

Low Birth Weight: Race and Maternal Nativity— Impact of Community Income

Jing Fang, MD; Shantha Madhavan, DrPH; and Michael H. Alderman, MD

ABSTRACT. *Background.* The purpose of this article is to determine the effect of community income as a co-factor in the association of low birth weight, race, and maternal nativity in New York City.

Methods. New York City birth records, 1988 through 1994, provided data on maternal and infant characteristics. There were 274 121 white and 279 826 black mothers included in this study. Black mothers were classified as US-born (South and Northeast) and foreign-born (the Caribbean, South America, and Africa). Based on the 1990 US census income data, census tracts of the city were aggregated by tertile of per capita income as low-, middle-, and high-income communities. Incidence of low birth weight was estimated by race, maternal nativity in the city as a whole, and each income community.

Results. Overall, black women had a substantially higher risk of low birth weight infants (<2500 g) than did whites (13.1% vs 4.8%). Foreign-born black mothers had a birth weight advantage over US-born black mothers (10.0% vs 16.7%). After controlling for socioeconomic and medical characteristics, the risks of low birth weight for blacks compared with whites were 0.95 (95% confidence interval: 0.87–1.03) and 0.86 (0.69–1.02) for Caribbean- and African-born black mothers, respectively. Moreover, in low-income communities, compared with white mothers, the risks for Caribbean- and African-born black mothers were 0.88 (0.79–0.97) and 0.77 (0.61–0.96), respectively. By contrast, US and South American-born black mothers had a consistently higher risk of low birth weight infants, regardless of community income level.

Conclusion. Low birth weight was significantly less frequent among whites than among blacks. However, this overall finding masked substantial variation among blacks, determined by maternal nativity and the income level of the community in which they lived. In fact, Caribbean- and African-born black mothers had birth outcomes generally similar to and, in poor communities, even more favorable than those for whites. *Pediatrics* 1999;103(1). URL: <http://www.pediatrics.org/cgi/content/full/103/1/e5>; low birth weight, nativity, blacks, New York City, community income.

ABBREVIATIONS. OR, odds ratio; CI, confidence interval.

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Low birth weight remains a greater public health problem in the United States than in most other industrialized nations.¹ It is more common among blacks than among whites and is a major determinant of infant mortality.^{2,3} The role of inheritance and environment in determining birth weight remains unresolved, although recent evidence suggests that genetic influences may not be the overriding determinant.⁴

In any event, we, and others, have found that the designation "black race" does not define a homogeneous population. For example, in New York City, cardiovascular mortality varies among blacks according to place of birth,⁵ and, more to the point here, non-US-born black mothers tend to have more favorable birth outcomes than do their US-born counterparts.^{4,6–8} In short, factors other than genetic inheritance may contribute substantially to birth outcomes.⁹

In New York City, we have now explored the relation of maternal birthplace to birth outcome, taking into account other ecologic social factors. In addition to confirming the favorable association of foreign maternal origin and birth outcomes among blacks,⁴ we demonstrate further that the risk of low birth weight varied substantially among foreign-born black mothers according to the particular place of maternal birth.

Perhaps more importantly, we have found that this association of maternal nativity to birth outcome was influenced profoundly by the socioeconomic characteristics of the community of current maternal residence. In fact, in poor communities, the risk of low birth weight for Caribbean- and African-born black mothers actually was less than that for white mothers.

MATERIAL AND METHODS

Data Sources

This study is based on New York City birth records from 1988 through 1994.¹⁰ The material was provided by the New York City Health Department, to which all births and deaths in the city are reported. Personal identifying information was eliminated to preserve confidentiality. Birth certificates included sociodemographic characteristics for mother and father, information about maternal experience during pregnancy, her relevant risk factors, and the characteristics of the newborn.

Maternal race for blacks was based on birth certificate indication that race was Black, Negro, or African American, or by national origin being specified as Jamaican, Nigerian, West Indian, or Haitian. Mother's race of white was based on an indication of race as "white" or if it had been specified as Canadian, German, Italian, Lebanese, Near Eastern, Arab, or Polish. Those who cited their ancestry as of Mexican, Puerto Rican, Cuban, and/or other

Hispanic and Spanish-speaking descent were categorized as Hispanics and were excluded from this study. Subjects in this article were non-Hispanic blacks and non-Hispanic whites. All single live births of non-Hispanic black and white mothers residing in New York City were selected for analysis.

There were 950 924 total births in New York City over the 7-year period. Of these, 929 224 (97.7%) were single births. Among them, 29.4% and 30.1% were non-Hispanic whites and blacks, respectively. For 279 826 non-Hispanic blacks, maternal nativity sites were selected for analysis if each site had at least 1% of mothers. The following five sites met this criterion: South United States, 17 968 (6.4%); Northeast United States, 155 101 (55.4%); the Caribbean, 76 426 (27.3%); South America, 11 006 (3.9%); and Africa, 9362 (3.3%). Together, these five nativity areas accounted for 96.3% of total New York City non-Hispanic black mothers.

Low birth weight was defined as weight <2500 g. Preterm birth was defined as gestational age <37 weeks. Maternal characteristics included maternal age; race/ethnicity; birthplace; educational attainment; employment status; marital status; health insurance through Medicaid; and prenatal care utilization, which was described as percentage of mothers whose prenatal care started during the first trimester and the percentage with no prenatal care during pregnancy. Other variables included substance abuse during pregnancy, chronic diseases of the mother, and complications of pregnancy.

Because of the lack of income information on the birth records, income data were provided by Census Bureau to define the income status (summary tape file 3) by community.¹¹ All New York City census tracts were aggregated into communities by tertile of per capita income. These three strata of communities then were specified as low- (<\$10 913.7), middle- (\$10 913.7–\$15 785.6), and high-income community (>\$15 785.6).

Data Analysis

χ^2 Test for categorical variables and Student's *t* test for continuous variables were used to examine the significance of bivariate relationships between mother's race (black and white) and maternal characteristics, as well as for birth outcomes, which include low birth weight and preterm births. To determine the difference in maternal characteristics between black mothers by nativity status, χ^2 test for categorical variables and one-way analysis of variance for continuous variables were used.

Logistic regression analysis was used to estimate odds ratio (OR) for the independent association of maternal characteristics to low birth weight. Separate models for race (black vs white) and for each nativity group among black mothers vs whites were constructed. The other independent variables used in these models included maternal age; educational attainment; employment status; community income; marital status; prenatal care utilization; smoking, alcohol, and drug abuse during pregnancy; chronic disease history such as hypertension, cardiac, and renal diseases; and complications during pregnancy such as bleeding, eclampsia, and preterm birth.

Furthermore, stratifying New York City census tracts as communities by tertile of per capita income, the effects of race and nativity on risk of low birth weight in each income community were determined by constructing separate regression models, controlling for other socioeconomic factors.

RESULTS

Individual Factors: Race and Maternal Nativity

Overall, there were significant differences between whites and blacks in virtually all maternal characteristics (Table 1). In general, black compared with white mothers were younger; had poorer socioeconomic status; were less likely to obtain prenatal care; and more likely to smoke cigarettes, consume alcohol, and abuse drug during pregnancy. The percentage of low birth weight and preterm births was significantly higher among blacks than among whites (Table 1).

Stratification of black mothers by nativity revealed significant differences between the birthplace groups

TABLE 1. Maternal Characteristics and Birth Outcome by Mother's Race, New York City, 1988–1994

Characteristic*	Whites (273 295)	Blacks (279 826)
Age (y) (%)		
<20	3.4	14.5
20–34	76.9	74.7
≥35	19.7	10.8
Socioeconomic characteristic (%)		
Education (≥high school)	58.3	35.3
Employment	48.9	36.8
Married	86.9	33.1
Medicaid	13.9	54.9
Per capita income in 1989		
Low (<\$10 913.7)	16.0	61.7
Middle (\$10 913.7–15 785.6)	31.5	30.5
High (>\$15 785.6)	52.5	7.9
Substance abuse (%)		
Cigarettes (>½ pack/d)	6.5	10.2
Alcohol (>2 drinks/wk)	1.1	2.3
Drugs (heroin, cocaine use)	0.9	5.0
Prenatal care utilization (%)		
In 1st trimester	51.2	21.7
No prenatal care	1.9	7.3
Chronic disease history (%)		
Diabetes	2.4	2.7
Hypertension	1.5	2.8
Renal disease	2.0	2.2
Birth outcomes		
Birth weight (g)	3383.9	3133.3
Low birth weight (<2500 g) (%)	4.8	13.1
Very low birth weight (<1500 g) (%)	0.8	2.9
Preterm birth (<37 wk) (%)	7.3	16.2

* Differences between race for all characteristics were highly significant ($P < .001$).

for almost every maternal characteristic examined (Table 2). US-born black mothers (South, and Northeast) generally had poorer socioeconomic status, were unmarried, and were less likely to have had prenatal care compared with foreign-born black mothers. Compared with Northeastern-born, Southern-born mothers were older and less likely to be primiparous. The most striking difference, however, was in regard to substance abuse of all kinds, which was invariably a greater problem in the US than in the foreign-born groups.

Among the three groups of foreign-born mothers, Caribbean-born mothers enjoyed a slightly higher socioeconomic status than did the other foreign-born groups. Mothers from Africa had the lowest substance abuse rates.

Birth weight and preterm births differed sharply according to maternal nativity. Infants of foreign-born black mothers had significantly higher birth weight (3225.3 vs 3039.8 g) and a lower proportion of low birth weight (10.0% vs 16.7%) than did infants of all US-born black mothers. In the foreign-born groups, low birth weight rates were 7.6%, 8.6%, and 11.3%, respectively, for mothers born in Africa, Caribbean, South America (Table 3). A similar trend was observed for preterm births.

Logistic regression models, controlling for other maternal characteristics and socioeconomic factors, revealed that black mothers were significantly more likely to deliver low birth weight infants than were white mothers (OR = 1.61; 95% CI: 1.47–1.74).

Additional logistic regression models showed that

TABLE 2. Characteristics of Black Mothers by Nativity, New York City, 1988–1994

	South	Northeast	Caribbean	South America	Africa
Total births	17 968 (6.4%)	155 101 (55.4%)	76 426 (27.3%)	11 006 (3.9%)	9362 (3.3%)
Age (y) (%)*					
<20	5.9	21.0	6.4	9.2	3.0
20–34	73.7	72.6	77.0	78.1	83.7
≥35	20.4	6.4	16.6	12.71	13.3
Socioeconomic characteristic (%)					
≥High school*	33.4	36.7	36.3	34.4	43.9
Employment**	40.1	31.0	50.6	47.7	35.2
Married**	31.9	22.8	47.5	54.8	60.3
Medicaid**	56.3	62.6	47.3	44.7	47.4
Primipara**	24.8	33.4	32.5	35.3	28.2
Per capita income*					
Low	69.1	69.8	46.3	51.6	57.2
Middle	23.9	23.5	44.2	41.8	31.1
Substance abuse (%)					
Cigarettes**	15.8	14.7	1.9	1.6	0.8
Alcohol**	4.0	3.1	0.6	0.8	0.3
Drugs**	7.9	7.3	0.6	0.5	0.2
Prenatal care utilization (%)*					
In 1st trimester	22.4	19.8	24.7	25.7	22.3
No prenatal care	8.4	9.6	3.3	3.3	4.4
Chronic disease history (%)					
Diabetes	2.8	1.8	4.2	4.5	3.3
Hypertension	3.8	2.5	3.1	2.4	3.0
Renal disease	2.5	2.6	1.3	1.1	2.9

Note: substance abuse indicates [cigarette, >1/2 pack per day; alcohol, >2] drug, * $P < 0.05$; ** $P < .01$.

TABLE 3. Birth Outcomes Among Black Mothers by Nativity

	South N = 17 968	Northeast N = 155 101	Caribbean N = 76 426	South America N = 11 006	Africa N = 9362
Birth weight (g)*	3059.7	3062.9	3258.8	3167.3	3307.1
Low birth weight (%)					
<2500 g*	15.9	15.4	8.6	11.3	7.6
<1500 g**	3.4	3.2	2.2	2.6	1.8
Preterm birth (%)*	20.3	19.6	13.9	16.6	13.3

* $P < .01$; ** $P < .05$.

mother's birthplace was an independent predictor of low birth weight babies. Classifying black mothers by birthplace, the risk of a low birth weight infant for each nativity group was estimated using New York City whites as the reference group (Table 4). US-born, as well as South American-born, black mothers had a higher risk of delivering low birth weight infants than did New York City whites. By contrast, Caribbean- and African-born black mothers had a risk of low birth weight newborns similar to that for whites. As expected, most of the maternal socioeconomic characteristics and other risk factors were independently associated with low birth weight as well as with preterm birth.

Community Factor: Income Modifies the Effect of Race and Maternal Nativity on Low Birth Weight

The modifying impact of community income on other determination of incidence of low birth weight was revealed by three income levels (Table 5). Overall, white mothers had lower risk of low birth weight babies than did black mothers. This difference was greatest in high- and middle-income communities. In the poorest community, the risk of low birth weight was almost similar for white and black mothers born in the Caribbean and Africa. On the other hand, US-born black mothers living in the lowest income

TABLE 4. Maternal Factors Predicting Low Birth Weight by Logistic Regression

	OR	95% CI
Age <20 y (yes = 1)	1.32	1.24–1.40
Marital status (unmarried = 1)	1.06	1.01–1.12
Education (<high school = 1)	1.10	1.05–1.16
Employment (unemployed = 1)	1.02	0.93–1.10
Insurance (no insurance = 1)	1.03	0.99–1.07
Neighborhood income*		
Middle	0.93	0.89–0.98
High	0.90	0.86–0.95
Trimester in which prenatal care began (1st as reference)		
2nd and 3rd	0.96	0.91–1.01
No prenatal care	1.25	1.13–1.38
Alcohol (yes = 1)	1.42	1.26–1.61
Drug abuse (yes = 1)	2.49	2.27–2.71
Cigarette (yes = 1)	1.54	1.42–1.69
Primipara (yes = 1)	1.07	1.00–1.15
Preterm birth (yes = 1)	3.26	3.12–3.41
Birth place (NYC whites as reference)		
South US	1.52	1.35–1.68
Northeast US	1.30	1.21–1.40
Caribbean	0.95	0.87–1.03
South America	1.24	1.08–1.39
Africa	0.86	0.69–1.02
Chronic disease (yes = 1)	2.10	1.92–2.27

* Low income as reference.

TABLE 5. Incidence of Low Birth Weight by Community Income, Race, and Maternal Nativity

	Income Level (Per Capita Income 1989)		
	Low (<\$10 913.7)	Middle (\$10 913.7–15 785.6)	High (>\$15 785.6)
	(Per 100 live births)		
All mothers	10.4	7.6	5.6
Whites	7.4	4.6	4.0
Blacks	14.2	11.1	11.4
Southern-born	17.2	12.5	12.9
Northeastern-born	16.1	13.7	13.1
Caribbean-born	8.0	8.4	9.1
South American-born	11.3	11.0	12.5
African-born	7.0	7.8	7.8

communities had the highest rates of low birth weight babies.

Within each income category, the factors associated with risk of low birth weight were assessed by logistic regression analysis. Although US-born black mothers had a consistently higher risk of low birth weight babies in all three income communities, the excess risk was greatest in the poorest community (Fig 1). For foreign-born black mothers, community income modified substantially the risk of low birth weight. Overall, black mothers born in the Caribbean and Africa had risk of low birth weight similar to that for white mothers. This risk is smaller for mothers living in poor communities. On the other hand, Caribbean- and African-born mothers living in the poor communities had a lower risk of low birth weight compared with whites, with OR of 0.88 (95% CI: 0.79–0.97) and 0.77 (0.61–0.96), respectively. In

the middle- and high-income communities, the experience for Caribbean- and African-born mothers was similar to that for whites. For black mothers born in South America, the risk of low birth weight was consistently higher than that for whites across income levels.

DISCUSSION

Low birth weight is more common among black than white newborns. Mounting evidence suggests that genetic endowment may not be the full, or even the primary, explanation for this variation.⁴ We now confirm that in New York City the important association of factors such as low socioeconomic status, substance abuse, and maternal birthplace to the risk of low birth weight^{2,4,12–15}; however, in addition, we report that the specific area of maternal origin, and not just the United States versus foreign, as well as community income of maternal residence strongly influences low birth weight.

Although in general, black infants are at greater risk for low birth weight than are white infants, black race does not define a homogeneous group. The simple fact of maternal birthplace seen here, and elsewhere, strongly influences birth outcomes.^{4,6–8} In addition to confirming the superior birth outcomes of foreign-born black mothers, we have found that heterogeneity of both maternal characteristics and low birth weight exists within immigrant groups according to particular region of origin. The differences are so great that migrants from Africa and from the Caribbean had approximately the same likelihood of delivering a low birth weight infants as

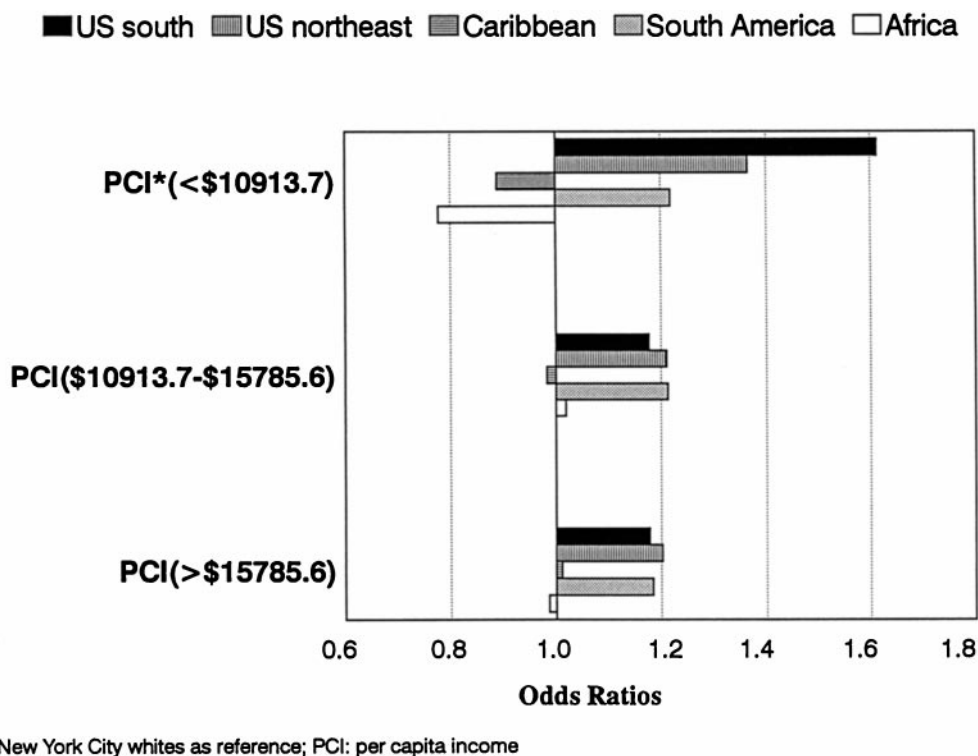


Fig 1. OR and 95% CI of low birth weight infants by nativity of black mothers and community income, New York City 1988–1994. S indicates Southern-born black mothers; NE, Northeastern-born black mothers; C, Caribbean-born black mothers; SA, South American-born black mothers; A, African-born black mothers.

did New York City white mothers. On the other hand, those from South America, as with US-born black mothers, were disadvantaged in terms of birth weight.

We also have found that maternal nativity is associated with the risk of low birth weight, depending on the income level of the community in which the mother resides. In the poor communities, Caribbean- or African-born mothers had significantly lower risk of low birth weight babies than did whites, even after adjusting for other socioeconomic and maternal characteristics. In the middle- and high-income communities, US-born and South American-born black mothers had a higher risk of low birth weight infants compared with risk for New York City whites, whereas mothers from Africa and the Caribbean had a risk similar to that for whites. It would appear that individual factors such as nativity may be expressed differently, depending on the social environment characteristics where the mother resides.

That nativity is associated with differences in other health outcomes has been reported previously for New York City. For example, black New Yorkers born in the Caribbean had lower cardiovascular and cancer mortality^{5,16} than did blacks born in the South and Northeast United States; however, we also have reported that a lower mortality risk is not the invariable outcome for Caribbean immigrants, because they have greater prostate cancer death rates than do other New York blacks.¹⁶

The nativity-related differences in incidence of low birth weight seen here suggests that early life experiences of the mothers may have enduring health impacts. Another possibility is that this outcome reflects selection by immigration. Those who migrated were favored by better early nutrition and superior early lifestyle conditions that led to more positive pregnancy-related health behaviors, particularly in regard to substance abuse.¹⁷

The favorable birth outcome of Caribbean- and African-born black mothers, compared with that for whites, particularly in the poorest communities where poor nutrition, poor access to medical care, and high rates of substance abuse are prevalent, suggests the possibility that early lifestyle of these black mothers provided a health advantage that cushioned the disadvantage of current community poverty.

These findings indicate that environmental factors such as income help to explain the occurrence of low birth weight. Furthermore, it was observed that substantial relation between this community-level factor and individual-level risk factors in determining low birth weight exist. These data suggest that efforts to reduce low birth weight might be more effective by targeting population by community factor, rather than by individuals identified by demographic characteristics.

The possible relation of these findings to variation in cardiovascular mortality is intriguing. Low birth weight has been associated with increased risk of hypertension, coronary heart disease, and diabetes in later life.¹⁸ Although these adult conditions are more common overall in black than in white, the incidence

also had been shown to differ among blacks. It is interesting, for example, that Caribbeans, who had the highest birth weight, also had the lowest cardiovascular mortality in New York.⁵

We also have reported previously the variation in cardiovascular mortality according to the degree of residential segregation in New York City. Blacks living in poorer black areas had lower cardiovascular mortality than did whites who lived in the same areas, even after controlling for socioeconomic status.¹⁹ This is consistent with the present finding that in the poorest communities, there was a lower risk of low birth weight in black mothers of Caribbean and African origin than in whites living in the same areas.

All foreign-born mothers in general migrated from a less affluent to a more affluent country, where native-born mothers should have been expected to have better pregnancy outcomes.²⁰ Because the reverse was generally true, it suggests that selective immigration may be a relevant factor. Those who migrated were more likely to be affluent members of their native country. On the other hand, the unfavorable pregnancy outcome of South American-born mothers suggests that selective immigration may not provide the complete explanation or may not be sufficient to ensure superior birth outcomes. It would be desirable, but not possible here, to compare socioeconomic status and birth outcomes of immigrants to those in their country of origin.

The major limitation of the current study is the absence of information on length of New York residence for foreign-born mothers before delivery. Acculturation, through long-term residence, has been associated with increasingly negative birth outcomes among foreign-born mothers.^{21,22} This included unhealthy behavior such as smoking and excessive use of alcohol and loss of traditional healthy behaviors. It also may affect health by virtue of being a source of stress or by affecting individual responses to stress.

The higher risk of low birth weight in infants of South American-born black mothers compared with infants of mothers born in other foreign countries has not been reported previously. This may be related to the fact that the educational level of South American-born mothers was below that of Caribbean and Africa immigrants. Again, differences in their early life experience, lifestyle, or other sociodemographic characteristics might explain the differences observed.

In summary, overall, black mothers in New York City are more likely than whites to deliver low birth weight babies. However, this is by no means a uniform finding and is influenced powerfully by such maternal factors as nativity as well as by communal factors as community per capita income level. Thus, if the lower risk of low birth weight among Caribbean- and African-born black mothers could be realized by other black mothers, the disparity in low birth weight between blacks and whites essentially would be eliminated.

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