Ethnic Differences in Birthweight: The Role of Lifestyle and Other Factors

ABSTRACT

Objectives. The purpose of this study was to expand the search for risk factors for low birthweight and to find new explanations for the ethnic-group disparities in birth outcomes.

Methods. The subjects were 1150 pregnant women from six ethnic groups (African American, Chinese, Dominican, Puerto Rican, Mexican, and White) who received prenatal care at clinics in New York and Chicago between December 1987 and December 1989. Two interviews were conducted during the second and third trimesters of pregnancy.

Results. The study, after controlling for poverty and other birthweight correlates, showed that living in public housing and believing that chance plays a major role in determining one's health status were negatively associated with birthweight. Having a stable residence was positively related to birthweight. Material hardship, social adversity, perceived racial discrimination, physical abuse, anxiety, and depression were not associated with birthweight.

Conclusions. The negative role of an impoverished living environment and feelings of helplessness, as well as the positive role of having a stable form of social support, suggest new directions for research on the causes of low birthweight and the ethnic disparities in US birth outcomes. (*Am J Public Health.* 1997;87: 787–793)

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Introduction

The persistence of unexplained ethnic group differences in low birthweight and infant mortality continues to be a source of scientific and social concern.[1,2] Previous studies that have examined risk factors associated with low birthweight have concluded that, with the exception of cigarette smoking, very little is known about the causes of low birthweight.[3–5] Moreover, the known correlates of low birthweight do not explain the observed ethnic disparities in birthweight.[1]

The purpose of the Women's Lifestyle in Pregnancy Study was to expand the search for possible risk factors for adverse birth outcomes and explanations for the ethnic-group disparities in birth outcomes. In this prospective study, pregnant women from six ethnic groups were questioned about the details of their lifestyles during pregnancy. The aim of this study was to go beyond the standard medical risk factors for adverse birth outcomes[3] and examine the independent effects of a large number of social, psychological, and economic factors. In addition, indices of material hardship and social adversity were developed to measure the combined effects of several facets of the living conditions experienced by the women during their pregnancies.

Methods

Sample Selection

Pregnant women who registered for prenatal care at one of six participating clinics were eligible for the study. Two of the sites were located in Chicago (Prentice Hospital and Pilsen Clinic) and four in New York City (Columbia–Presbyterian Hospital, Harlem Hospital, St. Vincent's Hospital, and Chinatown Clinic). Eligibility criteria were as follows: over 17 years of age; expecting a singleton birth; between 16 and 28 weeks' gestational age; not taking medications for diabetes, heart disease, kidney disease, or hypertension; and self-designated member of one of six ethnic groups: African American, Chinese, Dominican, Mexican, Puerto Rican, or non-Hispanic White. These ethnic groups were selected on the basis of well-known group differences in reproductive health outcomes.[1,2] Eligible women were initially identified through clinic record reviews of all new clinic registrants, who were approached for informed consent and verification of eligibility at the time of a regularly scheduled prenatal care visit. All of the women were recruited between December 1987 and December 1989.

Information on birthweight was obtained from review of the baby's medical record, or by phone interview of the mother if the medical records could not be obtained. The women who attended the Pilsen Clinic planned to deliver at several hospitals in Chicago, and it was not possible for study personnel to travel to all of the hospitals to retrieve medical records. Thus, these women were contacted

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by phone to obtain information about the birth outcome.

We were forced to limit the number of women who could be included in the study because the length of our questionnaires required us to interview each woman twice during her pregnancy. As a result, we had to confine our analyses to mean birthweight, because there were too few women in the study to enable us to conduct analyses of rates of low birthweight or preterm birth. While changes in mean birthweight do not have the same clinical significance as changes in low birthweight, we believe that the differences in mean birthweight described in this study do provide clues about additional factors that deserve further attention in studies of low birthweight and preterm birth.

Measures

Eligible women were asked to participate in two face-to-face interviews. The first occurred between the 16th and 28th weeks and the second after the 32nd week of gestation. The structured interviews were administered by trained interviewers in the language in which the woman was most comfortable. All of the Chinese women were interviewed in Chinese (Cantonese, Mandarin, or Taiwanese dialect); 92% of the Dominican women, 72% of the Mexican women, and 29% of the Puerto Rican women were interviewed in Spanish. The interviews included standardized measures and additional questions designed for the present study. If the standardized measures were not available in all languages, they were translated and back-translated, as were all items designed specifically for the present study. The first interview lasted an average of 75 minutes and included the following areas: demographic data, employment information, pregnancy history, material living conditions,[6] social support and attachments,[7,8] anxiety,[9] depressive symptoms,[10] life events,[11] attitudes toward pregnancy,[12] and beliefs about health and illness.[13] The second interview lasted an average of 100 minutes and included the following areas: health behaviors, 24-hour physical activity, use of ancillary prenatal care services, perceived racial/ethnic discrimination, stressful life events, degree of acculturation, and a 24-hour dietary recall. The 1991 federal poverty guidelines[14] were used to calculate a percentage of poverty level for each woman's family.

Interviewer training and checks on reliability of the coding procedure were ongoing. Each interviewer coded a taped interview and responses were checked for interrater agreement. Quality control was maintained by regular site visits to the clinic and a random audit of approximately one out of five interviews by the project editors, who checked for completeness of the information. In addition, 15% of the women were recontacted by a research assistant, at which time five questions from the completed interviews were readministered. These quality control checks helped to ensure that the data we obtained were complete and accurate.

Two broad indices of material hardship and social adversity were developed to assess the living conditions experienced by each woman during her current pregnancy. Material hardships were defined as unmet basic needs in the areas of

TABLE 1—Variables Screened for Potential Correlation with Infant Birthweight: Women's Lifestyle in Pregnancy Study, New York and Chicago, 1987 through 1989

Factors	Definitions
	Demographic
Mother's age	Age groups <24 y, 25–34 y, >34 y
Marital status	Married or unmarried
Mother's education	High school or less than high school
Residence	New York or Chicago
Ethnic group	African American, Chinese, Dominican, Mexican, Puerto Rican, White
Mother's place of birth	United States or elsewhere
Primary language spoken	English or other
	Medical
Parity	Parity 0, 1, 2, 3+
Previous abortion	Had one or more induced abortions
Previous low-birthweight baby	Yes, no, no previous births
Prepregnancy body mass index (percentile)	(Prepregnancy weight [kg]/height [m]^2)/100
	Level of living
Family income	<$10 000, $10 000–$19 999, ≥$20 000
Poverty	≤100% federal poverty level
Welfare	Was on welfare
Public housing	Lived in public housing during pregnancy
Insurance	Medicaid, health maintenance organization, private, self or other or none
Employment	Was employed or was a student during pregnancy
No medical care	Could not pay for medical bill during pregnancy or did not go to hospital because of lack of money
No food	Did not have enough money to buy food during pregnancy
No housing	Did not have enough money to pay for housing during pregnancy
Housing density	Had two or more people per room during pregnancy
Stable housing	Lived 3 or more years in current residence
Moved	Moved two or more times in the past year
Housing problems	Had two or more major housing problems in need of repair during pregnancy
	Psychological
Anxious	State-Trait Anxiety Inventory score ≥40[9]
Depressed	CES-Depression Scale score ≥16[10]
Dissatisfied	Unhappy about overall living conditions
Unhappy about pregnancy	Unhappy about being pregnant
Poor maternal adjustment	Maternal Adjustment Scale score ≥29[12]
Locus of control	
Chance	Chance locus of control score ≤7[13]
Powerful others	Power locus of control score ≥10[13]
Internal forces	Internal locus of control score ≥11[13]

(*Continued*)

TABLE 1—Continued

Factors	Definitions
	Social
Discrimination	Experienced one or more incidents of racial discrimination during pregnancy
Adverse life events	Had two or more adverse life events during pregnancy
Low social support	Maternal Social Support Index ≤9[7]
Low attachment	Henderson availability of attachment ≤5[8]
No support group	Didn't belong to religious, educational, social, political, or other group
	Exposures during pregnancy
Cigarettes	Smoked during pregnancy
Environmental tobacco smoke	Any exposure to tobacco smoke during pregnancy (among nonsmokers only)
Alcohol	Drank during pregnancy
Drugs	Used any illicit drug
Abuse	Was abused or assaulted or feared being abused or assaulted during pregnancy
Fasting	Fasted for 1 or more days during pregnancy
Level of physical activity	Weighted score based on 24-hour recall of physical activity levels
	Newly defined indices
Material hardship	Additive scale for No food, No housing, and No medical care
Social adversity	Additive scale for Adverse life events, Discrimination, Abuse, Public housing, Housing problems, Low social support, and Unmarried status

food, housing, and medical care as a result of lack of money (adapted from Mayer and Jencks[6]). These three areas were selected because they define the basic need areas in which noncash benefits are provided by the United States government (e.g., food stamps, public housing, Medicaid). The experience of having gone without any one of the basic necessities (i.e., food, housing, or medical care) during the current pregnancy counted as one hardship, with a maximum score of three possible hardships.

Social adversities were defined as unfavorable life conditions or exposures experienced during the current pregnancy. The following areas were assessed: negative stressful life events (loss of a loved one, legal problems, etc.); threats to physical safety (including abuse and family violence); residence in a public housing project; racial discrimination; social isolation (including two or more of the following indicators: lack of intimate relationships, lack of concrete support, lack of contact with a religious or social group); single parenthood during the current pregnancy; and unresolved housing problems (broken appliances, plumbing problems, insects or rodents, or inadequate heat, electricity, or refrigeration). These factors were selected from the literature because they are generally considered to be stress-inducing, although their impact on perinatal health outcomes is largely speculative. The presence of a condition counted as one point toward the total social adversity score, with a maximum score of seven.

Data Analysis

Analysis of variance[15] was used to measure differences in mean birthweight for each of the factors listed in Table 1. With the exception of known confounding factors for infant birthweight, only those factors that were statistically significant at the .10 level were included in a multiple regression model. Backward stepwise regression was then used to remove factors that were not significant at the .10 level. Other than social adversities and material hardships, no other interactions were evaluated.

Results

Study Population

Of the 11 937 women whose prenatal care clinic charts were reviewed, 4045 were identified as eligible for inclusion in the study. The majority of women were ineligible for inclusion because they were beyond 28 weeks' gestational age. Of those eligible, 288 (7.1%) refused to participate, 714 (17.7%) did not show up at the clinic for their next few appointments, 392 (9.7%) signed the consent form but were unable to participate, and 75 (1.9%) were reclassified as ineligible on the basis of additional information obtained at the time of personal contact. Of the remaining 2576 eligible women, 1541 were enrolled in the study. Enrollment was consecutive except at the Harlem Hospital and Columbia–Presbyterian Hospital clinics, where interviewers approached approximately one out of every two eligible women because of high clinic volume. Mothers were excluded if their infants were stillborn (n = 27), if they gave birth to multiple infants (n = 8), if their infants' birthweight was unknown (n = 162), or if they did not complete both interviews (n = 194). Thus, a total of 1150 women were included in this analysis.

Forty-six percent of the women in this study received prenatal care at four clinic sites in New York, and 54% at two sites in Chicago. The ethnic-group breakdown was as follows: African American, 30%; Chinese, 13%; Dominican, 13%; Mexican, 15%; Puerto Rican, 11%; and White, 19%. Most of the Chinese, Mexican, and Dominican women were born outside the United States. The majority of the women were married (53%), were high school graduates (65%), and had family incomes under 100% of the federal poverty level (53%); however, only a minority (45%) were receiving Medicaid.

Risk Factors

As the purpose of this study was to identify previously unexplored associations with adverse birth outcomes, we screened 44 individual factors for their relationship with mean birthweight, as well as 2 new variables that combined the effects of several facets of the living conditions experienced by the women during their pregnancies (Table 1).

The 21 factors that were associated with mean birthweight ($P < .10$) are presented in Table 2. The known correlates of birthweight are ethnic group, maternal age, marital status, education, poverty level, type of medical insurance, parity, smoking during pregnancy, prepregnancy body mass index, mother's place of birth, previous low-birthweight infant, adverse life events, and being unhappy about being pregnant. In addition, we

identified many other lifestyle factors that were associated with birthweight: living in public housing; living 3 or more years at the current residence; believing that one's health is a matter of chance, the influence of powerful others, or internal control; not belonging to any religious, educational, social, political, or other groups; level of physical activity; and fasting during pregnancy. No association with birthweight was observed for the newly created material hardship index, but number of social adversities was associated with birthweight.

While simple bivariate comparisons have identified several new potential correlates of birthweight, many of the individual factors evaluated are highly correlated with one another. For example, it is not clear whether the association between birthweight and living in public housing is actually accounted for by poverty level or by ethnic group. Thus, we used multiple regression techniques to help untangle these complex interrelationships. The regression coefficients may be interpreted as the average difference in birthweight between the levels of risk factors tested. For example, the African-American infants in our study were on average 236 g lighter than the White infants, and for each 1-year increase in maternal age there was an 8-g increase in birthweight. Each of the statistically significant factors in the model has an independent association with birthweight, because they are statistically adjusted for all of the other factors in the model.

Whether or not the mother had had a previous low-birthweight infant was not included in these regression models because this is an intermediate factor on the causal pathway between the risk factors studied and birthweight.[16] As most of the risk factors assessed in this analysis can be considered relatively constant exposures, such as cigarette smoking, it is likely that these risk factors would have been operating in the previous pregnancy as well as the current one. If the woman smoked during her previous pregnancy and smoking was associated with the birthweight of the previous infant, then controlling for the occurrence of a previous low-birthweight infant in subsequent births would overcontrol for the effects of smoking. The effects of overcontrolling would be to severely attenuate or remove the effects of cigarette smoking and other factors on the current pregnancy.

After controlling for the effects of ethnicity, age, marital status, education, poverty level, type of medical insurance, body mass index, and smoking, we found that three of the eight new factors initially identified in the simple bivariate analysis had independent associations with birthweight (Table 3). Living in public housing was associated with an 83-g decrease in birthweight, and believing that chance plays a role in staying healthy was associated with a 78-g decrease. Having a stable residence was associated with a 76-g increase in birthweight. The other factors listed in Table 2 were not statistically associated with birthweight after the

TABLE 2—Factors Associated with Mean Birthweight: Women's Lifestyle in Pregnancy Study, New York and Chicago, 1987 through 1989

	No.	Mean Birthweight, g	P
Previously described risk factors			
Ethnic group			
African American	346	3231	<.001
Chinese	144	3272	
Dominican	153	3484	
Mexican	169	3431	
Puerto Rican	123	3341	
White	215	3503	
Maternal age, y			
18–24	466	3260	<.001
25–34	594	3426	
35+	86	3455	
Marital status			
Married	612	3403	<.01
Unmarried	538	3315	
Mother's education			
<High school	401	3321	<.10
≥High school	747	3384	
Percentage of federal poverty level			
<100%	584	3333	<.10
100%–200%	236	3369	
>200%	284	3425	
Insurance			
Medicaid	509	3326	<.01
Health maintenance organization	169	3481	
Private	163	3340	
Self, other, none	284	3370	
Parity			
0	485	3326	<.10
1 or more	665	3388	
Cigarette smoking			
Yes	231	3286	<.05
No	919	3381	
Prepregnancy body mass index (percentile)			
≤25%	218	3265	<.01
26%–74%	647	3385	
75%–100%	245	3400	
Mother's place of birth			
United States	637	3333	<.05
Elsewhere	498	3405	
Previous low-birthweight infant			
Yes	87	3117	<.001
No	578	3429	
No previous births	485	3326	
Adverse life events during pregnancy			
<2 events	823	3383	<.05
≥2 events	327	3309	
Unhappy about pregnancy			
Yes	225	3306	<.10
No	925	3376	

(Continued)

TABLE 2—Continued

	No.	Mean Birthweight, g	P
Additional risk factors			
Residence in public housing			
Yes	166	3226	<.001
No	980	3385	
At current residence ≥3 y			
Yes	419	3411	<.05
No	730	3333	
Locus of control of one's health			
Chance			
Yes	748	3319	<.001
No	395	3442	
Powerful others			
Yes	439	3326	<.10
No	698	3386	
Internal forces			
Yes	699	3336	<.05
No	399	3399	
No affiliation with religious, educational, social, political, or other groups			
Yes	402	3305	<.01
No	748	3392	
Fasted for 1 or more days during pregnancy			
Yes	114	3250	<.05
No	1011	3380	
Weighted physical activity score based on 24-h recall			
0–11	250	3274	<.05
12–19	321	3372	
20–26	275	3380	
27–74	284	3418	
New indices			
Material hardship			
0	659	3363	. . .
1	257	3366	
2	133	3393	
≥3	101	3301	
Social adversity			
0	175	3415	<.01
1	304	3403	
2	305	3387	
≥3	366	3282	

Note. Risk factor subtotals may not add to 1150 because of missing data.

effects of the other factors in the model were taken into account. The addition of gestational age into the model resulted in slight decreases in these associations (15 to 20 g). This indicates that these three newly identified factors are much more highly associated with fetal growth than length of gestation. While social adversity was associated with birthweight in the unadjusted analysis, it was not associated with birthweight after the effects of marital status were taken into consideration.

The large ethnic-group disparities remained after all the factors listed in Table 3 were controlled. African-American infants were on average 236 g lighter than White infants, and Chinese infants were 215 g lighter than Whites. The birthweights of the Dominican, Mexican, and Puerto Rican infants were no different from those of the White infants. We were not able to adjust for clinic site in our analyses because all of the Chinese women were recruited from one clinic. Therefore, the ethnic-group differences observed may be partially due to clinic site.

Discussion

This prospective study of the correlates of infant birthweight confirmed previously described associations, ruled out many newly measured lifestyle factors, and defined additional lifestyle factors that are associated with birthweight. After controlling for level of poverty and the other known correlates of birthweight, we found that living in public housing had an independent negative relationship with birthweight; belief that chance has a major role in determining one's health status was also negatively associated with birthweight; and having a stable residence was positively related to birthweight. The significance of these newly described correlates of birthweight is unclear. It is likely that a factor such as living in public housing is a marker for other environmental exposures that were not measured in this study. Protective factors such as not having moved from one's place of residence in the past 3 years may also be a marker for other types of unmeasured social supports.

What is notable about this study is the large number and types of risk factors that were *not* related to birthweight. In our study, measures of material hardship and social adversity varied greatly by ethnic group but were not associated with mean birthweight, and thus may not explain the ethnic-group differences in birthweight. Factors such as perceived racial discrimination, physical abuse, anxiety, depression, and overall dissatisfaction with life were also not associated with birthweight.

Including pregnant women from a wide variety of backgrounds and obtaining information from them on an extensive variety of subjects is the source of both our study's major strength and its major weakness. The diversity of our study population provided us with the opportunity to examine the potential sources of the wide ethnic disparity in birth outcomes. However, obtaining valid information from this diverse group of women, many of whom were recent immigrants, was a challenge. Even though the questionnaires were translated into Spanish and Chinese and back-translated, it is possible that some of the questions were not translated successfully. Our interviewers noted that some women found it difficult or impossible to answer questions about self-esteem and to describe personal feelings.

TABLE 3—Multiple Regression Analysis of Factors Associated with Birthweight: Women's Lifestyle in Pregnancy Study, New York and Chicago, 1987 through 1989

	Regression Coefficient[a]	SE	P
Previously described risk factors			
Ethnic group			
African American	−236	59	<.001
Chinese	−215	78	<.01
Dominican	−49	47	
Mexican	−71	71	
Puerto Rican	−106	69	
White[b]	. . .	. . .	
Maternal age	8	3	<.05
Married	7	41	NS
Unmarried[b]	. . .	. . .	
High school graduate	43	39	NS
Not a high school graduate[b]	. . .	. . .	
Percentage of federal poverty level			
≤99%	5	55	NS
100%–199%	42	55	
≥200%[b]	. . .	. . .	
Type of health insurance			
Health maintenance organization	−10	71	NS
Medicaid	−25	58	
Private	−55	59	
Other, self, none[b]	. . .	. . .	
Smoked during pregnancy	−83	43	<.10
Did not smoke during pregnancy[b]	. . .	. . .	
Body mass index	11	3	<.001
New risk factors			
Lived in public housing	−83	49	<.10
Did not live in public housing[b]	. . .	. . .	
Chance locus of control	−78	35	<.05
Had stable housing	76	35	<.05
Did not have stable housing[b]	. . .	. . .	

Note. There are fewer women in this analysis because of missing data. n = 1028; $R^2 = 0.09$; degrees of freedom ($18_{regression}$, 1009_{error}). Ethnic group, marital status, education, percentage of federal poverty level, insurance type, smoking during pregnancy, living in public housing, and having stable housing were coded as categorical variables. Maternal age, body mass index, and locus of control were coded as continuous variables. All factors listed in Table 2 (except history of a previous low-birthweight infant) were entered into the initial regression model. Backward stepwise linear regression was used to remove factors that were not statistically significant ($P > .10$).

[a]Regression coefficients may be interpreted as the average difference in birthweight between the levels of risk factors tested.

[b]Comparison group.

To uncover the complete, multifaceted picture of the causes of low birthweight, we need to aggressively search new avenues that may provide us with important etiologic clues. Studies that cast a wide net and examine a large number of new potential correlates of birthweight may provide us with the impetus to continue this search. Our findings, while preliminary, point toward several new avenues that deserve attention. Factors such as the social and environmental risk factors associated with living in public housing and the protective factors that are associated with living in a stable residence appear to hold promise in this search.

That one third of the women from this very diverse population believe that chance plays a major role in determining one's health status, and that this attitude was associated with decreased birthweight, is a new and disturbing finding. However, it also leads us to an obvious potential solution—provide women with the skills and knowledge necessary to take more control of their lives and help them to take more positive steps toward a healthy lifestyle. Moreover, it is likely that obtaining a sense of control over her own health and perhaps her own life will have a positive effect not only on the woman's health but also on the health of her entire family. If the belief that chance plays a major role in one's health status does have an effect on behaviors that modify birthweight, then these potential solutions deserve to be tested.

In summary, our findings emphasize just how little we are able to document in the search for the causes of decreased birthweight. We screened 46 previously defined and new potential risk factors and found that a majority of the new factors tested were not associated with birthweight. However, our findings do confirm the negative role of an impoverished living environment and feelings of helplessness, as well as the positive role of having a stable form of social support. These findings provide us with new clues that deserve further attention in our search for the causes of low birthweight and the ethnic disparities in birth outcomes in the United States. □

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