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Does Neighborhood Risk Explain Racial Disparities in Low Birth Weight among Infants Born to Adolescent Mothers?

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Abstract

Study objective—To test associations and interactions between racial identification, neighborhood risk, and low birth weight disparities between infants born to African-American and White adolescent mothers.

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Design—Retrospective cross-sectional study. Birth cases were geocoded and linked to census-tract information from the 2010 United States Census and the 2007-2011 American Community Survey. A “neighborhood risk” index was created through principal component analysis, and mothers were grouped into three neighborhood risk levels (low, medium, high). Multilevel models with cross-level interactions were used to identify variation in racial differences in low birth weight outcomes across neighborhood risk levels when controlling for maternal demographics and pregnancy behaviors (smoking, prenatal care use).

Setting—North Carolina, United States.

Participants—7,923 cases of singleton infants born to non-Hispanic African-American and White adolescent mothers from the North Carolina State Center of Health Statistics for 2011.

Main outcome measures—Low birth weight.

Results—African-American mothers were significantly more likely to have infants of low birth weight than White mothers in this sample [OR 1.89, CI (1.53, 2.34)]. Mothers that resided in areas of high neighborhood risk were significantly more likely to have infants of low birth weight than mothers residing in areas of low neighborhood risk [OR 1.55, 95% CI (1.25, 1.93)]. Even when controlling for confounding factors, racial disparities in low birth weight odds did not significantly vary by neighborhood risk level.

Conclusions—Racial disparities can remain in low birth weight odds among infants born to adolescent mothers when controlling for maternal characteristics, pregnancy behaviors, and neighborhood risk.

Keywords

Adolescent pregnancy; low birth weight; racial disparities; health disparities; socioeconomic status; neighborhood; African-American

Introduction

Adolescent mothers experience greater levels of low birth weight (LBW), preterm birth, and neonatal mortality outcomes in comparison to mothers of older age groups^{1, 2}, and racial disparities in adverse birth outcomes persist in all age groups, including adolescent mothers³. Preterm birth as an independent adverse outcome is the most important factor associated with LBW, but studies have consistently identified other factors, such as individual characteristics and prenatal behaviors, as contributors to LBW. Studies on racial disparities in LBW have examined individual characteristics of mothers with limited consideration to neighborhood and structural factors. Previous findings demonstrate that women residing in deprived neighborhoods have higher rates of adverse birth outcomes than women in more affluent neighborhoods⁴⁻⁸; however, this research has focused on adult mothers or general samples of women of childbearing age rather than focusing exclusively on adolescent mothers. Given that adolescents could have heightened vulnerability toward neighborhood stress factors⁹, more studies on neighborhood socioeconomic factors and racial disparities in LBW among infants of adolescent mothers are needed to clarify these associations.

Testing the role of neighborhood factors on birth outcomes among adolescent populations brings additional challenges. For example, neighborhood factors examined in previous studies⁴⁻⁸ concentrated on income and educational demographics which have been deemed more problematic for assessing social class among adolescents in comparison to adults¹⁰. Further examinations of new neighborhood variables or more sensitive ways of clarifying existing variables are therefore needed that have greater relevance for adolescent mothers. To address this need, this study examined neighborhood risk (defined by multiple socioeconomic indicators from census tract data) as potential explanation of racial disparities in LBW outcomes among infants born to African-American and White adolescent mothers.

This study was designed to answer the following questions: 1) Do racial disparities in LBW outcomes persist between African-American and White adolescent mothers' infants after controlling for neighborhood risk? 2) Does neighborhood risk moderate the racial disparities in LBW outcomes between African-American and White adolescent mothers' infants? With the recognition of intersectional and socio-ecological frameworks of maternal and infant health outcomes^{11, 12}, this examination stemmed from the rationale that individual and neighborhood factors can intersect to influence distribution of resources, household income, access to health resources, employment, and education, and subsequently affect birth weight outcomes and disparities between racial groups of adolescent mothers.

With the exception of two studies^{13, 14}, previous research did not examine the contribution of neighborhood risk factors in explaining racial disparities in birth weight outcomes for infants born to adolescent mothers. This study extends these previous studies by using birth record data from a large statewide sample of almost 8,000 adolescent mothers to test the interdependent relationship of multiple neighborhood risk characteristics and the association with racial disparities in LBW. Moreover, this study contributes to the growing literature that examines neighborhood risk factors and associations with racial disparities in birth outcomes.

Methods

Data sources

This study used a cross-sectional design to examine birth record data from the North Carolina State Center of Health Statistics for 2011. Neighborhood was defined as census-tracts delineated by 2010 U.S. Census boundaries. Mothers' street addresses were geocoded to census-tract identification numbers using ArcGIS 10.0 (Redlands, CA: Environmental Systems Research Institute) and the U.S. Federal Financial Institutions Examination Council geocoder. These adolescent birth cases were subsequently linked to census-tract statistics from the 2010 US Census and the 2007-2011 American Community Survey. This study was deemed exempt by the authors' institutional review board because no interactions with human subjects occurred in these secondary data analyses of existing birth record data.

Study Sample

This study focused on 8,302 adolescent mothers who matched the following criteria: African-American or White racial identification, Non-Hispanic ethnic status, born in the United States, age younger than 20 years old, North Carolina residency, and delivery of single live births at gestational ages of 20 weeks or more. The study's gestational age cutoff at 20 weeks stemmed from the national use of the 20-week cutoff to compare fetal deaths between states and prior research recommendations for consistency in studies on birth outcomes across geographic locations¹⁵⁻¹⁷. Cases that could not be geocoded at the street address level were excluded from analyses, resulting in a final study sample of 7,923 adolescent mothers (95.4% of all eligible cases) who resided in 1,803 census-tracts across the state.

Study variables and measures

LBW (defined as infant birth weight under 2,500 grams) was used as the dependent variable because of the extensive literature of LBW as an adverse birth outcome. Maternal racial identification was dichotomized (African-American / White) and other racial categories were excluded from these analyses. Specifically, adolescent mothers of Hispanic and foreign-born status were excluded to avoid potential confounding of ethnicity in comparing racial groups and mothers of other racial groups (i.e. Asian, Native American) were excluded due to the small proportion of adolescent mothers in these groups.

A neighborhood risk index was created from selected census-tract variables because multiple socioeconomic factors interact at the community level to affect health outcomes. The potential variables to include in the index were chosen based on prior research^{13, 18-24} to assess how multiple interacting characteristics could explain the impact of socioeconomic status rather than solely relying on income and educational factors. Principal component analysis²⁵ was used to develop this index. This approach, similar to the creation of neighborhood context indices in previous research,^{13, 18, 19, 26} helps to summarize the pattern of relationships explained by the intersection of census-level socioeconomic factors. The neighborhood risk index was based on one principal component which accounted for 60.1% of the total variance. The final index included the following census-tract variables: median household income, poverty proportion, unemployment rate, percentage of people 25 years old and older with a high school diploma or more, percentage of households headed by single females with children younger than age 18, percentage of households that received public assistance, the Gini inequality index (a standardized measurement of inequality within census-tracts), and percentage of households residing in rental housing. Analyses for the neighborhood risk index indicate that the census-tract neighborhood risk for these adolescent mothers' residences ranged between -3.12 (low risk) and +4.54 (high risk).

Next, this index was used to divide adolescents into three levels of neighborhood risk following guidelines on research for adolescent samples and assessments on birth outcome disparities among adult mothers involving examination of socioeconomic factors^{27, 28}. The "low neighborhood risk" level included adolescents residing in the neighborhoods in the lowest quartile of neighborhood risk; adolescents in this level represented the referent group given the assumption that these adolescents would have more access to resources for optimal

birth outcomes. The “medium neighborhood risk” level included adolescents in the middle 50% quartiles, and the “high neighborhood risk” level included adolescents in the highest quartile of neighborhood risk.

Most examinations of adverse birth outcomes and associated disparities controlled for mothers' demographic and medical risk characteristics^{15, 29}; therefore, these characteristics were included in these analyses as potential confounders. Data on all demographic and medical risk characteristics came from the birth records dataset. Demographic variables included age (younger than 17 years old / 17-19 years old), marital status (single / married) and education (high-school graduate / non high-school graduate). Separate dichotomous indicators for each of the following medical risk factors were included as confounders^{15, 29-33}: pre-pregnancy hypertension, gestational hypertension (pregnancy induced hypertension & preeclampsia), pre-pregnancy diabetes, gestational diabetes, eclampsia, previous preterm births, and previous poor obstetric outcomes (small-for-gestational age or intrauterine growth restricted birth, perinatal death). Because of the increased probability of shortened interconception periods among adolescent mothers that have prior children³⁴, prior pregnancy status (no prior pregnancies / one or more prior pregnancies) was also included as a risk factor.

Behaviors such as inadequate prenatal care utilization, poor nutrition, smoking, and other substance use have also been associated with increased risk in adverse birth outcomes^{15, 29}. Therefore, analyses controlled for prenatal care utilization and tobacco use history; data were unavailable for other prenatal behaviors. Prenatal care utilization was measured with the Adequacy of Prenatal Care Utilization Index³⁵. Dummy variables for inadequate, intermediate, and adequate-plus prenatal care categories were included (adequate prenatal care was used as the reference category). Because of the greater risk associated with smoking during pregnancy in comparison to smoking before pregnancy, tobacco use was assessed using two separate dichotomous variables: 1) smoked at any point three months before pregnancy (yes/no) and 2) smoked at any point during pregnancy (yes/no).

Given the strong association between preterm birth (births occurring prior to 37 weeks gestation) and LBW¹⁵, preterm birth was included as a confounding birth outcome. LBW included both preterm and full-term births because the proportion of full-term LBW cases was too small to run separate analyses for each group. Because of these circumstances, preterm birth was assessed as a confounder in lieu of conducting analyses with full-term LBW births. Periviable birth (births occurring at 25 weeks gestation or less) was also included as a confounding birth outcome because of its association with extreme LBW and other comorbid conditions^{36, 37}.

Analyses

Racial differences in maternal characteristics, census-tract variables, and LBW outcomes were tested with chi-square and independent sample t-tests using SPSS v.21³⁸. Preliminary regression models were also run using SPSS^{38, 39} to test for multicollinearity between maternal characteristics. All tolerance values were above .3, indicating that multicollinearity among the predictor variables was not a problem in any of the models. To answer questions about cross-level associations between neighborhood factors and individual outcomes,

multilevel modeling⁴⁰ was used. This approach also accounted for the nesting of adolescent mothers (Level 1) within census-tracts (Level 2). Neighborhood risk was tested as a Level 2 moderator variable^{40, 41} in these models to determine whether racial disparities in birth outcomes varied across different levels of neighborhood risk. HLM 7.01⁴² was used for all multilevel analyses. Two-sided $p < .05$ determined significance for all analyses.

A series of binomial hierarchical generalized linear models was completed for determining if neighborhood risk was significantly associated with odds of LBW in context of racial identification and confounding variables. A description of each model is given below:

Model 1: Only included racial identification, to identify racial differences in LBW.

Model 2: Added neighborhood risk to test if racial differences persisted when controlling for neighborhood risk.

Model 3: Added the racial identification $\times$ neighborhood risk interactions to test whether neighborhood risk moderated the relationship between racial identification and LBW.

Model 4: Tested whether the significant associations or moderating effects of neighborhood risk changed after controlling for demographic and medical risk factors.

Model 5: Added the prenatal care and smoking variables to test whether significant associations or moderating effects of neighborhood risk changed after controlling for these health behaviors. These variables were added to address current advocacy for prenatal care and smoking abstinence as protective behaviors in reducing risk of adverse birth outcomes,

Model 6: Controlled for preterm birth and periviable birth as confounding birth outcomes to test whether differences related to racial identification and neighborhood risk changed after controlling for these strong predictors of LBW births.

Results

Table 1 provides descriptive statistics for the maternal characteristics of this sample and birth outcomes. Results from bivariate chi-square analyses indicated that LBW outcomes, maternal characteristics, behavioral characteristics, and preterm and periviable birth outcomes significantly differed between the two racial groups ($p < .01$), whereas medical risk factors (other than 1+ prior pregnancies) did not. African-American mothers had a higher proportion of LBW infants than White mothers, and a higher proportion of African-American mothers were younger than 17 years old, single, had one or more prior pregnancies, and had inadequate prenatal care use. However, significantly fewer African-American mothers smoked before and during pregnancy.

Table 2, which provides the census-tract characteristics for these mothers' residencies stratified by racial identification, highlights the presence of significant racial disparities across all measures of census-tract characteristics and the composite neighborhood risk index ($p < .001$). A significantly higher proportion of African-American mothers resided in areas of high neighborhood risk than White mothers (40.9% vs. 10.1%), whereas fewer

African-American mothers resided in areas of low and medium neighborhood risk than White mothers (15.0% vs. 34.1% for low risk; 44.1% vs. 55.7% for medium risk).

Table 3 provides the chi-square tests of LBW proportions stratified by racial identification and neighborhood risk. Significant racial disparities in LBW outcomes were identified across all neighborhood risk levels, but larger racial disparities in LBW outcomes were present among mothers residing in low risk and medium risk neighborhoods. Separate chi-square analyses (results not shown) indicated that although African-American mothers in high risk neighborhoods had the greatest proportion of LBW outcomes in the overall sample, this proportion was not significantly higher than African-American mothers living in low and medium risk neighborhoods ($p>.05$).

The multilevel results summarized in Table 4 were consistent with the bivariate results. A null model (results not shown) confirmed that significant variance in LBW odds were present across census-tracts ($p<.001$). In Model 1, African-American mothers had significantly higher odds of LBW than White mothers [OR 1.89, 95% CI (1.53, 2.34)]. In Model 2, mothers who lived in high risk neighborhoods had greater odds of LBW than mothers in low risk neighborhoods [OR 1.55, 95% CI (1.25, 1.93)]. However, racial disparities in LBW odds remained significant. In Model 3, the racial identification $\times$ neighborhood risk interactions were not significant, indicating that racial disparities in LBW odds do not vary by the level of neighborhood risk ($p>.05$). According to the results in Table 5, the main effects of racial identification and high neighborhood risk remained significantly associated with odds of LBW after controlling for demographics and medical risk factors (Model 4), maternal behaviors (Model 5), and preterm and periviable birth (Model 6). The racial identification $\times$ neighborhood risk interactions remained non-significant in Models 4-6.

Taking all analyses into account, racial differences in odds of LBW persisted regardless of neighborhood risk as shown by the higher odds of LBW among African-American mothers in all models. Neighborhood risk was also significantly associated with differences in LBW odds after controlling for maternal characteristics and behaviors. Notably, the racial disparities in LBW outcomes did not significantly vary by levels of neighborhood risk. Therefore, racial disparities remained in odds of LBW when controlling for individual characteristics, pregnancy behaviors, neighborhood risk, preterm birth and periviable birth.

Discussion

Overall, these results indicate that racial disparities in LBW outcomes persist across all levels of neighborhood risk for adolescent mothers. Therefore, African-American adolescent mothers, like their adult counterparts, experience unique health burdens based on racial identification that contribute to health disparities across all types of neighborhoods. Our descriptive results (Table 3) suggest that the intersection of racial identification and neighborhood risk may impact LBW outcomes. Although African-American and White mothers in the high neighborhood risk areas had the greatest proportions of LBW outcomes in their respective racial groups, the racial disparities were higher in the medium and low neighborhood risk communities. These results are consistent with previous findings in which

greater disparities in low birth weight and preterm birth were found between African-American and White adult mothers of higher socioeconomic status than between mothers of lower socioeconomic status^{28, 43}. However, our multilevel analyses (Tables 4 & 5) did not find statistically significant differences in disparities across levels of neighborhood risk, as indicated by the non-significant racial identification $\times$ neighborhood risk interactions.

The current study builds on past studies that tested neighborhood characteristics and their associations with birth weight outcomes among infants born to adolescent mothers in the United States^{13, 14}. One study¹⁴ found that adolescents residing in lower income neighborhoods had significantly higher odds of LBW after controlling for maternal race, but African-American adolescents still experienced higher odds of low birth weight when controlling for income. However, the study focused on LBW among mothers with repeat pregnancies in one Midwestern city and only included median household income as a neighborhood predictor with mothers' educational and marital status as socioeconomic predictors at the individual level. The other study¹³ found that neighborhood risk was not significantly associated with odds in LBW for African-American and White adolescents when controlling for individual factors. Although the research team used a robust neighborhood variable incorporating multiple census characteristics to examine contextual effects on LBW among a national sample of adolescent mothers, they did not directly test if neighborhood risk moderated racial disparities. Therefore, this study contributes to this scarce research in testing moderating effects using a multifaceted neighborhood socioeconomic index, and future studies can build on these findings by further testing the effect of neighborhood circumstances on racial disparities in birth outcomes among adolescent mothers.

These results also illustrate how the etiology of LBW can differ from preterm birth even though their influential factors often overlap. Findings from a recent North Carolina study⁴⁴ indicated that racial disparities in preterm birth existed in high income (i.e., potentially low neighborhood risk) neighborhoods but not in low income neighborhoods (i.e. potentially high neighborhood risk). In the previous study, African-American adolescent mothers residing in high income neighborhoods were twice as likely to have preterm births as White mothers in similar neighborhoods, but there were no significant racial differences in preterm birth odds in low income neighborhoods. Notably, African-American adolescent mothers in high income neighborhoods had the highest rates of preterm birth among all racial and income groups whereas White adolescent mothers in similar neighborhoods had the lowest rates of preterm birth. In contrast, this current study found racial disparities in LBW did not depend on neighborhood risk; African-American adolescent mothers had the highest rates of LBW regardless of their neighborhood risk level even after controlling for preterm and periviable births. One potential explanation for differences across outcomes is that African-American adolescents residing in neighborhoods of high socioeconomic status may be at increased risk of preterm birth due to unique neighborhood stressors, such as less social support resulting from fewer proportions of African-American residents in higher income neighborhoods⁴⁵. However, these same neighborhoods do provide the advantage of better resources that could improve factors such as nutritional status and subsequently lower the risk of LBW for African-American adolescents compared to what would be expected from their increased risk of preterm birth. Future research is needed to test these assertions.

The current results also indicated that neighborhood risk was associated with LBW outcomes even when controlling for racial identification. These results contrast study findings from a national sample of adolescent mothers¹³ that showed neighborhood disadvantage was no longer significantly associated with infant birth weight in context of racial identification. Although using national datasets can yield valuable information in health trends, national data trends can overshadow socioeconomic differences in relationships with birth outcomes within local and state populations. The 2010 U.S. Census⁴⁶ reported that North Carolina's proportion of African-American residents (21.5%) exceeded the national average (12.6%). Taking into account these differences in racial composition, results from this study indicate that the associations between birth outcomes, racial disparities in these outcomes, and neighborhood factors could vary by geographic region. Future exploration therefore requires further testing of relationships between neighborhood characteristics and birth outcomes across different geographic regions.

In looking at the multilevel results for medical risk factors and maternal behaviors, these results also indicated that pre-pregnancy hypertension, gestational hypertension and smoking during pregnancy were significant risk factors for higher LBW odds among adolescent mothers when controlling for racial identification, neighborhood risk, and all other factors. Although the rates of these risk factors were low in this sample, addressing hypertension and smoking abstinence might reduce differences in LBW odds between African-American and White adolescents across all levels of neighborhood risk. These risks could be addressed through preconception health initiatives, prenatal care, and other pregnancy support interventions for adolescent mothers. For pinpointing potential areas of intervention, future analyses could further examine associations of these risk factors in context of racial identification and neighborhood risk with other samples of adolescent mothers.

This study had several limitations which suggest future opportunities for researching birth outcome disparities among adolescent mothers. One limitation stemmed from the lack of data on social support variables; marital status was the only variable available for operationalizing social support. Although previous research consistently documented adolescent mothers' positive relationships with their mothers as beneficial for birth outcomes^{47, 48}, current research also identified associations between the presence of paternal support and favorable birth outcomes among adolescent parents^{49, 50}. Moreover, data was not available for stress-related factors such as violence and abuse which could also impact adolescent mothers during pregnancy. Another limitation came from the inability to account for other individual factors (BMI and obesity) and behavioral variables as confounders (ex. alcohol and other substance use) because of the lack of data on these variables. Third, the low number of adolescent mothers younger than 15 years old (less than 1% of the sample) hindered the further separation of age groups for analyses. Adolescents younger than 15 have a greater risk for adverse birth outcomes than older adolescents^{51, 52}, but the interaction between maternal race and younger maternal age on birth outcomes needs to be further explored. Finally, no information was available on the length of time that adolescents lived at the residence reported in birth records. Given the transient circumstances of adolescent mothers, variations in these mothers' length of residency could explain differences in the influence of neighborhood factors on these adolescents' maternal

health and subsequent differences in LBW rates. In addition, reliance on census data at the census-tract level instead of the smaller census-block level might have caused inaccuracies in assessing the neighborhood context of these adolescent mothers. Given these limitations and previous research findings, future studies are still needed for examining how racial differences in these factors might further explain the racial differences in birth weight outcomes.

Conclusion

Despite the limitations, this study builds on previous research^{53, 54} on birth outcome disparities in illustrating that racial disparities between African-American and White adolescent mothers can remain in LBW outcomes after controlling for demographic, medical risk, prenatal behaviors, and neighborhood factors. The results indicate that African-American adolescent mothers are at greater risk of LBW outcomes regardless of the extent of neighborhood socioeconomic status, and future intervention efforts are needed to reduce this increased risk. This study is among the first to examine associations of neighborhood factors on LBW disparities across a statewide population of infants born to adolescent mothers. Given that all states are required to collect birth records data, this study also shows the utility that can come from using state birth records data to examine racial disparities in birth outcomes in order to identify potential subgroups for intervention planning at the state and local levels. As another benefit, this study builds on existing literature that found significant associations between characteristics of neighborhood context and health outcomes^{23, 55, 56} by expanding the findings from adult mothers to adolescent mothers. Overall, these results support the need for more research regarding disparities in adverse birth outcomes in order to identify risk factors that can be modified through intervention and to subsequently reduce these outcomes and risk of infant mortality among infants born to adolescent mothers⁴⁸. Future studies can incorporate analyses of neighborhood factors with other samples of adolescent mothers, and these future analyses could provide more information to explain differences in birth outcomes and associated disparities.

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Table 1
Demographic characteristics for study sample

	Total (n=7,923)	African-American (n=3,782)	White (n=4,141)	Chi-square
LBW proportion	772 (9.7%)	483 (12.8%)	289 (7.0%)	50.88***
Maternal age <17	930 (11.7%)	546 (14.4%)	384 (9.3%)	50.87***
Less than high school graduate education	3962 (50.0%)	2031 (53.7%)	1931 (46.6%)	39.40***
Single status	6989 (88.2%)	3703 (97.9%)	3286 (79.4%)	679.70***
Medical risk factors				
Pre-pregnancy hypertension	77 (1.0%)	44 (1.2%)	33 (0.8%)	2.78
Gestational hypertension	449 (5.7%)	219 (5.8%)	230 (5.6%)	0.21
Pre-pregnancy diabetes	20 (0.3%)	6 (0.2%)	14 (0.3%)	2.53
Gestational diabetes	170 (2.1%)	71 (1.9%)	99 (2.4%)	2.48
Eclampsia	31 (0.4%)	17 (0.4%)	14 (0.3%)	0.63
Previous PTB	57 (0.7%)	31 (0.8%)	26 (0.6%)	1.02
Previous poor obstetric outcomes	32 (0.4%)	18 (0.5%)	14 (0.3%)	0.94
1+ prior pregnancies	1819 (23.0%)	976 (25.8%)	873 (20.4%)	34.35***
APNCU index ^a				
Inadequate	1886 (24.4%)	1156 (31.4%)	730 (18.0%)	186.45***
Intermediate	577 (7.5%)	288 (7.8%)	289 (7.1%)	1.29
Adequate	2388 (30.9%)	1020 (27.7%)	1368 (33.8%)	33.61***
Adequate plus	2880 (37.3%)	1219 (33.1%)	1661 (41.0%)	51.94***
Smoking				
3 months before pregnancy	1510 (19.1%)	323 (8.5%)	1187 (28.7%)	518.95***
During pregnancy	1147 (14.5%)	229 (6.1%)	918 (22.2%)	414.54***
PTB	740 (9.3%)	392 (10.4%)	348 (8.4%)	9.03**
Periviable births	52 (0.7%)	35 (0.9%)	17 (0.4%)	8.04**

Abbreviations: LBW = low birth weight; PTB = preterm birth; APNCU = Adequacy of Prenatal Care Utilization Index.

^aMissing data comprise less than 5% for the variable.

**
p<.01,

p<.001.

Unmarked variables were non-significant (p>.05).

Table 2
Comparison of census-tract characteristics by racial status

	African-American (n=3,782)	White (n=4,141)	Test statistic ^a
Median household income	\$36,781	\$43,738	-22.56***
Poverty proportion	25.3%	16.9%	-32.43***
Unemployment rate	13.8%	10.6%	-25.10***
Percentage of people 25 years old and older that graduated high school	78.2%	81.4%	-15.61***
Gini inequality index	0.43	0.41	-10.85***
Percentage of households receiving public assistance	20.5%	12.4%	-34.93***
Percentage of households headed by single females with children age 17 and younger	12.6%	7.7%	-37.45***
Percentage of households residing in rental housing	44.0%	30.3%	-33.05***
Neighborhood risk index	0.39	-0.36	-35.50***
Neighborhood risk levels			
Percentage of adolescents in low risk neighborhoods	15.0%	34.1%	384.71***
Percentage of adolescents in medium risk neighborhoods	44.1%	55.7%	107.95***
Percentage of adolescents in high risk neighborhoods	40.9%	10.1%	1003.64***

^a Statistics reflect t-values for tests comparing means and chi-square values for comparing neighborhood level proportions.

*** Differences significant at p<.001.

Table 3
Chi-square tests for racial differences in LBW rates stratified by neighborhood risk

	African-American (n=3,782)	White (n=4,141)	Chi-square
Low neighborhood risk	11.6%	6.9%	12.10***
Medium neighborhood risk	12.9%	6.6%	44.77***
High neighborhood risk	13.1%	9.3%	4.51*

Note:

* $p < 0.05$,

** $p < 0.01$,

*** $p < .001$.

Table 4
Binomial hierarchical generalized linear model analyses for LBW odds, Models 1-3 [OR
(95% CI); fixed effects only]

Independent Variables	Model 1	Model 2	Model 3
African American (AA) ^a	1.89 (1.53, 2.34) ***	1.98 (1.57, 2.50) ***	2.09 (1.62, 2.67) ***
Medium neighborhood risk ^b		1.13 (0.93, 1.38)	1.14 (0.93, 1.40)
High neighborhood risk		1.55 (1.25, 1.93) ***	1.59 (1.27, 1.99) ***
AA × Medium neighborhood risk			0.85 (0.47, 1.56)
AA × High neighborhood risk			0.65 (0.33, 1.29)

^aWhite is the referent category.

^bLow neighborhood risk is the referent category.

*
p<.05,

**
p<.01,

p<.001

Table 5
Binomial hierarchical generalized linear model analyses for LBW odds, Models 4-6 [OR
(95% CI); fixed effects only]

Independent Variables	Model 4	Model 5	Model 6
African American (AA) ^a	1.88 (1.51, 2.34) ***	2.06 (1.64, 2.58) ***	1.99 (1.57, 2.52) ***
Medium neighborhood risk ^b	1.14 (0.96, 1.37)	1.13 (0.95, 1.36)	1.12 (0.93, 1.35)
High neighborhood risk	1.59 (1.30, 1.94) ***	1.59 (1.30, 1.95) ***	1.58 (1.28, 1.96) ***
AA × Medium neighborhood risk	0.84 (0.50, 1.40)	1.01 (0.60, 1.72)	1.07 (0.62, 1.84)
AA × High neighborhood risk	0.65 (0.35, 1.20)	0.75 (0.40, 1.42)	0.87 (0.46, 1.64)
Demographic Covariates			
Maternal age <17	1.05 (0.82, 1.35)	1.10 (0.85, 1.42)	0.92 (0.70, 1.22)
Less than high school graduate education	1.16 (0.99, 1.37)	1.15 (0.97, 1.36)	1.20 (1.01, 1.43) *
Single status	0.85 (0.67, 1.11)	0.91 (0.70, 1.19)	1.00 (0.75, 1.32)
Medical Risks			
Pre-pregnancy hypertension	2.37 (1.19, 4.71) *	2.43 (1.23, 4.80) *	2.58 (1.29, 5.13) **
Gestational hypertension	3.38 (2.52, 4.53) ***	3.06 (2.27, 4.13) ***	3.36 (2.43, 4.66) ***
Pre-pregnancy diabetes	0.87 (0.20, 3.81)	0.78 (0.21, 2.93)	0.37 (0.15, 0.90) *
Gestational diabetes	1.01 (0.62, 1.67)	0.88 (0.52, 1.50)	0.90 (0.49, 1.64)
Eclampsia	8.92 (3.99, 19.92) ***	10.21 (4.35, 23.95) ***	2.28 (0.75, 6.96)
Previous PTB	4.77 (2.42, 9.38) ***	4.32 (2.10, 8.90) ***	0.76 (0.38, 1.52)
Previous poor obstetric outcomes	3.22 (1.35, 7.68) **	2.76 (1.14, 6.68) **	1.69 (0.47, 6.06)
Previous pregnancy status	0.99 (0.81, 1.22)	0.94 (0.77, 1.15)	0.83 (0.68, 1.02)
Tobacco Use			
Smoking before pregnancy		0.72 (0.49, 1.06)	0.77 (0.53, 1.12)
Smoking during pregnancy		2.02 (1.35, 3.04) ***	1.97 (1.32, 2.95) ***
APNCU variables ^c			
Inadequate		1.49 (1.20, 1.85) ***	1.10 (0.88, 1.38)
Intermediate		1.02 (0.74, 1.41)	0.87 (0.63, 1.21)
Adequate-plus		2.62 (2.18, 3.16) ***	1.33 (1.10, 1.62) **
PTB			34.73 (27.01, 44.67) ***
Periviable birth			33.53 (16.98, 66.23) ***

Abbreviations: LBW = low birth weight; PTB = preterm birth; APNCU = Adequacy of Prenatal Care Utilization Index.

^a White is the referent category

^b Low neighborhood risk is the referent category

^c Adequate is the referent category

* p<.05,

** p<.01,

p<.001

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