Community Income, Smoking, and Birth Weight Disparities in Wisconsin

Mario Sims, PhD
Tammy Harris Sims, MD, MS
Marino A. Bruce, PhD

Abstract

This study examined the extent to which community-level income and smoking status were associated with birth-weight disparities in the state of Wisconsin. Data included 1998 and 1999 birth record files with appended census income data for African-American, Latino, and White single births in Wisconsin. Multinomial logistic regression analysis was performed where the dependent variable included low birth weight (LBW: < 2,500 grams) and very low birth weight (VLBW: < 1,500 grams) relative to normal birth weight. The independent variables included income levels categorized as poor (< $12,499), lower middle ($12,500-34,999), and upper middle to affluent ($35,000 or more) determined by zip code, and smoking status (yes/no). African-American and Latino mothers who lived in poor communities and smoked were almost three times more likely to have a low birth weight (LBW) infant than their more affluent, non-smoking counterparts. Community income and smoking status played significant roles in birth weight disparities.

Key Words: *community income, low birth weight, racial disparity, smoking, very low birth weight*

Introduction

The saying that "it takes a village to raise a child" asserts that communities play an important role in the growth and development of a child. The racial disparities in infant mortality and morbidity noted in reports such as Healthy People 2010 (United States Department of Health and Human Services, 2000) and Unequal Treatment (Smedley, Stith, & Nelson, 2003), suggest that disadvantaged communities may not have the capacity to protect or positively impact their most vulnerable members. Research has begun to examine the relationships between neighborhood or community characteristics and health outcomes among children and adults (Collins & David, 1997; Geronimus, 2000; O'Campo, Xue, Wang, & Caughy, 1997; Robert, 1998). Results from this line of research have established a link between biological, behavioral, and community-level factors. However, it is believed that further specification of the relationship between community context and health outcomes could provide new insights into the alarming health disparities between racial and ethnic populations in the United States.

Background and Significance

African-Americans and other marginalized groups tend to live in disadvantaged communities with few economic resources. These communities are often characterized by high levels of unemployment, substandard educational resources, inadequate housing, family disruption, and general disorder (Massey & Eggers, 1990; Wilson, 1987). Research has noted that living in such areas can be physically and psychologically dangerous (Bruce, 2000; Morenoff, 2003). Some of the potential adversities can have implications for birth outcomes, particularly low birth weight, a predictor of infant mortality and morbidity. Factors impacting low birth weight (LBW) and very low birth weight (VLBW) such as inadequate maternal weight gain, a low pre-pregnancy weight, and maternal illness can be linked to the restricted availability of and the lack of access to quality prenatal care and nutritious foods (Farley, Mason, Rice, Habel, Scribner, & Cohen, 2006). Disadvantaged communities are stressful environments in which individuals can easily engage in risky behaviors (e. g., smoking, alcohol use, drug use, violence) in order to cope with the stress and disorder associated with these harsh economic and social environments (Borrelli, Bock, King, Pinto, & Marcus, 1996; Collins & David, 1997; Farley et al., 2006; Morenoff, 2003; Wilson, 1996). Findings from recent research indicating that poor women smoke at higher rates than affluent women do provide some support for this idea (Borrelli, Bock, King, Pinto, & Marcus, 1996; Geronimus, Neidert, & Bound, 1993).

Purpose of the Study

The primary aim of this study was to demonstrate how birth weight disparities by race and ethnicity could be associated with a mother's community income level and smoking status. Using data from the state of Wisconsin, separately for different racial and ethnic groups, smoking and residing in poor communities was examined for the impact that it had on the risk for LBW or VLBW in newborns. Findings from this study indicated that com-

Mario Sims, PhD, is an Assistant Professor, Department of Medicine, Jackson Heart Study, University of Mississippi Medical Center, Jackson, MS.
Tammy Harris Sims, MD, MS, is an Assistant Professor, Department of Pediatrics, University of Wisconsin Medical School, Madison, WS.
Marino A. Bruce, PhD, is an Associate Professor, Family and Community Medicine, Meharry Medical College, Nashville, TN.
Address Requests for Reprints and Correspondence to: Mario Sims, PhD, Department of Medicine, The Jackson Heart Study, University of Mississippi Medical Center, 350 W. Woodrow Wilson AVE. Jackson, MS 39213. Email: msims2@medicine.umsmed.edu

munity income was an important consideration for any program aimed at eliminating birth weight disparities in particular, and overall health disparities in general, between racial and ethnic populations. The results also provided support for the notion that smoking cessation efforts in poorer communities for minority women before, during, and after pregnancy would be a crucial link in such public health endeavors.

Methodology

Research Design

The dataset in this descriptive study was used to examine the relationship between community income, smoking status, and birth-weight. This dataset was created by appending the 1990 U.S. census zip-code level data for individual birth records in the 1998 and 1999 Vital Records Birth file for the state of Wisconsin (United States Bureau of the Census, 1990; Wisconsin Department of Health and Family Services, 2000). It should be noted that zip code was the only level of geography made available in the Vital Records Birth files; therefore, it was not possible to estimate models using other units of analysis such as census tracts or block groups.

Sample and Setting

The vital records of all live born non-Hispanic Black, Latino, and non-Hispanic White single births were analyzed. Race and ethnicity of the mother was recorded on a Standard Certificate of Live Birth by the attendant physician or nurse. The race of the child was determined by the race of mother. It is important to note that the U.S. Census Bureau classifies Latinos as an ethnic group. Whereas race (African-American and White) is based on external physiological differences, ethnicity is based on identification with the cultural features of language, religion, dress, and dietary customs. The sample size for this study was 100,074. African-Americans (n = 11,313) made up 11.30% of the sample population, and Latinos (n = 6,450) made up 6.45% of the sample.

Outcome Variables

The primary outcome variable was birth weight status. The dependent variable was constructed from the birth weight that was recorded on the birth certificates for live birth infants in 1998 and 1999. The measure used in this analysis was a three-category variable that denotes three important birth weight designations. Specifically, the categories indicated whether an infant was a normal birth weight baby (birth weight exceeding 2,500 grams), a low birth weight baby (birth weight between 1,501 and 2,500 grams, or a very low birth weight baby (birth weight less than 1,500 grams or 3.3 pounds). The normal birth weight category served as the reference category.

Community income was the measure used to capture information about the economic disadvantages in a given area. The measure was drawn from the 1990 U.S. census, where zip codes represented different community areas. Krieger and colleagues (2003) have determined that the percentage of people who live below the poverty line in a census tract is a stronger indicator than other area-based measures of socioeconomic positions (Krieger, 2003; Krieger, Chen, Waterman, Rehkopf, & Subramanian, 2003; Krieger et al., 2002; Krieger, Williams, & Moss, 1997). However, it has been found that the percentage of people who live below the poverty line is not a statistically significant measure in area-level, race-specific models when examining disparities in health outcomes (Bruce, 2004; Sims, Sims, & Bruce, 2007).

Community income data was used to create three separate variables that represented important social class designations. These were poor, lower-middle income, and upper-middle to affluent income based on 1989 dollars. The birth file contains data about births occurring in the latter 1990s, however, this incongruence was not expected to effect the results. Previous analyses have shown that using census data that are removed from primary data by a decade do not effect the regression results, as neighborhoods remain stable over time (Geronimus, 1996). The poor areas in this study were those in which the average income for a family of four was less than $12,499 annually. The lower-middle income communities were those in which families had an average annual income ranging from $12,500 to $34,999. Upper-middle income areas in this study were those in which the average annual income for a family of four exceeded $35,000. The upper-middle-to-affluent income category was an omitted category in the regression analysis. Less than one percent (0.79%) of the sample of Wisconsin mothers lived in poverty income areas, while 52.10% and 47.11% of the sample resided in zip codes that were classified as lower-middle and upper-middle-to-affluent income areas, respectively.

Smoking status was the second independent variable in the analysis. This dichotomous variable classified respondents as either smokers (coded 1) or non-smokers. Approximately 19% of the pregnant mothers in this sample reported that they smoked at some point during pregnancy. It was also recognized that smoking was one of many of risk factors known to be associated with LBW, therefore, other important risk factors were included from the 1998 and 1999 Wisconsin birth records. Maternal age was represented by a dichotomous variable that was coded in a manner consistent with existing literature (Collins & David, 1997; Collins & Shay, 1996). This variable indicated whether the birth mother was younger than 20 years of age (coded 1) or older (coded 0). Maternal marital status was a categorical variable that indicated whether the individuals in the sample were married (coded 1) or not (coded 0). Maternal education was a represented by three dummy variables that indicated whether an individual completed between 0 and 11 years of education, was a high school graduate, or went to college. College attendees made up the reference category. Prenatal care was represented in a manner that has been well established in the epidemiologic literature (Collins & David, 1997). This measure consisted of three dummy variables that classified prenatal care as inadequate, intermediate, or adequate. Inadequate care only corresponded to the occasions when

a mother initiated care in the second trimester of pregnancy with one to four visits to an obstetrician/gynecologist, or initiated care in the third trimester with one or more visits. The intermediate care dummy represented the category of mothers who initiated care in the first trimester with five to eight visits, or initiated care in the second trimester with five or more visits. Adequate care corresponded to mothers who initiated care in the first trimester with nine or more visits. Adequate care is the reference category. Gestational age was a dichotomous variable that indicated whether the birth was classified as pre-term (< 37 weeks) or not (coded 0).

Data Analysis

Results from the descriptive and multivariate analyses are presented in the following section. Table 1 provides a description of the sample by race and ethnicity. Racial and ethnic disparities are noted by observing the risk ratios when comparing African-Americans to Whites and Latinos to Whites (95% confidence interval – CI). Confidence limits are estimated by the Taylor Series Method (Schessalman, 1982) (see Table 1).

The final two tables present results from multinomial logistic regression models that predict birth weight status. Multinomial logistic regression allows comparisons between the odds of low birth weight to normal birth weight, and the odds of very low birth weight to normal birth weight (Aldrich & Nelson, 1984; Long, 1997). Table 2 reports key findings from the multinomial logistic regression models that predict birth weight status represented by adjusted odds ratios (95% CI) (see Table 2).

Table 3 presents the key results from a multinomial regression model that explores how community income and smoking interact to impact birth weight status. All analyses were performed using the SPSS statistical package version 10.5 (see Tables 1 through 3).

Institutional Review Board Approval

This study was submitted to the Human Subjects Committee for review. It met the criteria for exemption by the Human Subjects Committee and the study was undertaken.

Results

The descriptive results that are presented in Table 1 show how material and health disparities can vary across racial and ethnic groups. African-American mothers were three times more likely to deliver a VLBW baby and two times more likely to have a LBW baby than White mothers were. Latino mothers, by contrast, have VLBW and LBW rates that were similar to White mothers. African-Americans were found to be more likely to live in poor areas, to smoke cigarettes, to have less than a high school education, to have inadequate prenatal care, and to have pre-term births than White mothers were. Latino mothers were found to be more likely to live in poor areas, to have children before the age of 20, to be poorly educated, and to have inadequate prenatal care relative to White mothers. It is also noteworthy that the magnitude of the risk ratios differs considerably, suggesting that the African-American/White disparities in maternal and infant risk factors and the community-income levels were greater than the corresponding Latino/Whites disparities.

Table 2 presents the multinomial logistic regression findings, represented by the adjusted odds ratios and 95% CI for risk factors that predicted LBW and VLBW relative to NBW for each racial and ethnic group in Wisconsin. The results associated with community income and gestational age did not vary across racial and ethnic groups. The community income coefficients (not reported) were not statistically significant for any group. On the other end of the spectrum, short gestation (< 37 weeks) significantly increased the odds of VLBW and LBW for each racial and ethnic group. The results associated with smoking varied slightly across racial groups. Mothers who smoked during pregnancy were twice as likely to have a LBW infant rather than a NBW infant than were mothers who did not smoke during pregnancy. However, this pattern did not hold for all groups when considering the likelihood of having a VLBW infant relative to having a NBW infant. Specifically, White mothers were the only group for which the odds of having a VLBW infant relative to a NBW infant were significantly greater (2.05, 1.63-2.57 CI) than corresponding odds for non-smokers.

The impact of marital status on birth weight status was found to vary by race as well. According to Table 2, being unmarried increases the odds of having a VLBW (1.79, 1.42-2.25 CI) or LBW (1.34, 1.20-1.49 CI) infant relative to having a NBW infant, respectively, for White mothers. Surprisingly, martial status was found to have an inverse relationship with birth weight status among Latino mothers. However, the finding that single mothers were less likely to have a VLBW infant relative to a NBW infant was produced from a sample in which only 77 Latino mothers had VLBW babies. Additional studies need to be conducted to assess the reliability of this result. Table 2 also shows that the relationship between a mother's educational attainment and the birth weight status of her child is only pertinent for White mothers. Educated White mothers are less likely to give birth to a VLBW or LBW baby relative to a NBW baby, respectively, than their less educated counterparts.

The results associated with the relationship between prenatal care and birth weight status raise a number of interesting questions. African-American mothers with few prenatal visits were less likely to give birth to a VLBW child relative to a NBW child than were African-American mothers who visited physicians on a timely and regularly basis. The results associated with prenatal care among Latino mothers indicated that adequate care decreased the likelihood that a woman would give birth to a VLBW baby relative to a NBW baby. However, the results in Table 2 also show that Latino mothers with few or no prenatal care visits were less likely to give birth to a LBW child relative to a NBW child than their counterparts who had timely and regular prenatal visits. The results for White mothers were more conventional. White mothers

Table 1. Percentage Distributions for African-American, Latino and White Mothers in Wisconsin, 1998-1999 (Sample Size)

	African-American (11,313)	Latino (6,450)	White (82,311)	RR1[1]	95% CI*	RR2[1]	95% CI*
Very low birth weight[2]	2.6 (290)	1.2 (77)	0.9 (726)	3.0	2.6-3.4	1.4	1.1-1.7
Low birth weight[2]	9.5 (1,077)	4.6 (295)	4.1 (3,405)	2.3	2.2-2.5	1.1	0.9-1.2
Cigarette use							
yes	21.8 (2,468)	9.3 (600)	19.9 (16,353)	1.1	1.0-1.2	.47	.43-.51
no	78.1 (8,837)	90.6 (5,846)	80.0 (65,874)	.96	.97-.98	1.1	1.0-1.2
Age							
<20	30.5 (3,448)	21.2 (1,370)	9.1 (7,475)	3.4	3.2-3.5	2.3	2.2-2.5
20-35	69.5 (7,865)	78.8 (5,080)	90.9 (74,836)	.76	.75-.77	.86	.85-.88
Marital status							
married	15.0 (1,699)	53.1 (3,428)	75.4 (62,102)	0.2	.19-.21	1.1	1.0-1.2
not married	85.0 (9,614)	46.9 (3,022)	24.6 (20,208)	3.5	3.4-3.6	.96	.97-.98
Education							
Less than HS	43.0 (4,868)	51.6 (3,331)	10.8 (8,918)	4.0	3.8-4.1	4.8	4.6-5.0
HS graduate	34.9 (3,946)	29.1 (1,878)	33.4 (27,529)	1.1	1.0-1.2	.87	.84-.91
College or more	21.9 (2,481)	18.9 (1,217)	55.6 (45,780)	.39	.38-.41	.34	.32-.36
Prenatal care[3]							
adequate	55.7 (6,296)	60.5 (3,904)	79.8 (65,725)	.71	.70-.73	.77	.75-.78
intermediate	28.4 (3,218)	26.9 (1,736)	14.1 (11,641)	2.0	1.9-2.2	1.9	1.8-2.0
inadequate	10.3 (1,167)	8.4 (541)	2.7 (2,259)	3.9	3.6-4.1	3.1	2.8-3.4
Gestational age[4]							
<37 weeks	8.4 (946)	4.7 (306)	4.0 (3,345)	2.1	1.9-2.2	1.2	1.0-1.3
37 weeks or more	91.6 (10,367)	95.3 (6,144)	96.0 (78,966)	.96	.95-.97	.99	.98-1.0
Community income[5]							
poor	5.8 (643)	1.0 (61)	0.1 (47)	95.5	71.1-128.4	16.0	11.0-23.5
lower-middle	76.9 (8,582)	69.2 (4,338)	47.2 (36,865)	1.63	1.61-1.65	1.47	1.44-1.50
upper-middle to affluent	17.3 (1,930)	29.9 (1,871)	52.8 (41,211)	.32	.31-.34	.57	.54-.59

Source: 1998 & 1999 Wisconsin Birth Record Files of the Vital Statistics and 1990 U.S. Census STF 3A data.

*CI - confidence interval

[1]RR1 equals the relative risk that compares blacks African-Americans with whitesWhites; RR2 is the relative risk that compares Latinos with whitesWhites.

[2]Low birth weight (LBW) rate equals births that are <2500 grams per 100 live births. Very low birth weight (VLBW) rate equals births that are <1500 grams per 100 live births.

[3]Adequate – initiation of prenatal care in the first trimester with 9 or more visits; Intermediate – initiation of prenatal care in the first trimester with 5 to 8 visits, or initiation in the second trimester with 5 or more visits; Inadequate – initiation in the second trimester with 1 to 4 visits, or initiation in the third trimester with 1 or more visits.

[4]Gestational age of less than 37 weeks is classified as pre-term or premature birth. Thirty Thirty-seven weeks or more is classified as term and post-term.

[5]Community/zip code-level income (median family income): poor – <$12,499; lower-middle – $12,500 to 34,999; upper-middle to affluent – $35,000 or more.

Table 2. Odds Ratios (95% Confidence intervals) of Very Low Birth Weight (VLBW) or Low Birth Weight (LBW) for African-American, Latino and White mothers, adjusted for individual-level characteristics: Wisconsin, 1998–1999[1]

Variable	African-American		Latino		White	
	VLBW	LBW	VLBW	LBW	VLBW	LBW
Cigarette use (yes = 1)	1.42 (.95-2.13)	2.03 (1.69-2.43)	2.00 (.88-4.56)	1.93 (1.29-2.88)	2.05 (1.63-2.57)	2.02 (1.83-2.24)
Age (<20 = 1)	1.26 (.85-1.88)	1.20 (.99-1.45)	1.09 (.53-2.22)	1.28 (.91-1.81)	1.00 (.72-1.36)	.94 (.81-1.09)
Marital status (unmar = 1)	1.19 (.73-1.93)	.15 (.89-1.48)	.44 (.23-.82)	.86 (.63-1.16)	1.79 (1.42-2.25)	1.34 (1.20-1.49)
Education (<HS =1)	.74 (.45-1.24)	1.11 (.87-1.42)	1.49 (.61-3.62)	1.00 (.67-1.50)	1.22 (.88-1.70)	1.17 (1.01-1.36)
(HS grad = 2)	.98 (.62-1.55)	.87 (.69-1.10)	1.27 (.50-3.19)	.75 (.48-1.16)	1.29 (1.04-1.60)	1.12 (1.02-1.24)
Prenatal care (inadeq = 1)	.44 (.26-.75)	.87 (.67-1.12)	4.85 (1.34-17.5)	.63 (.41-1.00)	.73 (.43-1.23)	1.23 (1.00-1.53)
(intermed = 2)	.74 (.51-1.08)	.97 (.81-1.16)	5.84 (1.55-22.0)	.89 (.56-1.41)	1.15 (.91-1.44)	1.27 (1.14-1.41)
Gestation (<37 wks = 1)	32.0 (13.0-79.0)	51.9 (42.0-64.0)	63.1 (27.0-88.0)	54.8 (39.5-76.1)	75.6 (61.5-89.1)	70.2 (63.7-77.4)

Source: 1998 & 1999 Wisconsin Birth Record Files of the Vital Statistics and 1990 U.S. Census STF 3A data.
[1]See footnotes in Table 1 for variable definitions.

who had adequate prenatal care were less likely to have a VLBW or LBW child relative to a NBW child, respectively, than White mothers who had inadequate or intermediate care (see Table 2).

Table 3 presents results from race-specific models exploring the interaction between two independent variables of interest – community income and smoking status. It is noteworthy that African-American mothers were the only group who had a segment of individuals who lived in poor communities and gave birth to VLBW and LBW children large enough for full model estimation. Nevertheless, the models, adjusted for the risk factors specified in Table 2, illustrate how environment and behavior can interact to impact health outcomes. African-American mothers who smoked during pregnancy and lived in impoverished communities were almost three times more likely to have a LBW baby (relative to a NBW baby) than were non-smoking African-American mothers who lived in affluent areas. Less stark differences in community economic resources were also found to be salient among African-American mothers because the odds of having LBW infants relative to having NBW infants among smokers residing in lower-middle income areas were 2.53 times greater (1.86-3.43 CI) than non-smoking mothers living in affluent communities. Residence in lower-middle income communities also significantly increased the odds of having a VLBW or LBW baby relative to having a NBW baby, respectively, for Latino and White mothers who smoked during pregnancy (see Table 3).

Discussion

Birth weight is a major health indicator because it conveys important information at the individual and group level. Specifically, birth weight allows researchers to draw inferences about the social welfare of a community or society, as well as make predictions about the health status of the next generation (Lewit, Baker, Corman, & Shiono, 1995; Paneth, 1995). Many factors, spanning multiple levels of analysis, combine to impact birth weight. Making sense of birth weight disparities among racial and ethnic groups in the United States involves the development and testing of models that are more explicit with regard to community context, individual behavior, and health outcomes. The relationship between community income and health outcomes has become an important component of study in social epidemiology in recent years. This study draws from and builds on this line of research. That is, race-specific models were estimated when examining the impact of community income and smoking on birth weight status among three racial and ethnic groups in the United States.

The results from this research are important because they provide a glimpse into the complexity associated with community context, individual behavior, and their implications for health outcomes. Minority mothers who smoked and lived in poor areas had a greater risk of delivering a LBW and VLBW baby than did their affluent counterparts. Interestingly, similar patterns held when comparing mothers in lower-middle income communities and mothers living in communities with more economic resources. That is, smokers in lower-middle income communities were found to have elevated risks of having a LBW infant when com-

Table 3. Odds Ratios (95% Confidence intervals) of Very Low Birth Weight (VLBW) or Low Birth Weight (LBW) for African-American, Latino and White mothers, adjusted for individual-level factors: Wisconsin, 1998–1999[1]

	Adjusted for Individual-Level Factors:					
	African-American		Latino		White	
Community Income[2]	VLBW Smoker[3]	LBW Smoker	VLBW Smoker	LBW Smoker	VLBW Smoker	LBW Smoker
Poor	1.41 (.34-5.85)	2.80 (1.56-5.05)	– §	2.74 (.48-4.63)	– §	– §
Lower-middle	1.78 (.96-3.32)	2.53 (1.86-3.43)	3.35 (1.08-10.4)	1.93 (1.15-3.24)	2.17 (1.60-2.94)	2.10 (1.84-2.40)

Source: 1998 & 1999 Wisconsin Birth Record Files of the Vital Statistics and 1990 U.S. Census STF 3A data.
[1]See footnotes in Table 1 for variable definitions.
[2]omitted category is upper-middle to affluent income.
[3]omitted category is non-smoker.
§ – undefined (no or very few low or very low weight births occurred).

pared to mothers living in affluent areas. Race appears to have less of an impact in the lower-middle income areas because each of the race-specific models produced similar results. However, it would be premature to discount the impact of race on birth outcomes because the full models could not be compared across race. The fact that less than one percent of White mothers in this sample lived in impoverished areas suggested that race can provide a buffer against living in communities having pernicious consequences for health outcomes.

The findings in this study are important, however, the analysis does have some limitations worth noting. First, the models depicted in Tables 1-3 were estimated using data from one state, the state of Wisconsin. Places vary considerably along a number of factors including economic development and race relations. Therefore, the findings reported here are not generalizable to other states or regions. A second limitation involved the presumption that zip codes represented communities. A zip code represents a heterogeneous level of geography, and does not necessarily reflect a homogenous community. A smaller level of geography such as a census block, block group, or tract would produce stronger results because this smaller area would represent a closer approximation of a homogeneous neighborhood. Finally, it is important to note that the model used does not include factors known to be associated with VLBW and LBW such as nutrition, pre-pregnancy weight, weight gain, alcohol use, drug use, psycho-social stress, STDs, and genetic factors. Incorporation of these factors could produce models that could shed more light on the relationship between community context and birth outcome disparities among racial and ethnic groups in the United States (Davis, Rovi, & Johnson, 2005; Harville, Schramm, Watt-Morse, Chantala, Anderson, & Hertz-Picciotto, 2004; Lee et al., 2005; Robert & Reither, 2004).

Conclusions

Community context and individual behaviors are especially important for understanding birth weight disparities. Two policy options should be considered when attempting to eliminate these disparities. First, public health policies need to address the structural factors that concentrate poverty in communities. This concentration of disadvantages leaves mothers to cope with negative conditions by engaging in risky behaviors, such as smoking during pregnancy, which in turn adversely affects infant health outcomes. Addressing the "invisible hand" of institutional discrimination means eliminating housing, education, and employment discrimination so that minorities are free to gain the skills necessary to live in viable communities that are likely produce optimal health outcomes for its residents (Chomitz, Cheung, & Leiberman, 1995). It also means creating an atmosphere in which minorities are not treated differently by health-care providers because of their racial or ethnic background. This will ensure that they are provided with the same information as their White counterparts about the importance of prenatal care visits, weight gain, diet, and the importance of avoiding alcohol consumption and smoking during pregnancy (Jones, 2000).

Second, in order to eliminate birth weight disparities, several alternatives related to smoking should be considered. First, policymakers and public health officials may want to consider increasing their efforts to help pregnant smokers to stop or to reduce their smoking. A recent survey of public and quasi-public organizations reveals that almost 75% of the respondents indicated that they were not doing enough to reduce smoking among pregnant women (Klerman & Spivey, 2003). The necessary resources should be given to public health agencies to make smoking prevention and cessation a fundamental part of prenatal care in order to make a significant difference in the health of low-income women and their children (Collins, David, Symons, Handler, Wall, & Dyer, 2000). Clinical trials that examine the prevalence of tobacco-use, quitting, and

relapse behavior of mothers should examine (among other factors) how adverse community factors (as well as stress and depression) influence smoking patterns. Public health policy should consider how the advertisement of cigarettes in minority magazines might contribute to the smoking patterns of poor minorities. Anti-smoking campaigns should continue to disclose to the public the numerous toxic substances that are placed in cigarettes that cause severe addiction to nicotine. Finally, researchers should continually report the high costs to society that are associated with the caring for infants exposed to tobacco before and after birth by environmental tobacco smoke. These alternatives will enable health-care providers, researchers, and public health policy makers to explore a wider array of factors that would help pregnant mothers in poor communities to permanently quit or to never start smoking. Moreover, these alternatives will indirectly help to eliminate the racial and ethnic disparities in birth weight.

References

Aldrich, J. H., & Nelson, F. D. (1984). *Linear Probability, Logit, and Probit Models.* Newbury Park, CA: Sage Publications.

Borrelli, B., Bock, B., King, T., Pinto, B., & Marcus, B. H. (1996). The Impact of Depression on Smoking Cessasion in Women. *American Journal of Preventative Medicine, 12*(5), 378-386.

Bruce, M. A. (2000). Violence among African Americans: A conceptual assessment of potential explanations. *Journal of Contemporary Criminal Justice, 16*(2), 171-193.

Bruce, M. A. (2004). Inequality and Adolescent Violence: An Exploration of Community, Family, and Individual Factors. *Journal of the National Medical Association, 96*(4), 486-495.

Chomitz, V. R., Cheung, L. W., & Lieberman, E., (1995). The role of lifestyle in preventing low birth weight. *The Future of Children: Low Birth Weight, 5*(1), 121-138.

Collins, J. W., & David, R. J. (1997). Urban violence and African-American pregnancy outcome: An ecologic study. *Ethincity and Disease, 7*(3), 184-190.

Collins, J. W., David, R. J., Symons, R., Handler, A., Wall, S. N., & Dyer, L. (2000). Low-income African American mother's perception of exposure to racial discrimination and infant birth weight. *Epidemiology, 11*(3), 337-339.

Collins, J. W., & Shay, D. K. (1996). Prevelance of low birthweight among Hispanic infants with United States-born and foreign-born mothers: The effect of urban poverty. *American Journal of Epidemiology, 139*(2), 184-192.

Davis, E. M., Rovi, S., & Johnson, M. S. (2005). Mental health, family function and obesity in African-American women. *Journal of the National Medical Association, 97*(4), 478-482.

Farley, T. A., Mason, K., Rice, J., Habel, J. D., Scribner, R., & Cohen, D. A. (2006). The Relationship Between the Neighbourhood Environment and Adverse Birth Outcomes. *Paediatric and Perinatal Epidemiology, 20*(3), 188-200.

Geronimus, A. T. (1996). Black/White differences in the relationship of maternal age to birth weight: A population-based test of the weathering hypothesis. *Social Science and Medicine, 42*(4), 589-597.

Geronimus, A. T. (2000). To mitigate, resist, or undo: Addressing structural influences on the health or urban populations. *American Journal of Public Health, 90*(6), 867-872.

Geronimus, A. T., Neidert, L. J., & Bound, J. (1993). Age patterns of smoking in US Black and White women of childbearing age. *American Journal of Public Health, 83*(9), 1258-1264.

Harville, E. W., Schramm, M., Watt-Morse, M., Chantala, K., Anderson, J. J., & Hertz-Picciotto, I. (2004). Calcium intake during pregnancy among white and African-American pregnant women in the United States. *Journal of the American College of Nutrition 23*(1), 43-50.

Jones, C. P. (2000). Levels of Racism: A theoretic framework and a gardener's tale. *American Journal of Public Health, 90*(8), 1212-1215.

Klerman, L. V., & Spivey, C. (2003). Smoking-related activities in prenatal care programs. *American Journal of Preventative Medicine, 25*(2), 129-135.

Krieger, N. (2003). Does racism harm health? Did child abuse exist before 1962? On explicit questions, critical science, and current controversies: An ecosocial perspective. *American Journal of Public Health, 93*(2), 194-199.

Krieger, N., Chen, J. T., Waterman, P. D., Rehkopf, D. H., & Subramanian, S. V. (2003). Race/ethnicity, gender, and monitoring socioeconomic gradients in health: a comparison of area-based socioeconomic measures—the public health disparities geocoding project. *American Journal of Public Health, 93*(10), 1655-1671.

Krieger, N., Chen, J. T., Waterman, P. D., Soobader, M. J., Subramanian, S. V., & Carson, R. (2002). Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: does the choice of area-based measure and geographic level matter?: the Public Health Disparities Geocoding Project. *American Journal of Epidemiology, 156*(5), 471-482.

Krieger, N., Williams, D. R., & Moss, N. E. (1997). Measuring social class in U. S. public health research: Concepts, methodologies, and guidelines. *Annual Review of Public Health, 18*, 341-378.

Lee, R. E., Harris, K. J., Catley, D., Shostrom, V., Choi, S., Mayo, M. S., et al. (2005). Factors associated with BMI, weight perceptions and trying to lose weight in African-

American smokers. *Journal of the National Medical Association, 97*(1), 53-61.

Lewit, E. M., Baker, L. S., Corman, H., & Shiono, P. H. (1995). The direct cost of low birth weight. *The Future of Children: Low Birth Weight, 5*(1), 35-56.

Long, J. S. (1997). *Regression Models for Categorical and Limited Dependent Variables.* Thousand Oaks, CA: Sage Publications.

Massey, D. S., & Eggers, M. L. (1990). The ecology of inequality: Minorities and the concentration of poverty, 1970-1980. *American Journal of Sociology, 95*(5), 1153-1188.

Morenoff, J. D. (2003). Neighborhood mechanisms and the spatial dynamics of birth weight. *American Journal of Sociology, 108*(5), 976-1017.

O'Campo, P., Xue, X., Wang, M. C., & Caughy, M. O. (1997). Neighborhood risk factors for low birth weight in Baltimore: A multilevel analysis. *American Journal of Public Health, 87*(7), 1113-1118.

Paneth, N. S. (1995). The problem of low birth weight. *The Future of Children: Low Birth Weight, 5*(1), 19-34.

Robert, S. A. (1998). Community-level Socioeconomic Status Effects on Adult Health. *Journal of Health and Social Behavior, 39*(1), 18-37.

Robert, S. A., & Reither, E. N. (2004). A multilevel analysis of race, community disadvantage, and body mass index among adults in the US. *Social Science & Medicine, 59*(12), 2421-2434.

Schessalman, J. J. (1982). *Case Control Studies: Design, Conduct, and Analysis.* New York: Oxford University Press.

Sims, M., Sims, T. L., & Bruce, M. A. (2007). Urban poverty and infant mortality rate disparities. *Journal of the National Medical Association, 99*(4), 349-356.

Smedley, B. D., Stith, A. Y., Nelson, A. R., & Institute of Medicine (U.S.). Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. (2003). *Unequal treatment : confronting racial and ethnic disparities in health care.* Washington, D.C.: National Academies Press.

United States Bureau of the Census. (1990). *1990 Census of Population and Housing: Summary Tape File 3A.* Washington, DC: U. S. Department of Commerce, Bureau of the Census.

United States. Dept. of Health and Human Services. (2000). *Healthy people 2010.* Washington, DC: U.S. Dept. of Health and Human Services : For sale by the U.S. G.P.O., Supt. of Docs.

Wilson, W. J. (1987). *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy.* Chicago: University of Chicago Press.

Wilson, W. J. (1996). *When Work Disappears: The World of the New Urban Poor.* New York: Alfred A. Knopf.

Wisconsin Department of Health and Family Services. Division of Health Care Financing. Bureau of Health Information. (2000). *Wisconsin Vital Records Birth Certificate Data, 1998-1999.* Madison, WI: Wisconsin Department of Health and Family Services.

Acknowledgments

The authors acknowledge Drs. Michael Fleming, Michael Fiore and David Brown for their comments. We also thank Randall Glysch of the Wisconsin Department of Health and Family Services and Bureau of Health Information for creating the data files for this study.