** (4.4)	−113.2*** (4.4)	−116.4*** (3.0)
Birth order (reference: 1st born)								
2nd–3rd born					73.9*** (5.0)	105.6*** (5.0)	92.7*** (5.0)	107.7*** (3.3)
4th born or higher					57.9*** (8.4)	130.9*** (8.0)	121.2*** (8.1)	136.3*** (5.2)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<u>Maternal Health Behaviors</u>								
Pregnancy weight gain (reference: 36+ lbs)								
0–14 lbs						−341.4*** (7.8)	−338.6*** (7.7)	−154.9*** (4.5)
15–24 lbs						−237.9*** (6.3)	−240.5*** (6.3)	−134.8*** (4.2)
25–35 lbs						−137.6*** (5.4)	−141.3*** (5.3)	−98.7*** (4.0)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Prenatal care (reference: after 1st trimester)								
None/missing						−253.4*** (15.3)	−247.0*** (15.1)	−5.3 (8.5)
1st trimester						−46.8*** (9.9)	−50.2*** (9.9)	16.1** (6.3)
Smoked while pregnant						−118.5*** (7.5)	−112.8*** (7.5)	−90.1*** (4.9)
Drank alcohol while pregnant						−126.8*** (18.8)	−119.5*** (18.9)	−66.8*** (12.3)
Maternal Health Conditions								
Hypertension							−209.8*** (13.7)	−41.6*** (7.3)
Other medical risks (reference: none)								
One or more							−66.6*** (4.5)	−1.2 (3.1)
Missing							−99.7*** (18.0)	−34.1*** (9.7)
Labor complications							−47.6*** (4.6)	−2.4 (3.0)
Gestational age								175.5*** (0.5)
Constant	3129.7*** (3.2)	3104.3*** (5.7)	3144.0*** (6.6)	3180.7*** (17.7)	3166.5*** (18.1)	3304.8*** (19.2)	3380.4*** (19.9)	−3502.2*** (22.9)
F-statistic	213.6	94.1	99.7	84.6	149.7	236.3	245.3	6111.1
Degrees of freedom	2	5	6	7	13	20	24	25
R^2	0.01	0.01	0.01	0.01	0.03	0.08	0.09	0.59

Note. Robust standard errors (in parenthesis) computed to account for clustering within census tracts. Source: New Jersey linked infant birth-death data.

+ p<0.10,

* p<0.05,

** p<0.01,

*** p<0.001.

Note. Robust standard errors (in parenthesis) computed to account for clustering within census tracts. Source: New Jersey linked infant birth-death data.

+ p<0.10,

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