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Differing Intergenerational Birth Weights among the Descendants of US-born and Foreign-born Whites and African Americans in Illinois

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The authors analyzed Illinois vital records to determine the intergenerational birth weight patterns among the descendants of US-born and foreign-born White and African-American women. Among the descendants of the generation 1 US-born White women (n = 91,061), generation 3 females had a birth weight 65 g more than that of their generation 2 mothers ($p < 0.0001$); generation 3 infants had a 10% lower moderately low birth weight (1,500–2,499 g) rate than did their generation 2 mothers: 5.0% versus 5.5% percent, respectively (relative risk = 0.9, 95% confidence interval: 0.9, 0.9). Among the descendants of generation 1 European-born White women (n = 3,339), generation 3 females had a birth weight 45 g more than that of their generation 2 mothers ($p < 0.0001$). Among the descendants of generation 1 US-born African-American women (n = 31,699), generation 3 females had a birth weight 17 g more than that of their generation 2 mothers ($p < 0.001$). Among the descendants of generation 1 African/Caribbean-born women (n = 104), generation 3 females had a birth weight 57 g less than that of their generation 2 mothers; generation 3 females had a 40% greater moderately low birth weight rate than did their generation 2 mothers: 9.6% percent versus 6.7% percent (relative risk = 1.4, 95% confidence interval: 0.6, 3.6). Maternal age and marital status did not account for the birth weight trends. The authors conclude that the expected intergenerational rise in birth weight does not occur among the direct female descendants of foreign-born African-American women. *Am J Epidemiol* 2002;155:210–16.

Blacks; cohort effect; ethnic groups; infant, low birth weight

In the United States, the mechanisms underlying the disparity in low birth weight (<2,500 g) rates between African-American and White infants are a longstanding epidemiologic enigma and a major public health problem (1, 2). Maternal factors and conditions during pregnancy—age, education, marital status, income, parity, interpregnancy interval, cigarette smoking, and impoverishment—fail to account for the African-American infant's birth weight disadvantage (2–6). However, the limited available data suggest that pregnancy is not an isolated event independent of prior life experiences (7–10). Intergenerational factors are defined as those factors, experiences, and exposures experienced by one generation that relate to the health of the next generation (9). The effect of intergenerational factors on the reproductive outcome of Whites and African Americans is incompletely understood.

We previously found that the birth weight patterns of African-American infants with African-born mothers and White infants with US-born mothers are more closely related to one another than to the birth weights of African-American infants with US-born mothers (11). Consistent with this finding, studies have shown that African-American infants of Caribbean-born mothers also weigh more than African-American infants of US-born mothers independent of maternal risk status during pregnancy (12, 13). These observations suggest that intergenerational factors closely related to lifelong minority status contribute to the African-American women's reproductive disadvantage.

To our knowledge no data have been published on the intergenerational birth weight patterns among the descendants of foreign-born White and African-American women. These populations are uniquely suited to delineate the effect of maternal lifelong minority status on infant birth weight. We therefore undertook an intergenerational birth weight analysis of the direct, female descendants of US-born and foreign-born White and African-American women in Illinois.

MATERIALS AND METHODS

Study population

A detailed description of the Illinois transgenerational data set has been published elsewhere (7). Briefly, the birth certificate data tapes for infants born in 1989–1991 from the Illinois Department of Public Health were linked to those of their mothers who were born in Illinois between 1956 and 1975. There were approximately 328,000 infants in the 1989–1991 cohort with mothers who were also born in

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Illinois. On the basis of each mother's maiden name (first and last) and exact date of birth, we successfully linked 267,604 (79 percent) maternal birth records to infant records. Duplicate matches occurred for 2 percent of infants and were eliminated. After the linkage of maternal and infant birth certificates was complete, all identifying information on the individual mothers and their infants was removed. Thus, the transgenerational file was "sterilized" prior to the initiation of data analyses.

White and African-American mothers in the transgenerational birth file had a slightly better sociodemographic profile than mothers of the 1991 population of Illinois births (7). For example, 9.2 percent of African-American and 2.2 percent of White mothers in the transgenerational file were <18 years of age compared with 12.1 percent of African-American and 2.4 percent of White mothers in the general population, respectively; in addition, 71 percent of African-American and 11 percent of White mothers in the transgenerational file were unmarried compared with 78 percent of African-American and 17 percent of White mothers in the general population, respectively.

Nativity status was empirically defined by maternal grandmother nativity status. Maternal grandmothers were classified as generation 1, mothers (1956–1975 birth cohort) were classified as generation 2, and female infants (1989–1991 birth cohort) were classified as generation 3. The Illinois birth certificates contained a detailed maternal ethnicity variable that included separate codes for "Black," "non-US Black," and "European White." It also contained a maternal nativity variable: It was coded as "Illinois," "other United States," or "remainder of the world." The generational distributions of maternal age and marital status were determined among Whites and African Americans. The birth certificates from the 1956–1975 birth cohort lacked important sociodemographic information such as maternal education and parity.

As a first step toward exploring the possible contribution of maternal lifelong minority status to the racial disparity in pregnancy outcomes, we compared the birth weight distribution curves of generation 2 and generation 3 White and African-American females (i.e., mothers and daughters). Next, we calculated the mean birth weight and the rates of moderately low birth weight (defined as the number of births of infants weighing 1,500–2,499 g) and very low birth weight (defined as the number of births of infants weighing less than 1,500 g) among generation 2 and generation 3 White and African-American females. Finally, we calculated the mean birth weight and moderately low birth weight rates in generation 2 and generation 3 females according to the level of selected sociodemographic characteristics and race.

The 95 percent confidence intervals for the relative risk were calculated by the Taylor series method (14).

RESULTS

Table 1 shows the distribution of young maternal age and unmarried marital status across generations. Among the direct descendants of generation 1 US-born White, European-born White, and US-born African-American women, generation 3 infants had a greater proportion of unmarried mothers than did generation 2 infants. Among the descendants of generation 1 African/Caribbean-born women, generation 3 infants had a greater proportion of both teenaged and unmarried mothers than did generation 2 infants.

TABLE 1. Distribution of selected sociodemographic characteristics in generation 2 and generation 3 females according to generation 1 race and nativity status, Illinois

Generation 1 (maternal grandmothers)	Generation 2 (1956–1975, mothers)		Generation 3 (1989–1991, female infants)	
	Maternal age <20 years (%)	Unmarried marital status (%)	Maternal age <20 years (%)	Unmarried marital status (%)
White				
US born (n = 91,061)	12.2	1.0	9.1*	18.0*
European born (n = 3,339)	5.5	1.0	5.4	9.0*
African American				
US born (n = 31,699)	29.9	14.0	31.9	82.0*
African/Caribbean born (n = 104)	12.5	1.0	34.6*	26.0*

* $p < 0.01$, compares generation 3 with generation 2 according to generation 1 race and nativity status.

Figures 1–4 show race-specific birth weight distribution curves for the direct female descendants (generation 2 and generation 3) of US-born and foreign-born women (generation 1). In both subgroups of Whites, the birth weight distribution curves of generation 3 female infants (compared with their generation 2 mothers) were shifted toward higher birth weights. Among the descendants of US-born African-American women, the birth weight distribution curves of generation 3 female infants were equivalent to that of their generation 2 mothers. Among the descendants of foreign-born African-American women, the distribution curves of generation 3 female infants (compared with their generation 2 mothers) were shifted toward lower birth weights.

Table 2 shows race-specific intergenerational trends in mean birth weight, moderately low birth weight, and very low birth weight rates according to generation 1 (maternal grandmothers) nativity status. Among the descendants of generation 1 US-born White women, generation 3 females had a birth weight 65 g more than that of their generation 2 mothers. Generation 3 infants had a 10 percent lower moderately low birth weight rate and a fourfold greater very low birth weight rate than did their generation 2 mothers. Among the descendants of European-born White generation 1 women, generation 3 females had a birth weight 45 g more than that of their mothers. There were no intergenerational differences in moderately low birth weight rates. There were too few very low birth weight generation 2 infants to calculate meaningful rates.

Among the descendants of generation 1 US-born African-American women, generation 3 females had a birth weight 17g more than that of their generation 2 mothers (table 2). Generation 3 infants had a moderately low birth weight rate equivalent to that of (and a threefold greater very low birth

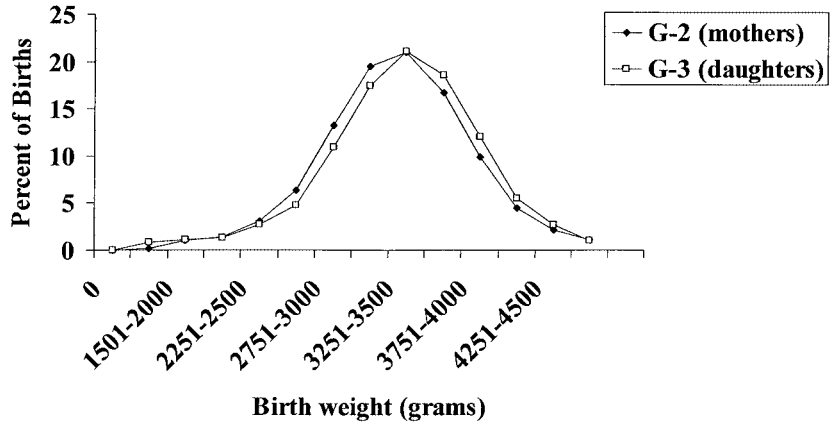

FIGURE 1. Distribution of birth weights among the generation 2 (G-2) and generation 3 (G-3) descendants of generation 1 US-born White women, Illinois, 1956–1975, 1989–1991.

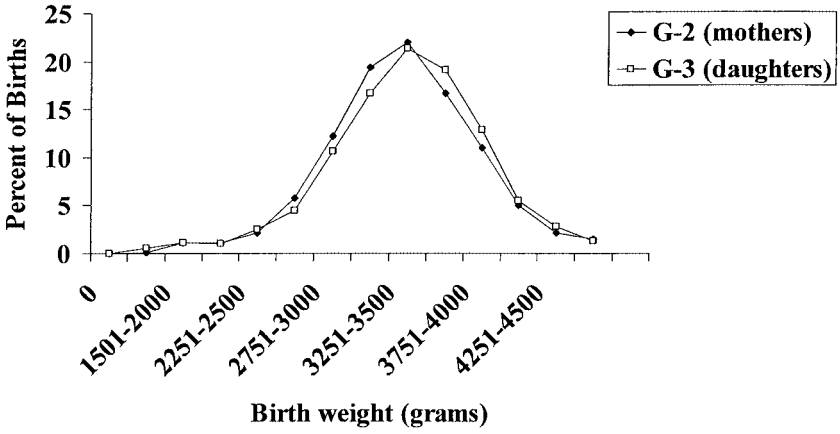

FIGURE 2. Distribution of birth weights among the generation 2 (G-2) and generation 3 (G-3) descendants of generation 1 European-born White women, Illinois, 1956–1975, 1989–1991.

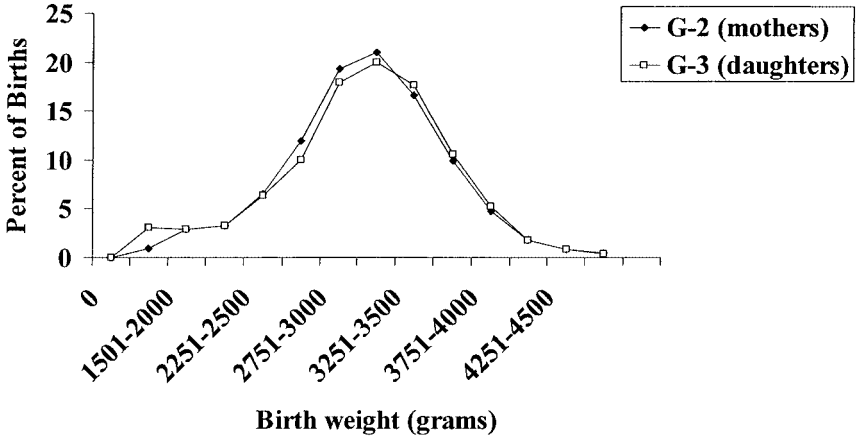

FIGURE 3. Distribution of birth weights among the generation 2 (G-2) and generation 3 (G-3) descendants of generation 1 US-born African-American women, Illinois, 1956–1975, 1989–1991.

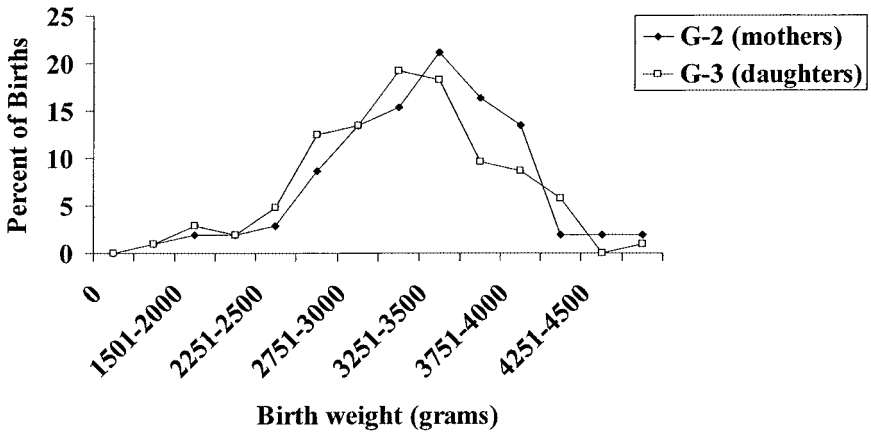

FIGURE 4. Distribution of birth weights among the generation 2 (G-2) and generation 3 (G-3) descendants of generation 1 African/Caribbean-born African-American women, Illinois, 1956–1975, 1989–1991.

weight rate than) their generation 2 mothers. Among the descendants of generation 1 African/Caribbean-born women ($n = 104$), generation 3 females had a birth weight 57 g less than that of their generation 2 mothers (p = not significant). Generation 3 infants had a 40 percent greater moderately low birth weight rate than did their generation 2 mothers (relative risk = 1.4, 95 percent confidence interval: 0.6, 3.6). There were too few generation 2 and generation 3 very low birth weight infants to calculate meaningful rates.

In contrast to Whites, the birth weight of generation 2 African-American infants varied according to generation 1 nativity status (table 2). Generation 2 African-American infants of generation 1 US-born mothers had a 90 percent greater moderately low birth weight rate than did generation 2 African-American infants of generation 1 foreign-born mothers: 12.7 percent versus 6.7 percent (relative risk = 1.9, 95 percent confidence interval: 0.9, 3.8). This differential lessened in the subsequent generation: Generation 3

TABLE 2. Infant birth weight in generation 2 and generation 3 females according to generation 1 race and nativity status, Illinois

Generation 1 (maternal grandmothers)	Generation 2 (1956–1975, mothers)			Generation 3 (1989–1991, daughters)		
	Mean birth weight (g)	1,500–2,499 g (%)	<1,500 g (%)	Mean birth weight (g)	1,500–2,499 g (%)	<1,500 g (%)
White						
US-born ($n = 91,061$)	3,309	5.5	0.2	3,374*	5.0†	0.8‡
European-born ($n = 3,339$)	3,347	4.2	—§	3,392*	4.5¶	0.6
African-American						
US-born ($n = 31,699$)	3,060	12.7	0.9	3,077*	12.5#	3.1**
African/Caribbean-born ($n = 104$)	3,249	6.7	—	3,192	9.6††	—

* $p < 0.001$, compares mean birth weight in generation 3 with that in generation 2 according to generation 1 race and nativity status.

† Relative risk = 0.9 (95% confidence interval: 0.9, 0.9), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

‡ Relative risk = 3.7 (95% confidence interval: 3.2, 4.3), compares percentage of infants (<1,500 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

§ —, undefined, ≤3 infants.

¶ Relative risk = 1.0 (95% confidence interval: 0.8, 1.3), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

Relative risk = 1.0 (95% confidence interval: 1.0, 1.1), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

** Relative risk = 3.3 (95% confidence interval: 2.9, 3.0), compares percentage of infants (<1,500 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

†† Relative risk = 1.4 (95% confidence interval: 0.6, 3.6), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

African-American infants of generation 1 US-born women had only a 30 percent greater moderately low birth weight rate than did generation 3 African Americans of generation 1 foreign-born women: 12.5 percent versus 9.6 percent (relative risk = 1.3, 95 percent confidence interval: 0.7, 2.3).

In both races, the generational trends in birth weight tended to persist among female infants born to nonteenaged and married mothers, respectively (tables 3 and 4).

DISCUSSION

To our knowledge the present study is the first to examine the intergenerational birth weight patterns of the descendants of US-born and foreign-born White and African-American women. We found racial differences in intergenerational birth weight patterns depending on generation 1 nativity status. Among the descendants of generation 1 US-born and European-born White women, the birth weight of generation 3 female infants shifted upward from that of their generation 2 mothers. An intergenerational improvement in birth weight of a substantially smaller magnitude occurs among the descendants of generation 1 US-born African-American women. Most striking, among the direct female descendants of generation 1 foreign-born African-American women, the birth weight of generation 3 infants shifted downward from that of their generation 2 mothers. Intergenerational trends in moderately low birth weight rates tend to parallel that observed in mean birth weight. These findings suggest that maternal lifelong minority status, or something closely related to it, is associated with infant birth weight.

Our data shed new light on the relation between maternal race and infant birth weight in the United States. A 65-g intergenerational increase in mean birth weight and a concurrent 10 percent decrease in moderately low birth weight rates occur among the female descendants of generation 1 US-born White women. This finding is consistent with findings from prior studies showing secular improvements in the mean birth weight on the order of 40–100 g over decades (15, 16). Most striking, only a 17-g intergenerational increase in the mean birth weight and an equivalent moderately low birth weight rate occur among the female descendants of generation 1 US-born African-American women. These disparate racial group trends point to the disquieting speculation that some key measures of African-American women's health in the United States are not improving.

Generation 2 White and African-American women who were themselves born to foreign-born women are uniquely positioned to ascertain the effect of maternal lifelong minority status on infant birth weight. If maternal lifelong minority status did not play a prominent role in determining racial differences in reproductive outcome, the birth weight of generation 3 female African-American infants should follow the same trend observed among generation 3 female White infants and show an upward shift from their generation 2 mothers. We found just the opposite: The mean birth weight of generation 3 female African-American infants shifted downward from that of their generation 2 mothers. Moreover, the 40 percent greater moderately low birth weight rate among generation 3 (compared with generation 2) African-American infants suggests that the deterioration in birth weight is pathologic.

TABLE 3. Birth weight patterns among female infants born to nonteenaged mothers in generation 2 and generation 3 according to generation 1 race and nativity status, Illinois

Generation 1 (maternal grandmothers)	Generation 2 (1956–1975, mothers)*			Generation 3 (1989–1991, daughters)†		
	Mean birth weight (g)	1,500–2,499 g (%)	<1,500 g (%)	Mean birth weight (g)	1,500–2,499 g (%)	<1,500 g (%)
White						
US-born	3,305	5.3	0.2	3,363‡	4.9§	0.8¶
European-born	3,336	4.1	—#	3,385‡	4.1**	0.5‡
African-American						
US-born	3,067	13.5	1.0	3,009‡	15.5††	3.9‡‡
African/Caribbean-born	3,243	6.6	—	3,196	—	—

* Generation 2: White, US-born (n = 79,945) and European-born (n = 3,155); African-American, US-born (n = 22,211) and African/Caribbean-born (n = 91).

† Generation 3: White, US-born (n = 82,768) and European-born (n = 3,160); African-American, US-born (n = 21,587) and African/Caribbean-born (n = 68).

‡ $p < 0.001$, compares mean birth weight in generation 3 with that in generation 2 according to generation 1 race and nativity status.

§ Relative risk = 0.09 (95% confidence interval: 0.9, 0.9), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

¶ Relative risk = 3.6 (95% confidence interval: 3.1, 4.3), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

—, undefined, ≤3 infants.

** Relative risk = 1.0 (95% confidence interval: 0.8, 1.3), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

†† Relative risk = 1.2 (95% confidence interval: 1.1, 1.2), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

‡‡ Relative risk = 3.8 (95% confidence interval: 3.2, 4.4), compares percentage of infants (<1,500 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

TABLE 4. Birth weight patterns among female infants born to married women in generation 2 and generation 3 according to generation 1 race and nativity status, Illinois

Generation 1 (maternal grandmothers)	Generation 2 (1956–1975, mothers)*			Generation 3 (1989–1991, daughters)†		
	Mean birth weight (g)	1,500–2,499 g (%)	<1,500 g (%)	Mean birth weight (g)	1,500–2,499 g (%)	<1,500 g (%)
White						
US-born	3,312	5.5	0.2	3,381‡	4.5§	0.8¶
European-born	3,358	5.0	—#	3,393‡	4.3**	0.5
African-American						
US-born	3,076	12.6	1.1	3,127‡	13.6††	2.3‡‡
African/Caribbean-born	3,250	6.8	—	3,155	12.9§§	—

* Generation 2: White, US-born (n = 90,245) and European-born (n = 3,319); African-American, US-born (n = 27,122) and African/Caribbean-born (n = 103).

† Generation 3: White, US-born (n = 75,036) and European-born (n = 2,986); African-American, US-born (n = 5,782) and African/Caribbean-born (n = 77).

‡ $p < 0.001$, compares mean birth weight in generation 3 with that in generation 2 according to generation 1 race and nativity status.

§ Relative risk = 0.8 (95% confidence interval: 0.8, 0.8), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

¶ Relative risk = 3.1 (95% confidence interval: 2.7, 3.7), compares percentage of infants (<1,500 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

—, undefined, ≤3 infants.

** Relative risk = 0.9 (95% confidence interval: 0.6, 1.2), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

†† Relative risk = 1.1 (95% confidence interval: 1.0, 1.2), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

‡‡ Relative risk = 2.4 (95% confidence interval: 1.9, 2.9), compares percentage of infants (<1,500 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

§§ Relative risk = 2.2 (95% confidence interval: 0.7, 6.8), compares percentage of infants (1,500–2,499 g) in generation 3 with that in generation 2 according to generation 1 race and nativity status.

Our study adds to earlier observations regarding maternal nativity and infant birth weight among African Americans (11–13). As expected, the present study shows that the moderately low birth weight rate of generation 2 African-American infants with US-born mothers exceeds that of generation 2 African-American infants with foreign-born mothers. Moreover, it indicates that the moderately low birth weight rate of generation 3 African-American descendants of generation 1 foreign-born women approaches that of generation 3 African-American descendants of generation 1 US-born women. Given the probable selective migration of healthy generation 1 African-born women (11) and their descendants' worsening birth weight outcomes, we speculate that unidentified aspects of US society are indeed deleterious to the reproductive health of African-American women.

In seeking to understand the mechanisms underlying the birth weight disadvantage of African-American infants with US-born mothers, the dominant concept has been that pregnancy is a relatively acute condition. A corollary is that controlling for maternal age, socioeconomic status, and adequacy of prenatal care usage should largely eliminate racial differences in pregnancy outcome. An extensive literature shows that these pregnancy-related factors and conditions fail to explain birth weight differences between and within the races (2–6, 11–14). The disparate intergenerational birth weight patterns between Whites and African Americans provide evidence that pregnancy, while occurring during a limited time period of a woman's life, should not be considered an isolated event independent of prior life experiences. We encourage researchers to take a woman's prepregnancy (fetal, infant, and childhood) experiences into account when examining racial differences in infant birth weight.

Our study has a number of limitations. First, there was a built-in selection bias in creating the transgenerational birth file. Infants for whom maternal matches were unsuccessful were more likely of low socioeconomic status and thus more prone to low birth weight (7). This would not weaken the main finding that an improvement in intergenerational birth weight does not occur among the descendants of immigrant African-American women. However, it limits that conclusion somewhat in that it is based on observations confined to the less disadvantaged portion of the population. Second, we implicitly assumed that intergenerational improvement in mean birth weight is a good phenomenon. Further research is needed to determine the extent to which it actually lowers mortality and morbidity risk. Third, because of the poor survival of very low birth weight infants in the generation 2 cohort (1956–1975), we were unable to evaluate fully the impact of intergenerational factors on the very low birth weight tail of the birth weight distribution curve. The greater very low birth weight rate among generation 3 (compared with generation 2) infants is an artifact of the Illinois transgenerational birth file. Generation 2 Whites and African Americans in the transgenerational birth file had a very low birth weight rate, approximately one fourth of that of general population births. Since the transgenerational file was defined by generation 3 infants born to generation 2 survivors, this finding is consistent with the high birth

weight-specific mortality rate of very low birth weight generation 2 infants (17). Fourth, the lack of information on maternal educational status in the 1956–1975 birth cohort and the relatively small population of generation 1 African/Caribbean-born women in our data set prevented us from fully evaluating the contribution of generation 1 sociodemographic and nativity status to intergenerational birth weight patterns. Finally, vital records contain minimal clinical information. Maternal weight before pregnancy, weight gain during pregnancy, gestational diabetes, and cesarean-section rates might account for some of our mean birth weight findings.

In summary, the expected intergenerational rise in birth weight does not occur among the female descendants of foreign-born African-American women. It may reflect US-born women's exposure to unidentified intergenerational factors closely linked to minority status (18–20). The identification of such factors will help us attain the Healthy People 2010 goal to eliminate the racial disparity in infant mortality rates (21, 22).

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