Published in final edited form as:
Health Place. 2009 September ; 15(3): 784–791. doi:10.1016/j.healthplace.2009.01.001.

Effects of Neighborhood Racial Composition on Birthweight

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Abstract

We employed multilevel models to estimate the effects of neighborhood racial composition on birthweight, using a national urban sample of 1,871 births to unmarried black mothers from the Fragile Families and Child Wellbeing birth cohort study. The mothers lived in 1,181 census tracts with substantial variability in racial composition and poverty. Controlling for individual characteristics, census tract poverty, and city characteristics, the proportion black in the mother's census tract had no linear association with infant birthweight. There was an observed non-linear association, but the pattern was inconsistent with prevailing theories of how neighborhoods affect health. The results were robust to alternative measures, covariates, and sample restrictions and when accounting for the length of time the mother resided in her neighborhood.

Keywords

birthweight; neighborhood effects; racial composition

Racial, ethnic, and economic characteristics of neighborhoods have long been viewed by sociologists as factors that can shape individual behaviors and social outcomes (e.g., Burgess, 1916; Park et al., 1925; Wirth, 1928; Zorbaugh, 1929). Interest in how neighborhood contexts affect health is much more recent (Diez-Roux, 2001; Entwisle, 2007). In this study, we investigate one aspect of neighborhoods—racial composition—and the extent to which it affects birthweight, an outcome that is strongly associated with infant survival and child health and for which individual level factors have not been able to explain large and persistent disparities by race. The analyses are based on a probability sample of births in 20 large U.S. cities.

Background

Low birthweight (< 2500 grams) is a leading risk factor for infant mortality and is associated with a number of health conditions and developmental problems among infants who survive (Reichman, 2005). In 2005, 14.0% of infants born to black mothers and 7.3% of those born to

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white mothers were low birthweight (Martin et al., 2007). This two-to-one disparity has persisted for more than forty years, exists at most maternal age ranges (Martin et al., 2002), and cannot be explained by socioeconomic status alone. Even infants born to college-educated black women are at much greater risk than infants born to college-educated white women of being low birthweight (Schoendorf et al., 1992; McGrady et al., 1992).

Studies have found substantial geographic variability in birthweight (e.g., Sastry & Hussey, 2003). Observed associations between birthweight and place may represent true causal effects of environments, but they could also reflect spatial clustering of individuals with characteristics that are associated with birthweight (i.e., selection). There are several hypothesized channels by which neighborhood racial composition could affect birthweight. Some have argued that poor or minority neighborhoods are detrimental to health because of reduced access to quality health services or resources such as nutritious foods. Others have argued that social support and cultural practices play protective roles in ethnic enclaves.

We focus on effects of racial composition, as distinct from racial segregation. The two, though related, are not equivalent concepts. Segregation refers to the degree to which groups live apart from each other. A given neighborhood's degree of segregation depends on its racial composition, the racial composition of adjacent neighborhoods, and the racial composition of the city. Findings from studies on birthweight and segregation are mixed, depending on the measure of segregation (see Massey & Denton, 1988 for a review of segregation measures). Studies have found that city-level centralization, dissimilarity, and isolation are negatively associated with birthweight (Bell et al., 2006; Ellen, 2000), as is neighborhood-level isolation (Grady, 2006)[0], but that city-level clustering is positively associated with birthweight (Bell et al., 2006).

Empirical evidence on the effects of neighborhood racial composition on birthweight is also mixed. Roberts (1997) found that the concentration of blacks in census block groups is negatively associated with low birthweight in Chicago, a finding he suggested reflects social support. In contrast, Morenoff (2003) found no effect of the concentration of blacks in neighborhood clusters on birthweight in Chicago, and using the same data, Buka et al. (2003), found no effect of black concentration in neighborhood clusters on birthweight among black mothers.

It is difficult to draw inferences about the effects of neighborhood racial composition from this set of findings, for several reasons. All three studies estimated linear models, but the effects of neighborhood racial composition may be non-linear. All three studies were based on data from Chicago. Only one (Buka et al., 2003) completely disentangled the effects of individual and neighborhood level race by limiting the sample to black mothers. All three studies used data from birth records, which do not include information on how long the mother resided in the neighborhood in which she gave birth. Finally, the results were inconsistent across studies.

Potential Mechanisms

This section describes theory-based mechanisms through which neighborhood racial composition could potentially affect birthweight, as well as the patterns of associations (between racial composition and birthweight across the range of racial composition) that would be consistent with the different hypothesized mechanisms. We also discuss selection as a potential explanation for observed associations between neighborhood racial composition and birthweight.

Distribution of resources—Studies have found that black neighborhoods have poorer quality health care (Groeneveld et al., 2005), more cigarette marketing (Mayberry & Price, 1993), and poorer food choices (Zenk et al., 2005; Moore & Diez-Roux, 2006) than non-black neighborhoods. Poor quality prenatal care, cigarette smoking, and inadequate nutrition all are associated with low birthweight (Reichman, 2005). If health care providers, cigarette companies, and food stores target neighborhoods on the basis of racial composition and those actions have appreciable effects on birthweight (in other words, if the distribution of resources underlies neighborhood racial composition effects on birthweight), associations between the proportion black in a neighborhood and birthweight would be negative and monotonic (not reversing direction). The functional form would likely be nonlinear, with little or no association at the low end of the distribution of proportion black (neighborhoods that all marketers would consider non-black) and negative associations at the higher end (as marketers target black neighborhoods).

Social environment—Social cohesion varies across neighborhoods (Sampson, Raudenbush, & Earls, 1997), and social ties and support are positively related to health (House, 2002; House et al., 1988; Seeman, 1996), perhaps through the buffering of financial hardships or the reduction of stress. If social environments underlie variations in birthweight by neighborhood racial composition, the expected direction of association between black concentration and birthweight would be ambiguous. On one hand, racially homogenous black neighborhoods may have networks that are more adaptive and socially cohesive than those in non-black or racially heterogenous neighborhoods (Stack, 1974). On the other hand, living in racially concentrated areas may increase stress due to collective reinforcement of discriminatory experiences, which in turn could adversely affect birthweight (Geronimus, 1992; Geronimus, 1996; Jackson et al., 1996; Williams & Collins, 2001; Morenoff, 2003). According to either theory, the association between neighborhood racial composition and birthweight would be monotonic.

Selection—If individuals with low levels of human capital or other characteristics that are negatively associated with birthweight select into poor and segregated neighborhoods, observed “effects” of racial composition could reflect individual level factors (e.g., Manski, 1995; Oakes, 2004). Not adequately controlling for selection into neighborhoods would bias estimates of the effects of living in black neighborhoods.

Our contribution

In this study, we redress many of the methodological limitations of the previous studies of the effects of neighborhood racial composition on birthweight. First, we restrict the analyses to black mothers, which is necessary for disentangling the effects of race and racial composition because the two are so highly correlated. Second, we limit the sample to unmarried mothers in order to minimize unobserved heterogeneity (selection bias) and because the majority of births to black mothers in the U.S. take place out of wedlock (70% in 2005, according to Martin et al., 2007). Third, we account for the length of time the mother lived in the neighborhood. Fourth, we explore alternative functional forms; doing so allows for nonlinear associations, improves the precision of the estimates, and helps us investigate underlying mechanisms. Finally, we use data that are representative of births in all large US cities and that are characterized by substantial variation in neighborhood poverty and racial composition. To avoid a potential pitfall noted by Ellen (2000)—namely, that multicity studies of neighborhood racial composition effects on health could actually be picking up effects of city level racial composition or segregation—we estimated multilevel models that include city level racial composition and other city level measures.

Methods

Data

The Fragile Families and Child Wellbeing study is an ongoing longitudinal birth cohort study. Here, we briefly describe the research design and sample, which are described elsewhere in detail (Reichman et al., 2001). Between the spring of 1998 and the fall of 2000, parents were interviewed in 75 hospitals in 20 U.S. cities shortly after their children were born. Cities were selected from all 77 cities in the U.S. with over 200,000 people, using a stratified random sample. In 18 of the cities, all hospitals within the city boundaries that had maternity wards were included. In the other two (the largest) cities, hospitals were randomly sampled. Within each hospital, births were randomly sampled from birth logs. Non-marital births were oversampled.

While still in the hospital after giving birth, mothers were approached by a professional survey interviewer and screened for eligibility. Mothers were eligible for the study if they and the infant's father were at least 18 years old (this restriction did not apply in approximately one-third of the hospitals, where they were considered emancipated minors), if they were able to complete the interview in either English or Spanish, if the father of the newborn was living, and if they were not planning to place the child for adoption. If they were eligible, mothers were asked to participate in a national survey about the conditions and capabilities of new parents, their relationships, and their children's well-being. Fathers, who were eligible for the study if their newborn's mother completed an interview, were also asked to participate. Informed consent was administered to all respondents.

A total of 4,898 mothers (3,712 unmarried; 1,186 married) were interviewed shortly after giving birth. The number of unmarried mothers interviewed in each hospital, which ranged from 8 to 193, was proportional to that hospital's share of non-marital births in the city. The 3,712 unmarried mothers represent 87% of the sampled unmarried mothers who were eligible for the study. For those births, 75% of the fathers completed interviews. We merged measures of tract level racial composition and poverty from the 2000 U.S. Census to the mothers' survey records using the mothers' addresses at the time of the birth.

The analyses in this study were based on the sample of non-marital births, which is representative of non-marital births in U.S. cities with at least 200,000 people. A total of 1,973 unmarried non-Hispanic black mothers with singleton births completed interviews. Of those, 46 were excluded from the analysis because of missing neighborhood data and another 56 were excluded because of missing data on one or more other analysis variables. The main analysis sample consisted of the remaining 1,871 births. Those mothers resided in 1,181 different census tracts. The average number of births per tract was 1.6; the range was 1 to 14 births.

Measures

The main outcome is birthweight, coded as a continuous variable (in grams). The key independent variables are neighborhood racial composition and poverty, characterized as the proportions of residents who were black and of households that were poor (had income below the poverty line), respectively, in the mother's census tract at the time of the birth. The analyses also included known determinants or correlates of birthweight that may vary across neighborhoods.

There is a well known U-shaped association between maternal age and birthweight, with teen mothers and older mothers having worse outcomes than mothers in their 20s (Martin et al., 2007). We therefore included measures for whether the mother was less than 20 years old and whether she was over 35 years old at the time of the birth, with 20–34 years old as the reference category. There is some evidence that the teen birthweight disadvantage may not apply to black mothers, but that pattern is not evident in U.S. vital statistics (Martin et al., 2002). Given recent findings that advanced paternal age is a risk factor for low birth weight among disadvantaged populations (Reichman & Teitler, 2006), we also included an indicator for paternal age greater than 35 years (versus less than that) at the time of the birth.

There are also strong socioeconomic gradients in birthweight (Finch, 2003). Although less is known about the extent to which this association holds among blacks, we included indicators for whether the mother had less than a high school education at the time of the birth and whether she was a high school graduate or equivalent, with having at least some college education as the reference category. We also included indicators for whether the infant's father completed high school or equivalent (versus less than a high school education) and whether the father was employed or in school (versus not employed or in school). To minimize sample loss due to father non-response, we used information about the father reported by the mother when father reports were missing. We also included indicators for missing data on father's education if data were missing from both the father and mother.[1]

We included indicators for whether the mother was born in the U.S. (versus not), the parents' relationship status at the time of the birth (romantically involved but not cohabiting and not romantically involved, both compared to cohabiting), whether the birth was the mother's first (versus higher-order) and the mother's health insurance status at the time of the birth (public insurance and no insurance, both compared to private insurance). Foreign-born mothers have more favorable birth outcomes than U.S.-born mothers, across virtually all racial/ethnic groups (Landale, Oropesa, & Gorman, 1999). Family structure is strongly associated with race (Ruggles, 1994) and varies by neighborhood (South & Crowder, 1999). There is some evidence that access to health insurance is associated with favorable birth outcomes (Currie & Gruber, 1996; Hanratty, 1996). We also included an indicator for the whether the child was female (versus male).

We controlled for the proportion black and the proportion poor in the city to ensure that estimates of neighborhood composition effects do not reflect city level characteristics. Finally, we conducted supplementary runs that considered duration of residence in a given neighborhood, which is thought to be important when assessing neighborhood effects on health outcomes (Entwisle, 2007). As there is no literature to guide us on specifying an appropriate time frame, we specified two different time frames (at least 3 years and at least 5 years) that seemed reasonable.

Analysis

We estimate multilevel models (linear models of birthweight in grams and logistic models of low birthweight) using MLWin version 2.01 software to account for the hierarchical data structure (individuals nested within census tracts nested within cities). Calculations revealed ample power ($P > .99$) to detect a .15 effect size of neighborhood racial composition.[2]

Results

Figure 1 shows the unadjusted association between proportion black in the mother's census tract and her infant's birthweight in grams. The horizontal line across the figure delineates the low birthweight threshold of 2500 grams. This scatterplot reveals no clear pattern. Only when

[1]The 7 observations for which father age was missing were assigned to the reference category (< 35) rather than flagged with a dummy variable, as the latter approach prevented models from converging.

[2]Power calculations were based on an estimated intra-class correlation of .05, an alpha of .05, and 18 predictors in the model (see Friedman, Furberg, & DeMets, 1998 for a discussion of power calculations for multilevel models). We selected an R^2 of .13 (13% of the total variance in birthweight accounted for by the predictors), $F^2 = .15$, which is a medium effect size according to Cohen (1989).

we compare the least black neighborhoods to the rest of the distribution does there appear to be any association between neighborhood racial composition and birthweight. Specifically, neighborhoods less than 5% black have a very low prevalence of low birthweight. The overall pattern is not consistent with any of the hypothesized mechanisms discussed earlier. We used multivariate (multilevel) regression models to estimate associations adjusting for individual risk factors and neighborhood poverty.

Since racial composition of neighborhoods is known to be associated with concentration of poverty, one concern was whether there was enough variation in neighborhoods to disentangle the two effects. Table 1 shows the counts of observations by neighborhood poverty and racial composition for the analysis sample. The association between the two is evident (the higher the proportion black, the higher the proportion poor) but there is also considerable variation by which to isolate neighborhood composition effects (many mothers lived in very poor mostly non-black neighborhoods or in non-poor mostly black neighborhoods).

Another concern was whether there was sufficient variation within cities to allow us to disentangle the effects of tract versus city level racial composition. As can be seen in Figure 2, which illustrates the distribution of the sample in each city by proportion black in the census tract, there is substantial variation in racial composition of tracts in most cities.

Table 2 presents the characteristics of the sample of urban black unmarried mothers, by proportion black in census tract. Most mothers were poor (had Medicaid births), had no more than a high school education, and did not live with the father at the time of the birth. The rate of low birthweight was 14.0% (not shown). Mothers in tracts with high proportions black were more likely than mothers in tracts with lower proportions black to be relatively young or old, less likely to be foreign-born, less likely to have been cohabiting at the time of the birth, less educated, and less likely to have had first births. In other words, they were at higher risk of adverse birth outcomes.

Table 3 displays multilevel estimates of the effect of proportion black in the mother's census tract on birthweight (in grams), controlling only for neighborhood poverty (Model 1), controlling for neighborhood poverty and individual level characteristics (Model 2), and controlling for neighborhood poverty, individual level characteristics, and city level racial composition and poverty (Model 3).

The proportion of individuals in a tract who are black is negatively and significantly associated with birthweight, controlling for neighborhood poverty (Model 1). However, the effect size is relatively small – a change from 0 to 100% black is associated with a 125 gram decrease in birthweight. Neighborhood poverty is not significantly associated with birthweight when controlling for racial composition, which is consistent with a recent finding by Grady (2006). The association between racial composition and birthweight is only somewhat diminished — to −117 grams—when the individual level measures are added (Model 2).

The associations between individual level characteristics and birthweight are consistent with prior research findings. Female, first birth, older maternal age, older paternal age,[3] the mother being U.S. born, the parents living apart, low maternal and paternal education, and public or no health insurance all are associated with lower birthweight (Model 2), though some of these associations are not statistically significant in our relatively homogeneous (unmarried, black, urban) sample.

[3]Reichman and Teitler (2006), who identified paternal age as an independent risk factor for low birthweight and found larger effects of paternal than maternal age, discuss several potential mechanisms that involve direct biological effects, indirect effects through the mother's health, and selection.

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The estimated effects of city level racial composition and poverty, shown in the third column, are statistically significant. Proportion black and poor at the city level are independently associated with lower birthweight, but the sign of city level poverty is not in the expected direction.[4] The individual level predictors change little in this model specification, but the effect of proportion black at the neighborhood level is reduced by about one third (to −76 grams) and is no longer statistically significant, suggesting that city level factors underlie much of the associations between neighborhood racial composition and birthweight.

Estimates from supplemental models, all of which controlled for census tract poverty, individual level characteristics, and city level racial composition and poverty (as in Model 3 of Table 3), are presented in Table 4. First we expanded the analysis to include a dichotomous indicator for low birth weight (< 2500 grams) in addition to birthweight in grams. To allow for non-linear associations between racial composition and the outcomes, we estimated models that included the proportion black in categories (.20 to .39, .40 to .59, .60 to .79, and .80 to 1.0, compared to < .20). We also estimated effects of the proportion white in the census tract instead of proportion black.

The effects of neighborhood racial composition on low birth weight are consistent with those on birthweight in grams. Measured continuously, neither the estimate of proportion black nor the proportion white in the mother's census tract is significantly associated with birthweight or low birthweight when controlling for city level racial composition and poverty. The associations between categorical measures of proportion black and birth weight do not follow a monotonic pattern. Relative to living in tracts with less than 20% black, residing in tracts that are 20–39% black is associated with a greater reduction in birthweight (−142 grams and 86% increased odds of low birthweight) than residing in tracts in the third and fourth categories of proportion black (.40 – .59 and .60 – .79). This pattern is inconsistent with all the hypothesized mechanisms discussed earlier.

Results from additional specifications and sample restrictions, not shown in tables, further support our finding of no significant effects of neighborhood racial composition on birthweight. We found no evidence that effects were diluted by recent movers, as the results were similar to those in Table 3 when we restricted the analyses to mothers who lived in their neighborhood for at least 3 and, separately, at least 5 years. The estimates were insensitive to whether or not we controlled for neighborhood poverty and to the exclusion of health insurance, employment, and parents' relationship status or any other covariates. Including Hispanic ethnicity, religiosity, family size, household income, and tract level housing vacancy rates did not affect findings. The estimates were insensitive to the inclusion of timing of prenatal care initiation and prenatal smoking, which represent potential mediating factors and are relevant to the theories laid out earlier. Limiting the sample to cases in which the father was also black did not affect findings. Models that included married black mothers in addition to unmarried black mothers produced estimates very similar to those presented here that limited the sample to unmarried mothers. Controlling for city racial segregation using an index of dissimilarity (a measure of racial segregation) rather than proportion black did not change the estimated effects of neighborhood racial composition. Finally, excluding cities with few births to black mothers or few tracts with black mothers (Austin, Corpus Christi, San Jose, Toledo, San Antonio, and Pittsburgh) or any subset of those cities did not change the estimates.

[4]The counterintuitive sign of city level poverty is an artifact of this particular model specification. City level poverty was negative and significant in models that did not include city level racial composition. The estimated effect and significance of city level racial composition, however, was not sensitive to the exclusion of city level poverty (result not shown).

Discussion

Social characteristics of neighborhoods are increasingly thought to be important determinants of health and health disparities. However, empirical evidence for such effects has been mixed, possibly because of the difficulty in accounting for selection into neighborhoods. We systematically investigated the effects of neighborhood racial composition on one marker for poor health at birth, birthweight, using a national urban sample of unmarried non-Hispanic black mothers with considerable variation in neighborhood racial composition and neighborhood poverty. The high-risk sample and the variability of neighborhoods positioned us well to detect neighborhood racial composition effects. Indeed, we found statistically significant negative associations between the proportion black in a census tract and birthweight, even when controlling for neighborhood poverty and potential individual level confounders. However, the estimated effect was reduced after controlling for racial composition and poverty at the city level and is non-linear in ways that are inconsistent with prevailing theories of how neighborhoods might affect health. The results were robust to alternative model specifications that included different measures and covariates, accounted for the length of time the mother resided in her neighborhood, and included married as well as unmarried black mothers.

Though not the primary focus of our study, it is noteworthy that city level racial composition is associated with birthweight for infants to unmarried black mothers. This finding is consistent with research by Ellen (2000), who argues that city level segregation, in particular racial centralization and uneven distribution across neighborhoods, may be more salient than neighborhood attributes for some health outcomes. City level racial composition could be associated with the same factors described earlier as potential mechanisms for neighborhood effects—in particular, the availability of resources affecting health care and health behaviors, advertising, and availability of healthful foods. Indeed, if most residents of cities have access to transportation and if most advertising is through television, radio, and newspapers, then cities might be the more relevant spatial environments. Our finding of no significant effects of neighborhood racial composition in our multicity sample is also consistent with the findings from two of the previous Chicago-based studies (Morenoff, 2003 and Buka et al., 2003), suggesting that the results of those studies were not an artifact of unique characteristics of that city or the model specifications used.

The analyses were based on census tracts, which are administratively defined neighborhoods that may not be the most salient geographical units by which to characterize neighborhoods and could potentially produce biased estimates of racial composition effects. That said, given the weakness of the associations found and, more importantly, the inconsistency of the findings with prevailing theories of how neighborhoods could affect health, we think the burden of proof now lies with those arguing the existence of neighborhood racial composition effects on birthweight.

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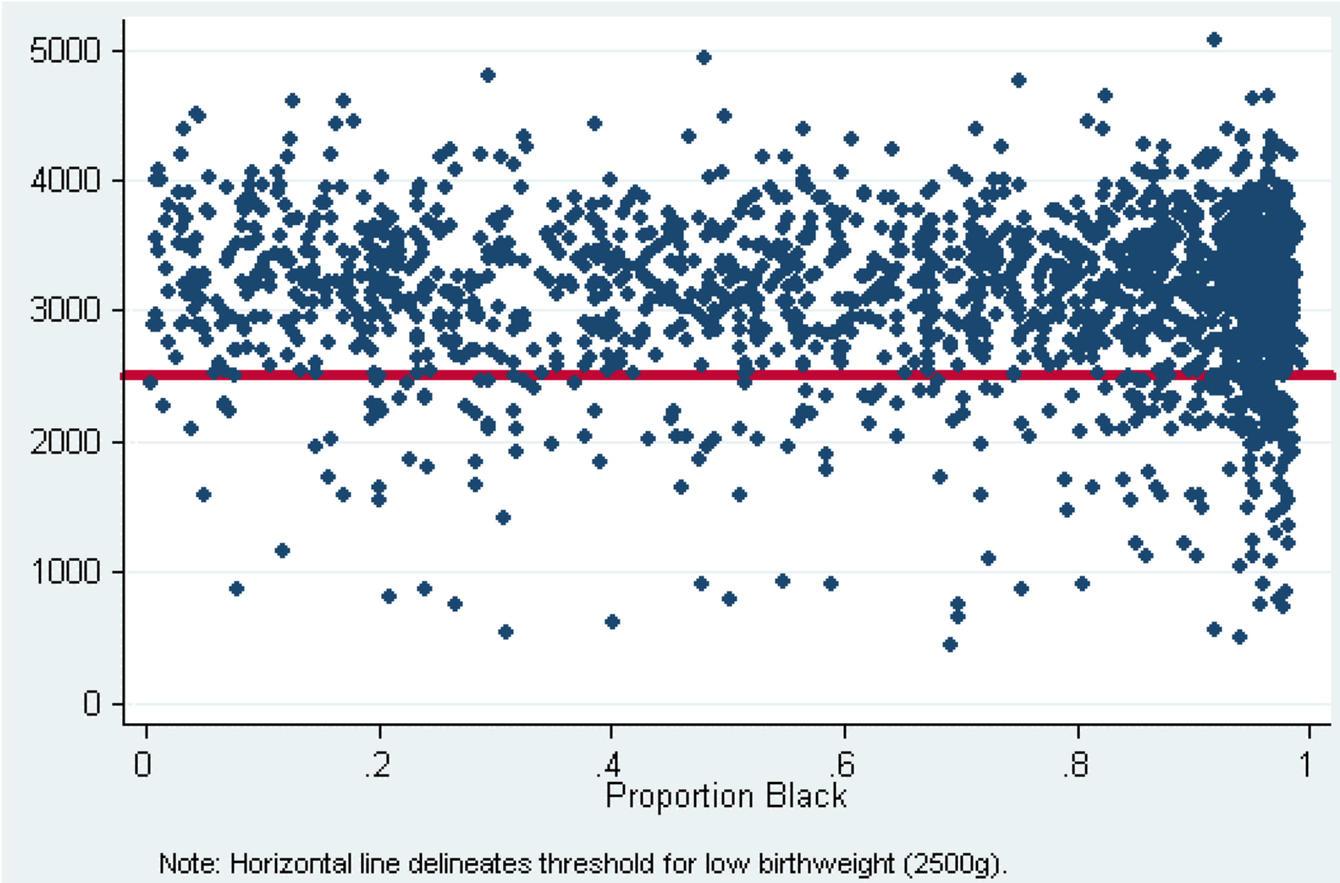

Figure 1.
Birthweight (Grams) by Proportion Black in Census Tract (N = 1,871)

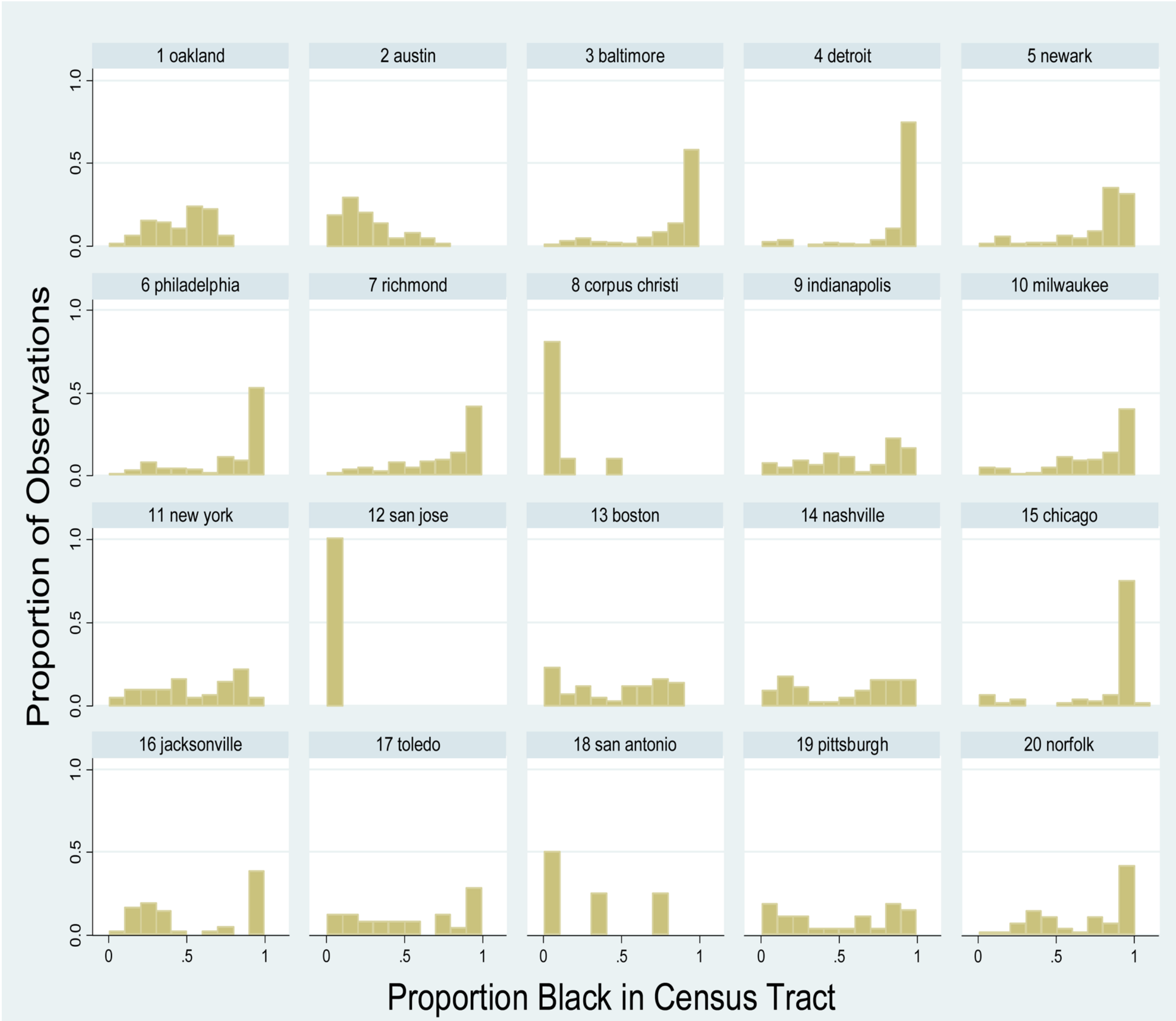

Figure 2.
Distribution of Sample by Proportion Black in Census Tract in Each of 20 Cities (N = 1,871)

Table 1

Proportion Families Poor in Tract by Proportion Families Black in Tract

	Proportion Black					
Proportion Poor:	**< .20**	**.20 – .39**	**.40 – .59**	**.60 – .79**	**.80 – .100**	**N**
< .10	93	68	45	38	53	297
.10 – .19	50	72	71	91	181	465
.20 – .29	32	40	59	64	333	528
.30 +	30	40	51	70	390	581
N	205	220	226	263	957	1,871

Table 2

Characteristics of Sample of Births to Unmarried Black Mothers by Proportion Black in Census Tract (N = 1,871)

	Proportion Black in Tract					All Mothers
	< .20	.20–.39	.40–.59	.60–.79	.80–1.00	
Child female (%)	47.8	50.9	45.1	46.4	45.3	46.3
First birth* (%)	38.1	37.7	38.1	41.1	31.9	35.3
Mother's age* (%)						
< 20 years	22.0	20.9	19.5	26.6	23.6	23.0
20 – 34 years	74.6	73.6	77.9	67.3	69.1	71.0
35 years or more	3.4	5.5	2.7	6.1	7.3	5.9
Father's age 35 years or more (%)	13.7	13.2	13.7	14.5	16.7	15.3
Mother U.S.-born* (%)	94.6	95.5	96.5	94.7	98.4	96.9
Parents' relationship status* (%)						
Cohabiting	45.9	45.9	40.7	36.9	36.5	39.2
Romantic, not cohabiting	36.1	40.0	40.3	50.2	44.0	43.1
Friends/hardly talk/father unknown	18.1	14.1	19.0	12.9	19.5	17.7
Mother's education* (%)						
Less than high school	28.3	40.5	35.0	33.1	38.7	36.5
High school or equivalent	35.1	29.6	36.7	38.4	38.6	36.9
Any college	36.6	30.0	28.3	28.5	22.8	26.6
Father's education: Less than high school (%)	27.8	28.2	29.7	28.5	35.4	36.4
Father employed or in school	64.9	68.6	64.2	65.0	65.3	65.5
Mother's health insurance (%)						
Private	22.9	23.2	16.8	20.2	20.2	20.4
Public	74.6	74.6	79.7	73.0	76.2	75.8
None	2.4	2.3	3.5	6.8	3.7	3.8

*Indicates significant ($p<.05$) differences across neighborhood racial composition categories based on chi-square tests of equal distributions.

Table 3

Effect of Proportion Black in Census Tract and Covariates on Birthweight in Grams (and 95% confidence intervals)

	Model 1	Model 2[a]	Model 3[a]
Census Tract Characteristics:[b]			
Proportion black	−124.6** (−231, −18)	−118.4** (−221, −16)	−76.9 (−190, 36)
Proportion poor	−9.8 (−230, 210)	120 (−113, 353)	65.2 (−157, 287)
Individual Level Characteristics:			
Child female		−79.3*** (−135,−24)	−81.1*** (−137, −25)
First birth		−43.8 (−109, 21)	−46.9 (−112, 18)
Mother's age (ref = 20–35)			
< 20 years old		48.4 (−28, 124)	44.3 (−32, 120)
35 years or more		−10.9 (−160, 139)	−18.5 (−168, 131)
Father's age 35 years or more		−206.2*** (−293,− 119)	−207.3*** (−294, −120)
Mother U.S.-born		−183.8** (−347, −20)	−156.9* (−318, 4)
Parents' relationship status (ref = cohabiting)			
Romantic not cohabiting		−38.7 (−101, 24)	−36.9 (−99, 25)
Friends/hardly talk/father unknown		−7.0 (−90, 76)	−6.1 (−89, 77)
Mother's education (ref = any college)			
Less than high school		−44.7 (−125, 35)	−44.5 (−124, 35)
High school or equivalent		−43.9 (−117, 29)	−41.8 (−115, 32)
Father's education: less than high school		−46.8 (−111, 17)	−45.8 (−110, 18)
Father employed or in school		−29.8 (−92, 32)	−25.6 (−88, 36)
Mother's health insurance (ref = private)			
Public		−153.0*** (−226, −80)	−154.8*** (−227, −82)
None		−164.3** (−321, −7)	−171.6** (−329, −15)
City Level Characteristics:			
Proportion black in city[b]			−306.1*** (−534, −78)
Proportion poor in city[b]			868.3* (−75, 1812)
Between-city variance: Ω(υ) (s.e.)	1506 (1774)	533 (1298)	0 0
Between-tract variance: Ω(μ) (s.e.)	19256 (12191)	12209 (11366)	117067 (11237)
Between-individual variance: Ω(e) (s.e.)	366096 (16527)	359392 (15992)	359012 (15942)
−2* log likelihood	29377	29307	29301
N	1,871	1,871	1,871

Notes:

* p < .10

** p < .05

*** p < .01.

[a] Model includes indicators for missing father's education and missing father's employment (estimates not shown).

[b] Since the characteristic is expressed as a proportion, the estimates indicate effects of a 0% to 100% increase in that characteristic.

Table 4

Effects of Census Tract-Level Racial Composition, Alternative Specifications

	Birthweight[a] (grams)	Low Birthweight[b] (< 2500 g)
Effect of Proportion Black	−76.9 (−190, 36)	1.43 (.83, 2.48)
Effect of Proportion Black (ref = < .20)		
.20 – .39	−141.7** (−259, −24)	1.86* (−99, 3.48)
.40 – .59	−87.1 (−205, 31)	1.27 (.67, 2.43)
.60 – .79	−73.8 (−190, 43)	1.20 (.63, 2.29)
.80 +	−116.9** (−223, −11)	1.73* (.98. 3.06)
Effect of Proportion White	57.8 (−89, 205)	1.00 (0.49, 2.03)
N	1,871	1,871

Notes:

* $p < .10$

** $p < .05$

*** $p < .01$.

All models include neighborhood poverty, child sex, parity, maternal and paternal age, maternal nativity, parents' relationship status, maternal and paternal education, paternal employment, maternal health insurance, proportion black in city, proportion poor in city (same set of covariates as in Table 3, Model 3).

[a]Linear regression coefficients and 95% confidence intervals.

[b]Odds ratios and 95% confidence intervals.