

Special Article

DIFFERING BIRTH WEIGHT AMONG INFANTS OF U.S.-BORN BLACKS,
AFRICAN-BORN BLACKS, AND U.S.-BORN WHITES

RICHARD J. DAVID, M.D., AND JAMES W. COLLINS, JR., M.D., M.P.H.

ABSTRACT

Background In the United States, the birth weights of infants of black women are lower than those of infants of white women. The extent to which the lower birth weights among blacks are related to social or genetic factors is unclear.

Methods We used vital records for 1980 through 1995 from Illinois to determine the distribution of birth weights among infants born to three groups of women — U.S.-born blacks, African-born blacks, and U.S.-born whites.

Results The mean birth weight of 44,046 infants of U.S.-born white women was 3446 g, that of 3135 infants of African-born black women was 3333 g, and that of 43,322 infants of U.S.-born black women was 3089 g. The incidence of low birth weight (weight less than 2500 g) was 13.2 percent among infants of U.S.-born black women and 7.1 percent among infants of African-born black women, as compared with 4.3 percent among infants of U.S.-born white women (relative risks, 3.1 and 1.6, respectively). Among the women at lowest risk (those 20 to 39 years old, with 12 years of education for themselves and their spouses, early prenatal care, gravida 2 or 3, and no previous fetal loss), the rate of low birth weight in infants of African-born black women (3.6 percent) was closer to the rate in infants of U.S.-born white women (2.4 percent), and the rate in infants of U.S.-born black women remained high (7.5 percent).

Conclusions The birth-weight patterns of infants of African-born black women and U.S.-born white women are more closely related to one another than to the birth weights of infants of U.S.-born black women. (N Engl J Med 1997;337:1209-14.)

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DURING the past 40 years, epidemiologic research has elucidated many important associations between the sociodemographic characteristics of mothers and the birth weight of infants.¹⁻⁴ For example, the extremes of childbearing age,¹ cigarette smoking,² inadequate prenatal care,³ urban poverty,⁴ and black race⁵ are well-documented risk factors for low birth weight. Other obstetrical risk factors account for part of the racial disparity in birth weights, but differences persist.⁶⁻⁹

Although the incidence of low birth weight de-

creases in both blacks and whites as the number of risk factors declines, the improvement is faster among whites, resulting in a wider birth-weight gap between blacks and whites among infants of low-risk women.^{1,4} This has led some investigators to believe that genetic factors associated with race influence birth weight.¹⁰⁻¹⁵ In the 1967 National Collaborative Perinatal Project, only 1 percent of the total variance in birth weight among 18,000 infants was accounted for by socioeconomic variables, leading the authors to conclude that “race behaves as a real biological variable in its effect on birth weight. This effect of race [is] presumably genetic.”¹⁰ The assumption that black women differ genetically from white women in their ability to bear normal or large infants persists in more recent studies of fetal growth,^{13,16} one of which, for example, refers to “genetic factors affecting growth, such as neonatal sex and race.”¹⁶

Few data have been published on the birth weights of infants born to African-born women in the United States. Most African Americans trace their origins to western Africa, where the slave trade flourished in the 17th and 18th centuries.^{17,18} It is estimated that U.S. blacks derive about three quarters of their genetic heritage from West African ancestors and the remainder from Europeans.¹⁸⁻²¹ To the extent that population differences in allele frequency underlie the observed differences in birth weight between blacks and whites in the United States, one would expect women of “pure” West African origin to bear smaller infants than comparable African Americans, considering the European genetic admixture in the latter. However, to our knowledge, no population of West African women delivering infants in the United States has been studied. We therefore undertook an analysis of racial differences in birth weight based on U.S.-born and African-born women giving birth in Illinois.

From the Division of Neonatology, Cook County Children's Hospital (R.J.D.); the Department of Pediatrics, School of Medicine, University of Illinois at Chicago (R.J.D.); the Division of Neonatology, Children's Memorial Hospital (J.W.C.); and the Department of Pediatrics, Northwestern University Medical School (J.W.C.) — all in Chicago. Address reprint requests to Dr. David at the Division of Neonatology, Cook County Children's Hospital, 700 S. Wood St., Chicago, IL 60612.

METHODS

Study Population

We obtained data on the birth weights of singleton black and white infants born in Illinois and the birthplaces of their mothers, using birth-certificate tapes for 1980 through 1995 from the Illinois Department of Public Health. All the white infants studied had U.S.-born mothers and were not of Latino origin. The mothers of the black infants fell into two groups: women born in sub-Saharan Africa and those born in the United States. We selected random samples of the white and black U.S.-born women in order to have groups convenient for analysis; these groups included 2.5 percent of white births and 7.5 percent of black births.

Black women born in the Western Hemisphere but not in the United States (i.e., born in Canada, the Caribbean, or South America) were excluded from the study. Such designations of maternal origin were available for the period 1980 through 1988. During that period, birth records were coded with three separate fields: the mother's race, the mother's place of birth, and the mother's origin or descent. Women whose race was coded as "black," whose place of birth was coded as "not in Western Hemisphere," and whose origin or descent was coded as "Africa, excluding northern Africa" were considered to have immigrated from sub-Saharan Africa. According to the 1990 Census, 66 percent of African-born blacks living in Illinois for whom a sub-Saharan country of birth was recorded came from either Nigeria or Ghana.²² From 1989 on, the variable indicating origin or descent was replaced by a variable specifically pertaining to Hispanic origin, but a new, detailed set of birthplace codes allowed us to identify births on the basis of the mother's country of birth. We therefore selected births from 1989 through 1995 in which the mother's birthplace was 1 of 17 present-day countries corresponding to the area from which African slaves originated in the 17th and 18th centuries.^{18,20}

Analysis of Birth Weights

As a first step toward exploring the possible contribution of genetic factors to the racial disparity in outcomes of pregnancy,

we compared the curves for the distribution of birth weight, the mean birth weights, and the rates of low birth weight (defined as the number of births of infants weighing less than 2500 g per 100 live births) of infants born to U.S.-born blacks, African-born blacks, and U.S.-born whites. In addition, we computed rates of moderately low (1500 to 2500 g) and very low (<1500 g) birth weight. Next, we determined the distribution of sociodemographic risk factors (the mother's age, education, and marital status, the trimester of first prenatal care, and the father's education) and reproductive risk factors (the overall number of pregnancies and whether there was a history of fetal loss or infant death) in the three groups of women. For the risk factors and outcomes, we calculated relative risks and 95 percent confidence intervals, using the infants of U.S.-born white women as the reference group.²³

Because the three populations differed, we repeated the birth-weight comparisons after adjustment for differences in risk profiles. We did so in three ways. First, we compared each African-born mother with two similar U.S.-born women, one white and one black, who were matched for age, education, marital status, prenatal care, parity, and history of fetal loss. Second, we used the REG procedure (SAS, release 6.07, Cary, N.C.) to create a model showing birth weight as a function of all the risk factors for which data were available, except paternal education (data on that variable were missing for 20 percent of births) and prior loss of an infant (prevalence, <5 percent). We then estimated mean differences in birth weight among the three subgroups, both by subtracting intercept terms estimated in three subgroup-specific models and by modeling the subgroups two at a time, with ethnic status entered as a dichotomous dummy variable.²⁴ Third, we repeated the birth-weight analysis but limited it to subgroups of low-risk women defined according to social, demographic, and reproductive risk factors.

Our analysis used birth-certificate tapes from which the identifying information on the individual women and their infants had been removed. These data were provided by the Illinois Department of Health, which provides such "sterilized" birth tapes to researchers conducting epidemiologic studies.

TABLE 1. BIRTH-WEIGHT DATA IN ILLINOIS, 1980-1995, ACCORDING TO THE MOTHER'S RACE AND PLACE OF BIRTH.*

VARIABLE	SUBGROUP OF MOTHERS			RELATIVE RISK (95% CI) IN BLACK MOTHERS†	
	U.S.-BORN WHITES	AFRICAN-BORN BLACKS	U.S.-BORN BLACKS	AFRICAN-BORN	U.S.-BORN
Raw data					
No. of births	44,046	3135	43,322		
Mean birth weight (g)	3,446	3333	3,089		
Low birth weight (% of infants)	4.3	7.1	13.2	1.6 (1.4-1.9)	3.1 (2.9-3.2)
Moderately low	3.6	4.8	10.6	1.3 (1.1-1.6)	3.0 (2.8-3.1)
Very low	0.7	2.3	2.6	3.2 (2.5-4.1)	3.5 (3.1-4.0)
Matched cases‡					
No. of births	2,950	2950	2,950		
Mean birth weight (g)	3,475	3341	3,195		
Low birth weight (% of infants)	3.6	6.9	8.5	1.9 (1.5-2.4)	2.4 (1.9-2.9)
Moderately low	3.1	4.7	6.1	1.5 (1.2-2.0)	2.0 (1.5-2.5)
Very low	0.5	2.2	2.4	4.1 (2.4-7.0)	4.5 (2.6-7.7)

*Data on birth weight were missing for 19 infants (0.02 percent of the total). Low birth weight was defined as a weight of less than 2500 g, moderately low birth weight as a weight of 1500 to 2499 g, and very low birth weight as a weight of less than 1500 g.

†Relative risks shown are for the risk of low birth weight in the infants of women in the group shown as compared with the infants of U.S.-born white women. CI denotes confidence interval.

‡In this analysis, each African-born black woman was matched with one U.S.-born white woman and one U.S.-born black woman for age, marital status, education and spouse's education, prenatal care, parity, and the presence or absence of previous fetal loss.

RESULTS

The mean birth weight of the white infants was 3446 g, as compared with 3333 g for the infants of the African-born black women and 3089 g for the infants of the U.S.-born black women (Table 1). The proportion of very-low-birth-weight infants was similar for African-born blacks and U.S.-born blacks. Even though the infants born to African-born blacks had a slightly lower mean birth weight than the white infants, the overall distribution of birth weights was similar in the two groups and was different from that among the infants of U.S.-born blacks (Fig. 1).

Table 2 shows the distribution of selected risk factors in the three groups of women. The African-born black women delivered the highest proportion of infants who were their mothers' fourth or subsequent children and had the highest proportion of previous fetal and infant deaths. The U.S.-born black women were the youngest, the least likely to be married, the least well educated, and the most likely to have received prenatal care late or not at all. The white women surpassed both groups of black women with regard to only one risk factor — primigravida.

When the infants of African-born black women were compared with those of U.S.-born women matched for the mother's age, marital status, education, prenatal care, parity, and prior fetal loss and the father's education, the differences between the groups narrowed somewhat, but their relation did not change (Table 1). With white infants as the reference group, the relative risks for low and moderately low birth weight were both significantly higher among infants of U.S.-born blacks than among infants of African-born blacks. However, the relative risk of very low birth weight was similar in the two groups of infants born to blacks.

To gain more insight into the relative importance of the risk factors in the three groups, we used multiple-regression analysis to study the changes in birth weight predicted by each factor. The models we constructed (Table 3) all showed a positive effect of being married (an increase of 60 to 124 g in predicted birth weight), having had one or two previous pregnancies (an increase of 29 to 50 g), and having no previous fetal loss (an increase of 19 to 55 g). Of the risk factors, only marital status had a statistically significant effect among the infants of African-born blacks.

On the basis of the multivariable models in Table 3, the birth weight of the infants of African-born blacks was 14 g less than that of the infants of U.S.-born whites after we controlled for risk factors. In another model, we looked at only the U.S.-born white women and the African-born black women, with race included as a dichotomous variable. In that analysis, the infants of the U.S.-born whites weighed 98 g more than the infants of the African-born blacks

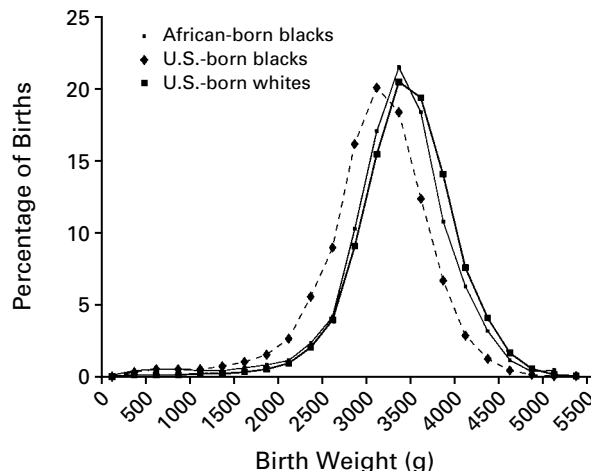


Figure 1. Distribution of Birth Weights among Infants of U.S.-Born White and Black Women and African-Born Black Women in Illinois, 1980-1995.

The calculation of frequencies was based on all singleton births in Illinois. The study population included the infants of 3135 black women born in sub-Saharan Africa, 43,322 black women born in the United States (a sample that included 7.5 percent of the total number of black women giving birth in Illinois), and 44,046 U.S.-born white women (2.5 percent of the total number of white women giving birth in Illinois).

after adjustment for age, education, marital status, gravidity, prenatal care, and a history of fetal loss. In a similar model that included only women born in the United States, the white infants weighed 248 g more than the black infants after adjustment for the same six variables.

Table 4 shows the mean birth weights and rates of low birth weight among infants born to the women at lowest risk — those 20 to 39 years of age who began their prenatal care in the first trimester, had at least 12 years of education, and were married to men who also had at least 12 years of education. Sixty-six percent of the white women fit this profile, as compared with 50 percent of the African-born black women and 14 percent of the U.S.-born black women. The mean birth weight and rates of low birth weight of the infants born to African-born blacks were intermediate between the values in U.S.-born whites and those in U.S.-born blacks. However, when reproductive risk factors were included in the selection of low-risk women, the differences between the infants of U.S.-born whites and the infants of African-born blacks in mean birth weight and rates of both low and very low birth weight were narrowed, whereas the differences between the infants of U.S.-born whites and U.S.-born blacks were unchanged. The greatest change was in very low birth weight; the exclusion of women with a history of fetal loss resulted in nearly identical rates among infants of African-born blacks and those of U.S.-

TABLE 2. DISTRIBUTION OF SELECTED RISK FACTORS IN THE STUDY POPULATION ACCORDING TO THE MOTHER'S RACE AND PLACE OF BIRTH.*

VARIABLE	SUBGROUP OF MOTHERS			RELATIVE RISK (95% CI) IN BLACK MOTHERS†	
	U.S.-BORN WHITES	AFRICAN-BORN BLACKS	U.S.-BORN BLACKS	AFRICAN-BORN	U.S.-BORN
	rate per 100				
Maternal age <20 yr	8.8	1.5	28	0.2 (0.1-0.2)	3.1 (3.0-3.2)
Education <12 yr					
Mother	13	8	36	0.6 (0.5-0.7)	2.9 (2.8-3.0)
Father	11	6	34	0.5 (0.4-0.6)	2.9 (2.9-3.0)
Mother unmarried	14	24	76	1.7 (1.6-1.8)	5.3 (5.2-5.4)
Late prenatal care or none	15	26	36	1.7 (1.6-1.8)	2.3 (2.3-2.4)
Gravidity					
1	34	22	29	0.6 (0.6-0.7)	0.9 (0.8-0.9)
>3	15	31	26	2.0 (1.9-2.1)	1.7 (1.6-1.7)
Prior death					
Fetus‡	24	39	28	1.6 (1.5-1.7)	1.1 (1.1-1.2)
Infant	1.7	3.0	2.9	1.8 (1.5-2.2)	1.7 (1.6-1.9)

*Data on the number of previous pregnancies were obtained for 44,053 U.S.-born white women, 3135 African-born black women, and 43,334 U.S.-born black women. For the other variables shown, there were missing data, as follows: maternal age, 0.01 percent; maternal education, 0.26 percent; paternal education, 16.4 percent; marital status, 0.05 percent; start of prenatal care, 1.38 percent; previous fetal death, 0.07 percent; and previous death of an infant, 0.36 percent.

†Relative risks shown are for the risk of low birth weight in the infants of women in the group shown as compared with the infants of U.S.-born white women. CI denotes confidence interval.

‡This category includes spontaneous and induced abortions, miscarriages, and stillbirths, regardless of the period of gestation.

TABLE 3. REGRESSION MODELS SHOWING THE PREDICTED EFFECTS OF LOW-RISK SOCIODEMOGRAPHIC AND REPRODUCTIVE VARIABLES IN THE MOTHER ON THE BIRTH WEIGHT OF INFANTS IN EACH SUBGROUP DEFINED ACCORDING TO THE MOTHER'S RACE AND PLACE OF BIRTH.*

VARIABLE	SUBGROUP OF MOTHERS		
	U.S.-BORN WHITES (N=44,046)	AFRICAN-BORN BLACKS (N=3135)	U.S.-BORN BLACKS (N=43,322)
	grams		
Birth weight with no protective factors present	3144†	3130†	2942†
Maternal age >19 yr	0	+146†	-25†
Maternal education >11 yr	+128†	-26	+82†
Mother married	+118†	+60‡	+124†
Prenatal care in 1st 3 mo	+60†	-4	+47†
Gravida 2 or 3	+50†	+41	+29†
No prior fetal loss	+19§	+36	+55†

*The values in the table show the increase or decrease in the predicted birth weight in each group, as estimated by arithmetically combining the predicted birth weight with no protective factors present with the sum of the protective factors, each multiplied by 1 if the factor was present or by 0 if it was absent. P values indicate the stability of these point estimates; the greater the standard error of the coefficient, the less the statistical significance.

†P<0.001.

‡P<0.05.

§P<0.01.

born whites, eliminating the significant excess of infants with very low birth weight born to African-born blacks.

DISCUSSION

The distribution of birth weights among infants of African-born black women approximated that

among infants of U.S.-born white women. The rate of low-birth-weight births for African-born black women was between the rate for U.S.-born white women and that for U.S.-born black women. Adjusting for maternal risk factors in three ways shifted the magnitude of the differences in birth weight but did not alter the basic pattern. Among infants of

TABLE 4. MEAN BIRTH WEIGHTS AND RATES OF LOW BIRTH WEIGHT AMONG INFANTS WITH MOTHERS AT LOW RISK, ACCORDING TO THE MOTHER'S RACE AND PLACE OF BIRTH.

LOW-RISK VARIABLES STUDIED	SUBGROUP OF MOTHERS			RELATIVE RISK (95% CI) IN BLACK MOTHERS*	
	U.S.-BORN WHITES	AFRICAN-BORN BLACKS	U.S.-BORN BLACKS	AFRICAN-BORN	U.S.-BORN
Sociodemographic variables only†					
No. of births	29,012	1577	6181		
Mean birth weight (g)	3,497	3344	3243		
Low birth weight (rate per 100)	3.3	7.0	9.0	2.2 (1.8–2.6)	2.8 (2.5–3.1)
Very low birth weight (rate per 100)	0.6	2.4	1.8	4.3 (3.4–6.2)	3.3 (2.6–4.2)
Reproductive variables added‡					
No. of births	12,361	608	2670		
Mean birth weight (g)	3,551	3454	3299		
Low birth weight (rate per 100)	2.4	3.6	7.5	1.5 (1.0–2.4)	3.0 (2.5–3.5)
Very low birth weight (rate per 100)	0.4	0.5	1.3	1.3 (0.4–4.2)	3.3 (2.2–5.2)

*Relative risks shown are for the risk of low birth weight in the infants of women in the group shown as compared with the infants of U.S.-born white women. CI denotes confidence interval.

†This analysis was limited to women 20 to 39 years of age who began their prenatal care in the first trimester of pregnancy, had at least 12 years of education, and were married to men who also had at least 12 years of education.

‡This analysis was limited as described in the preceding note but also excluded primigravidas and mothers with a history of fetal or infant loss.

African-born black women and those of U.S.-born black women, very low birth weight occurred at a similar frequency. Nevertheless, these data provide some evidence against the theory that there is a genetic basis for the disparity between white and black women born in the United States in the mean birth weights of their infants.

According to most studies, racial differences in birth weight persist independently of numerous social and economic risk factors.^{8,9} This has led some investigators to suggest that the differences have a genetic basis.^{11–14} Our findings challenge the genetic concept of race as it relates to birth weight. The African-born women in our study were new immigrants from the same region from which the ancestors of most U.S. blacks came, but without the estimated 20 to 30 percent admixture of European genetic material that has occurred since the mid-17th century.^{18–21} If genetics played a prominent part in determining black–white differences in birth weight, the infants of the African-born black women should have had lower birth weights than those of the U.S.-born black women. We found the opposite: regardless of socioeconomic status, the infants of black women born in Africa weighed more than the infants of comparable black women born in the United States.

The birth-weight distribution of the infants of African-born black women who delivered in Illinois is consistent with previous reports of the birth weights of infants of foreign-born black women of largely Caribbean origin.^{25–28} Studies of groups of women from New York, Boston, and multiple states have had concordant results: black women born outside the

United States have heavier infants than those born inside the United States, even after adjustment for cigarette smoking, alcohol intake, and illicit-drug use.

As data inconsistent with the genetic hypothesis of racial differences accumulate, social and psychosociologic hypotheses are advanced.^{5,29,33} A woman's exposure as a young child to the effects of poverty or racial discrimination could adversely affect birth weight in the next generation.^{28,34} The high educational level of African-born black women in Illinois indicates that rigorous selection occurs among African immigrants and suggests an overrepresentation of women born into affluent families, an elite subgroup in any developing nation.

Wilcox and Russell, in their extensive work on birth-weight distributions, developed a model that can be applied to the birth-weight curve of any group, partitioning it into an underlying gaussian curve and a "residual" distribution of very-low-birth-weight infants.³⁵ They proposed that the definition of normal birth weight differs for different groups, on the basis of the underlying distribution in the group under consideration. They attribute the residual births of very-low-birth-weight infants to "disorganized, perhaps pathologic, processes"^{35,36} that are presumably environmental in origin.

In our study, the proportions of very-low-birth-weight infants born to African-born black women and to U.S.-born black women were similar. The factors that account for this finding are unclear. As in most published studies, the majority of the risk factors we examined were related to the course of pregnancy. In such a conceptualization, pregnancy is a relatively short-term condition, minimally related to

past life experiences. In an attempt to broaden this concept, we studied how the outcome of prior pregnancy affected the disparity between blacks and whites in rates of very low birth weight. When we controlled for the outcome of prior pregnancy, we found that the rate of very low birth weight among infants of African-born black women more closely resembled that among infants of U.S.-born white women. This observation deserves further investigation.

Our study has important limitations. Vital records contain minimal clinical information. Data on cigarette smoking, weight before pregnancy, and weight gain during pregnancy might, if available, have explained some of our findings. In addition, the group of African-born black women studied, although more than 10 times larger than the group studied previously,³⁷ was too small to permit stable estimates of very low birth weight in subgroups.

In summary, African-born black women have infants with a greater mean birth weight and a different birth-weight distribution than black women born in the United States.

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