



MEDIATORS OF ETHNIC-ASSOCIATED DIFFERENCES IN INFANT BIRTH WEIGHT

RUTH E. ZAMBRANA, PHD, CHRISTINE DUNKEL-SCHETTER, PHD,
NANCY L. COLLINS, PHD, AND SUSAN C. SCRIMSHAW, PHD

ABSTRACT

Purpose. To examine whether ethnic differences in low birth weight babies of low-income women may be explained in part by group differences in prenatal health behaviors and psychosocial factors.

Method. A prospective survey of 1,071 low-income, primiparous African-American and Mexican-origin women was conducted in Los Angeles County, California. In face-to-face interviews, data were obtained on substance use, prenatal stress, social support, attitudes toward pregnancy, initiation of prenatal care, and medical risk. Medical chart data were abstracted regarding medical risk factors and labor, delivery, and neonatal data. Interview data were linked with birth outcome data retrieved from maternal medical records. Structural equation modeling was used to test a hypothesized model in which differences in birth weight were expected to be mediated by ethnic differences in substance use, psychosocial factors, and medical risk.

Results. As expected, African-American women delivered babies of earlier gestational age and lower birth weight than did women of Mexican origin. Direct predictors of low birth weight were use of drugs and cigarettes, prenatal stress, and positive attitudes toward pregnancy; together, these factors accounted for the observed ethnic differences in birth weight.

Conclusion. These data contribute to our understanding of the factors that may account for ethnic-associated differences in low birth weight.

KEY WORDS Ethnicity, Low Birth Weight, Substance Use.

Dr. Zambrana is from the Social Work Program, George Mason University; Dr. Dunkel-Schetter is from the Department of Psychology, University of California, Los Angeles; Dr. Collins is from the Department of Psychology, State University of New York at Buffalo; and Dr. Scrimshaw is from the School of Public Health, University of Chicago at Illinois.

Correspondence and reprints: Ruth E. Zambrana, George Mason University, Social Work Program, 4400 University Drive, Mail Stop 2E8, Fairfax, VA 22030-4444.

INTRODUCTION

Ethnic differences in birth weight persist despite focused research attention in the last two decades.¹⁻⁶ Nationally, higher rates of low birth weight in the US occur in urban areas with high concentrations of low-income ethnic populations.^{1,2} The role of poverty and its differential effects on maternal prenatal behaviors and psychosocial factors have captured scientific attention. Substantial evidence links low socioeconomic status (SES) and poverty to less-favorable birth outcomes. However, SES cannot explain differences among US ethnic groups who share similar levels of economic disadvantage.³ Recent evidence shows that poverty directly influences infant outcome as a result of vulnerability to a set of behavioral, psychosocial, and community-based environmental risk factors.⁶⁻¹⁰ Thus, lifestyle and health behaviors, living conditions, life stressors, social integration, and social support are viewed not as individual characteristics, but as the patterned response of social groups to the realities and constraints of the external environment.¹¹ Furthering our understanding of ethnic-specific disparities in birth weight requires inquiry into the social, cultural, and community context of low-income women, their environmental stressors, and any protective mechanisms available in the community for responding to stress.¹² The evidence is convincing that maternal prenatal health behaviors and psychosocial factors are linked closely to infant birth weight.

Multiple studies of stress and social support provide evidence of direct or interactive effects of these factors on birth weight or gestational age.¹³⁻¹⁶ Both high stress and low social support are associated negatively with lower birth weight.¹⁷⁻¹⁹ The use of substances such as cigarettes and alcohol or drugs during pregnancy are linked directly to decreased fetal growth, low birth weight, and premature delivery.²⁰⁻²⁴ Use of several of these substances, or consistent use of any one of them, contributes to adverse birth outcomes. National estimates of the true incidence of drug-exposed infants are as high as 11% to 15%.²⁰ Prenatal substance use patterns between low-income African-American and Mexican-origin mothers may account in part for differences in birth weight.²⁵

In contrast, prenatal health behaviors associated with favorable birth weight include positive attitudes toward a pregnancy and early initiation of prenatal care.² Prior studies suggest that ethnic women with more traditional attitudes regarding the role of motherhood are more likely to engage in certain self-care behaviors during pregnancy, such as proper nutrition and abstinence from drugs and alcohol.^{2,26-28} Closely related to self-care behaviors is early initiation of prenatal care. Among low-income racial/ethnic women, only about 60% initiate prenatal

care in the first trimester.²⁴ Studies of the effects of prenatal care show favorable, albeit modest, effects on birth weight among low-income women,⁹ suggesting that extent of care and psychosocial stressors are contributing factors in low birth weight.¹³

The primary goal of this study was to examine whether ethnic differences in low birth weight of infants of low-income women may be explained, in part, by group differences in prenatal health behaviors and psychosocial factors. Several major hypotheses were tested. Consistent with past research, we expected that rates of low birth weight would be higher for African-American women than for women of Mexican origin. We predicted that there would be ethnic differences in prenatal health behaviors (substance use), psychosocial factors (stress, social support from the baby's father, attitudes toward pregnancy), prenatal care, and medical risk. We expected that these prenatal risk factors would be significant predictors of birth weight differences between the two ethnic groups when controlling for gestational age. Finally, we predicted that the relationship between ethnicity and low birth weight would be significantly less in magnitude after accounting for the effects of differences in prenatal substance use, stress, social support, attitudes toward pregnancy, and medical risk.

METHODS

SAMPLE SELECTION AND INTERVIEW PROCEDURES

To be eligible for this study, a woman had to be either African-American (born in the US) or of Mexican origin. Two groups of Mexican-origin women were recruited: Mexican-Americans (born either in the US or Mexico, but residing in the US since age 10) and Mexican immigrants (born in Mexico and residing in the US for 7 years or less). All Mexican-origin women were combined into a single category because there were no significant differences between these groups in birth weight or gestational age of babies born to the women.²⁹ To examine ethnic differences independent of sociodemographic and medical risk factors, we limited our sample to women who were between 17 and 35 years old, primiparous (no prior pregnancies beyond 16 weeks gestation), at least 20 weeks pregnant, and low income (12 or fewer years of completed education and eligible for public insurance programs for the indigent).

Potential respondents were identified in 22 community-based prenatal care clinics during the years 1987–1989. After an initial screening, women who met all eligibility criteria were invited to participate in the study. Of those eligible, 96% agreed to participate. Written informed consent was obtained for the interview and for retrieval of infant outcome data after delivery. Women then were

interviewed in a private area of the clinic, and approximately two-thirds (65%) of the interviews were conducted in Spanish. Women were an average of 30 weeks pregnant at the time of their interview.

After delivery, birth outcome data were abstracted from maternal medical records at 26 hospital sites. We attained a 78% match rate of interviews with medical record data ($n = 1,202$). From this larger sample, 90% ($n = 1,071$) had complete data for all variables used in this paper. Match rates and missing data rates did not differ by ethnicity.

The current sample consisted of 900 Mexican-origin and 171 African-American women who had complete interview and medical records data. The mean age of women in our sample was 21 and the mean years of education were 9.5. Approximately 70% of the sample were unemployed at the time of the interview; 39% were receiving public medical insurance. Of the sample, 57% reported living with the baby's father; 38% were married to the baby's father at the time of the interview.

MEASURES

Four psychosocial measures were used for this paper.

1. A 16-item stressful life events inventory assessed whether particular life events (e.g., recent move, loss of home, unusual money worries) had occurred since the respondent became pregnant. Life events were scored as present (1) or absent (0), and a life events index was computed by summing the total number of events present.
2. To assess distress associated with life events, respondents rated a single item that indicated, on a 5-point scale, the degree to which their life events were upsetting (1 = not at all; 5 = extremely).
3. An eight-item version of the Perceived Stress Scale assessed chronic strain and inability to cope.³⁰ Items were rated on a 5-point scale (1 = never; 5 = almost always), with higher scores indicating greater perceived stress. Cronbach's alpha was .73 in English and .75 in Spanish.
4. A six-item scale was used to measure social support from the baby's father during pregnancy (e.g., "Has he shown that he cares about you?" and "Has he disappointed you or let you down?").³¹ Items were rated on a 5-point scale, with responses ranging from "never" to "almost always." Cronbach's alpha was .91 in English and Spanish.

A three-item index of positive attitudes toward pregnancy was included on an exploratory basis.^{2,28} Women rated, on a five-point scale ranging from "never" to "almost always," the degree to which they felt "special," "lucky," and "healthy"

during their pregnancy. Cronbach's alpha was somewhat low (.51), but was adequate for exploratory purposes.

Respondents were asked about the frequency of their use both "during pregnancy" and "3 months before pregnancy" of cigarettes, alcohol, and illicit drugs (cocaine, phencyclidine [PCP], marijuana, or heroin). Items were rated on a 6-point scale (1 = never; 6 = daily intake) and then recoded into dichotomous variables that distinguished users from nonusers.³³ Three substance use variables were computed: (1) smoking during pregnancy, (2) alcohol use during pregnancy or up to 3 months prior to pregnancy, and (3) illicit drug use during pregnancy or up to 3 months prior to pregnancy. We combined prior users and current users of alcohol and drugs because of very low base rates and because past research indicates that pregnant women are likely to under-report their current substance use.³⁴

To assess adequacy of initiation of prenatal care, respondents were asked how many weeks pregnant they were at the time of their first prenatal care visit.

Biomedical risk data were abstracted from maternal prenatal care and delivery records. A medical risk index was computed based on criteria from the Problem Oriented Perinatal Risk Assessment System (POPRAS) and prior research.³⁵ Each woman was assigned a medical risk score that was the sum of all her medical risk conditions. Risk scores in the sample ranged from 0 to 9, with an average risk score of 1.5.

Birth outcomes were abstracted from medical charts as reported by nurses and/or physicians at the time of delivery. The primary outcome examined in this study was infant birth weight (in grams). However, for control purposes, we also examined infant gestational age (in weeks) at delivery. Because gestational age was unlikely to have been measured precisely, we coded it into three categories for most analyses (clearly preterm < 35 weeks; marginally preterm 36–37 weeks; full term 38 weeks).

RESULTS

ETHNIC DIFFERENCES IN BIRTH OUTCOMES AND MEDIATORS

In our first analysis, we examined ethnic differences in birth outcomes. As shown in the upper panel of Table I, significant group differences emerged for both gestational age and birth weight. As expected, African-American women gave birth earlier and delivered babies of lower birth weight. Next, we dichotomized gestational age and birth weight into clinically significant groups using standard clinical definitions (preterm birth as less than 37 weeks gestation, low birth weight as less than or equal to 2,500 grams). Logistic regression analyses then

TABLE I Means (or Percentages) for African-American and Mexican-Origin Women for All Study Variables

Variable	African-Americans (N = 171)		Mexican Origin (N = 900)		F or χ^2
	Mean	SD	Mean	SD	
Birth outcomes					
Birth weight (grams)	3,147	546	3,361	460	29.17*
Gestational age (weeks)	39.47	2.33	39.80	1.65	4.90†
Background					
Age	20.28	3.13	21.12	3.30	9.42*
Education	11.48	0.78	9.11	2.71	128.37*
Currently employed	15%	—	20%	—	42.17*
Medical risk	2.23	1.88	1.37	1.31	53.15*
Psychosocial					
Number of life events	3.33	2.20	2.55	2.04	20.45*
Distress from life events	2.94	1.25	2.24	1.21	47.20*
Perceived stress	19.35	5.30	17.55	5.64	14.81*
Father support	22.30	5.72	23.03	7.64	1.43
Pregnancy attitudes					
Positive attitudes	3.55	0.96	4.17	0.76	88.25*
Substance use					
Current smoking	12%	—	1%	—	39.79*
Current/prior alcohol	34%	—	24%	—	9.21†
Current/prior drugs	21%	—	4%	—	47.35*
Prenatal care					
Week initiated	12.31	6.33	13.77	6.72	6.88‡

Note: F statistics were computed for all numerical variables, and chi-square statistics were computed for all categorical variables. Standard deviations (SDs) are not shown for categorical variables.

* $P < .001$

† $P < .05$.

‡ $P < .01$.

were employed to obtain relative risk ratios. Compared to women of Mexican origin, African-American women were 2.39 (95% confidence interval [CI] = 1.16–4.96) times more likely to have a preterm birth (6.4% vs. 2.8%) and were 2.66 (95% CI = 1.38–5.15) times more likely to deliver a baby of low birth weight (8.2% vs. 3.2%). These analyses provide clear evidence for the expected ethnic difference in birth outcome.

In our next set of analyses, we examined ethnic differences on all potential mediator variables. As shown in Table I, compared to Mexican-origin women, African-American women were younger, more educated, had higher medical risk scores, initiated prenatal care earlier, were less likely to be living with the

baby's father, and were less likely to be employed currently. In addition, African-American women experienced significantly more prenatal stress—as indicated by all three stress measures—and they reported less-positive feelings during their pregnancy. Support from the baby's father did not differ significantly between the two groups. Finally, African-American women were more likely to smoke during pregnancy and more likely to have used drugs and alcohol during and/or 3 months prior to pregnancy.

BIVARIATE TESTS OF RELATIONS BETWEEN MEDIATORS AND OUTCOMES

In the next set of analyses, we examined the bivariate relations between the hypothesized mediators and the two birth outcomes. Pearson correlation coefficients and point-biserial correlations were computed for the full sample and within each ethnic group. Because the patterns for the two groups were highly similar, we present correlations for the full sample only.

As shown in Table II, women whose babies were born earlier reported more perceived stress, more distress from life events, and were more likely to have used drugs or alcohol than women whose babies were born later. Women with

TABLE II Correlations Between Birth Outcomes and All Potential Mediator Variables

Variable	Gestational Age	Birth Weight
Age	.025	.042
Education	-.020	-.037
Currently employed	.013	-.020
Medical risk	-.040	-.064*
Psychosocial		
Number of life events	-.055	-.082†
Distress from life events	-.080†	-.060*
Perceived stress	-.064*	-.023
Father support	.041	.078*
Pregnancy attitudes		
Positive attitudes	-.006	.101†
Substance use		
Current smoking	-.039	-.107†
Current/prior alcohol	-.060*	.010
Current/prior drugs	-.065*	-.094†
Prenatal care		
Week initiated	.054	.027

Note. N = 1,071.

* $P < .05$.

† $P < .01$.

lower-birth-weight babies had higher medical risk scores, more prenatal life events, and more distress associated with life events than did women with higher-birth-weight babies. In addition, women with lower-birth-weight babies reported less social support from the baby's father, were less likely to be living with the baby's father, had less-positive attitudes during pregnancy, and were more likely to have used drugs and to be current smokers.

MODEL SPECIFICATION AND TESTING

In the last analysis, we performed structural equation modeling (SEM) to test the links between ethnicity, the prenatal (mediator) variables, and birth weight simultaneously.³⁶ If ethnic differences in birth weight can be explained by differences in prenatal psychosocial factors and health behaviors, then there should be no direct relationship between ethnicity and birth weight once the mediator variables have been accounted for.

The following variables were included in the model. First, ethnic group was coded as a dummy variable (African-American = 0, Mexican origin = 1). Second, the bivariate analyses were used as a guide for selecting specific mediator variables. A variable qualified as a potential mediator only if it differed significantly between ethnic groups *and* was related significantly to gestational age or birth weight. On this basis, the following variables were included: number of stressful life events, distress associated with life events, perceived stress, positive attitudes during pregnancy, drug use, smoking, and medical risk. We then formed three latent factors, which enabled us to improve measurement by reducing our variables to a smaller, more reliable and valid set of underlying constructs. A prenatal stress latent variable included number of life events, distress associated with these events, and perceived stress. Current smoking and drug use were included in a second latent factor, substance use; a third latent factor, positive attitudes during pregnancy, included ratings of the three pregnancy attitude items (lucky, special, healthy). Finally, gestational age and birth weight were included as continuous outcome variables.

The hypothesized model specified direct paths from ethnicity to each of the mediator variables (stress, substance use, positive attitudes, and medical risk) and from each of the mediator variables to the two birth outcomes (gestational age and birth weight). In addition, because gestational age is a direct cause of low birth weight, we also included a path from gestational age to birth weight. The inclusion of this path means that gestational age is controlled for in any relation between birth weight and any other variable in the model. Finally, it was expected that some of the mediators would be intercorrelated. Prenatal stress

was hypothesized to be associated positively with substance use and associated negatively with positive attitudes during pregnancy. Positive attitudes also were expected to be related inversely to substance use.

MODEL RESULTS

The hypothesized model was tested using EQS software and maximum likelihood estimation.³⁶ After estimating the hypothesized model, the model was trimmed by dropping nonsignificant paths, one at a time, until only significant paths remained. Next, modification indices (diagnostic tools) provided by EQS indicated that two additional pathways would improve the fit of the model. First, the residual from the perceived stress index was correlated inversely ($r = -.27$) with the residual for the positive attitudes latent factor. This suggests that women who scored high on the unique aspects of the perceived stress scale (aspects not shared with the other two life events indicators) were less likely to feel "healthy, special, and lucky." Second, a regression path linking ethnicity to the residual for feeling "lucky" also was added to the model ($b = .25$). This path indicates that Mexican-origin women were more likely to feel lucky, in ways that were not shared by the other two positive attitudes. Adding these additional paths improved model fit, but did not alter the substantive relations between the mediators and the outcomes.

The final model provided a good fit to the data, as indicated by a Comparative Fit Index (CFI) of .97 and a ratio of chi-square to degrees of freedom of 2.1 [$X^2(45) = 94.92, P < .01$]. (The CFI, which is the best measure of model fit when the sample size is large, can range from 0 to 1.0. Values of CFI in excess of .90 indicate good model fit). Parameter estimates for the final model are shown in the Figure. Numbers on arrows represent standardized regression coefficients; paths linking the latent variables (e.g., stress) to the measured variables (e.g., number of life events) represent factor loadings. For simplicity, residuals (disturbances) and correlations between residuals are not shown.

As shown in the Figure, African-American women experienced greater prenatal stress, and prenatal stress was associated with earlier delivery. Early delivery, in turn, was the strongest predictor of birth weight. Next, African-American women used more substances and had less-positive attitudes toward their pregnancy; these factors, in turn, were associated with lower birth weight (after controlling for gestational age). Although African-American women also had higher medical risk scores, this factor was not associated with birth weight. Finally, as predicted, there were no direct links between ethnicity and either of the birth outcomes. (We tested these links by adding direct paths from ethnicity

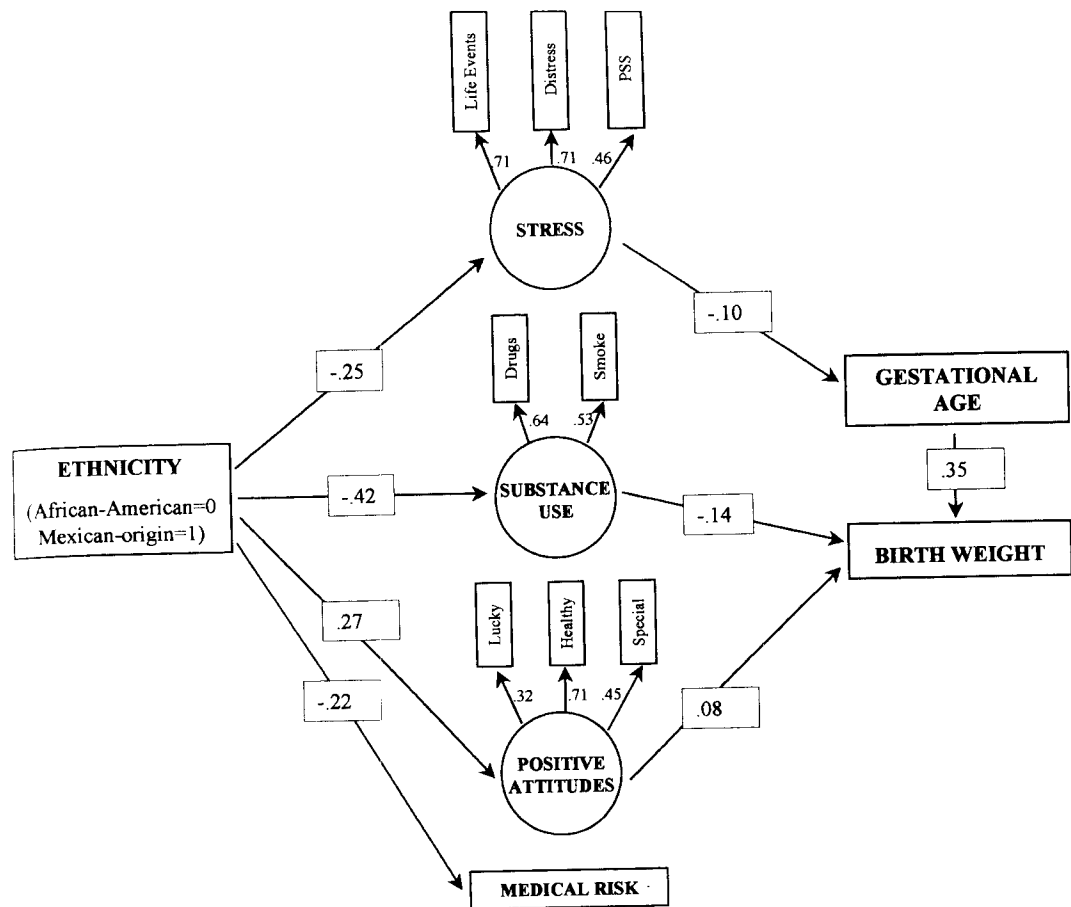


FIGURE Relationships of prenatal health behaviors and psychological factors on birth weight.

Statistical note: Final parameter estimates for the modified mediational model of ethnic differences in birth weight. All paths are significant at $p < .05$. $N = 1071$. *Not* shown are the residuals (the disturbances) associated with all endogenous variables. Also *not* shown are the following additional paths: a correlation between the residual for stress and the residual for substance use ($r = .29$), a correlation between the residual for stress and the residual for positive attitudes ($r = -.36$), a correlation between the residual for substance use and the residual for positive attitudes ($r = -.17$), a correlation between the residual for perceived stress (PSS) and the residual for positive attitudes ($r = -.27$), and a regression path linking ethnicity to the residual for lucky ($b = .25$). PSS = Perceived Stress Scale.

to gestational age and birth weight. Neither path was significant statistically, and their addition did not improve model fit.) In summary, this model is consistent with the hypothesis that ethnic differences in birth weight were mediated by stress, substance use, and pregnancy attitudes.

DISCUSSION

This study sought to advance our understanding of the complex direct and indirect effects of ethnicity on low birth weight. We tested whether substance

use, psychosocial factors, attitudes toward pregnancy, initiation of prenatal care, and medical risk may explain, or mediate, the observed link between ethnicity and infant birth weight.

The hypothesis concerning the direct effects of substance use on low birth weight clearly was supported. In this study, about 8% of all respondents reported use of drugs, which is comparable to national estimates of drug use among pregnant women.²⁵

The hypothesis concerning prenatal stress and low birth weight also was supported clearly. These data suggest that prenatal stress may contribute to low birth weight through three indirect avenues: an association with relatively unhealthy behaviors, such as substance use; an association with less-positive attitudes toward pregnancy; and direct effects on preterm delivery.³⁷ Many of the stressful life events reported by women in our sample are events that are largely environmental and outside their control.^{7,11,37,38} Low-income women confront multiple chronic stressors in their daily living that involve serious, chronic, and environmentally linked events, such as being mugged or attacked or having someone close being injured; prior evidence suggests that such events can contribute to substance use.^{38,39} Alternatively, it may be that respondents who use drugs are more vulnerable to the experience of stressful life events. While the direction of the relationship between stress and substance use cannot be determined by this study, future research should explore the context of pregnancy, particularly the role of violence, in the lives of pregnant women who use drugs.⁴⁰

The hypothesis concerning the effects of positive attitudes toward pregnancy on birth weight was supported partially. Although our measure of positive attitudes toward pregnancy was modest in comparison to the measures of other mediators, it had a direct relationship with birth weight, as well as an indirect relationship, by means of lower stress, to gestational age. Although this study cannot explicate fully the pathways through which positive attitudes affect infant birth weight, it is likely that a woman's attitudes during pregnancy are associated with prenatal behaviors in a number of ways. For example, a woman who feels special during her pregnancy may be more likely to take care of herself and may engage in more positive health behaviors.^{2,3,27} Not unexpectedly, we found a negative correlation between positive attitudes and self-reported substance use. Although empirical work in this area has been limited, these data suggest the potential significance of maternal attitudes as protective factors in understanding infant outcomes.

Contrary to our hypotheses, medical risk, prenatal care initiation, and support from the baby's father were not significant predictors of either birth weight or

gestational age. We speculate that the limited variation on biomedical risk and initiation of prenatal care in our sample is perhaps due to the respondents being relatively young and healthy, and all respondents were receiving prenatal care. Further, medical risk assessment measures have limited validity for primiparous and low-income women.^{2,19,41} These factors may have reduced our power to detect the effects of important medical risk factors. However, a recent study found that the components of prenatal care that are most effective in reducing risk of low birth weight were time spent in psychosocial services. The authors found that, when length of gestation was accounted for, rates of low birth weight no longer differed significantly between low-income African-American, Latin, and white women.¹³ Thus, it is plausible that high-quality prenatal care and its potential gate-keeping functions, such as psychosocial interventions, advice about health behaviors, and referral for treatment for substance use, were not readily available to our sample of low-income women in public health care settings.³⁷ Support from the baby's father was not a significant predictor of birth weight when other factors were controlled. This is not too surprising, given that prior studies have not demonstrated consistently the direct effects of a father's support on birth weight.^{17,38} In addition, what constitutes social support from the baby's father, given that these fathers face similar social and economic disadvantage and life stressors as the pregnant respondents, merits further investigation.

The last hypothesis, that ethnicity would no longer be a significant predictor of birth weight when the mediators were included in the analyses, was also supported. Our data are consistent with the hypothesis that differences in birth weight between African-American and Mexican-origin women are mediated by differences in prenatal health behaviors and psychosocial factors. Our data show that, for women of low SES, substance use, prenatal stress, and positive attitudes toward pregnancy predict preterm delivery and low birth weight more directly than does ethnic status. Additional variables not included in these analyses, such as nutritional habits, other social and environmental risk factors, and institutional racism, which are correlated highly with SES, also may contribute to ethnic differences in birth weight and should be examined in future studies.^{12,42-44}

Our study offers evidence that prenatal health behaviors, psychosocial factors, and attitudinal factors may explain in part ethnic differences in birth weight, when controlling for SES. Although these data cannot be used to draw firm conclusions about causal relationships, they demonstrate the relevance of prenatal health and psychosocial factors in examining low birth weight in low-income women. Ethnic birth weight differences, in fact, may be the result of the long-term intergenerational effects of poverty (SES) on behavioral and psychosocial risk

factors, combined with institutional and societal discrimination. It is worth noting that the focus of health research has been driven by a bias that implies that:

The disproportionate share of the burden of poverty and disease borne by minorities is related to inherent racial traits and genetic defects, rather than on societal problems such as poverty, suboptimal health care, or a legacy of racial prejudice.^{45(p277)}

It is essential to expand our scientific paradigms to build toward a more multidimensional understanding of the complex set of biopsychosocial factors that influence ethnic-specific differences in birth weight. The reconciliation in scientific frameworks of biological, social, and environmental contributors to ethnic-specific low birth weight is imperative for advancing knowledge in this area.^{3,4,9,11,12}

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the efforts and cooperation of respondents, administrators, providers, and medical record staff, without whom this study could not have been conducted. We also wish to thank Dr. Hector Balcazar for his helpful comments and suggestions. This research and data derived for this study were funded by the Agency for Health Care Policy and Research (grant R01 HS/HD 05518-01A).

REFERENCES

1. *Troubling Trends: the Health of America's Next Generation*. Washington, DC: National Committee to Prevent Infant Mortality; 1990.
2. Institute of Medicine. *Prenatal Care: Reaching Mothers. Reaching Infants*. Washington, DC: National Academy Press; 1988.
3. Rumbaut RG, Weeks JR. Unraveling a public health enigma. *Res Soc Health Care*. 1996; 13B:337-391.
4. Paneth NS. The problem of low birth weight. *Future Child*. 1995;5(1):19-34.
5. Shiono PH, Rauh VA, Park M, Lederman SA, Zuskar D. Ethnic differences in birth weight: the role of lifestyle and other factors. *Am J Public Health*. 1997;87(5):787-793.
6. Singh GK, Yu SM. Adverse pregnancy outcomes: differences between US- and foreign-born women in major US racial and ethnic groups. *Am J Public Health*. 1996;86(6): 837-843.
7. Chomitz VR, Cheung LWY, Lieberman E. The role of lifestyle in preventing low birth weight. *Future Child*. 1995;5(1):121-138.
8. Adler NE, Boyce WT, Chesney MA, Folkman S, Syme L. Socioeconomic inequalities in health. *JAMA*. 1993;269(24):3140-3145.
9. James, SA. Racial and ethnic differences in infant mortality and low birth weight. *Ann Epidemiol*. 1993;3:130-136.
10. Combs-Orme T, Risley-Curtiss C, Taylor R. Predicting birth weight: relative importance of sociodemographic, medical, and prenatal care variables. *Soc Serv Rev*. 1993;67:617-630.
11. Williams DR. Socioeconomic differentials in health. *Soc Psychol Q*. 1990;53(2):81-99.
12. Rowley D. Research issues in the study of very low birth weight and preterm delivery among African American women. *J Natl Med Assoc*. 1994;86:761-764.
13. Zimmer-Gembeck MJ, Helfand M. Low birth weight in a public prenatal care program:

- behavioral and psychosocial risk factors and psychosocial intervention. *Soc Sci Med.* 1996;43(2):187-197.
14. Norbeck JS, DeJoseph JF, Smith RT. A randomized trial of an empirically-derived social support intervention to prevent low birthweight among African American women. *Soc Sci Med.* 1996;43(6):947-954.
 15. Elbourne D, Oakley A. An overview of trials of social support during pregnancy. In: Berendes H, Kessel S, Yaffe S, eds. *Advances in the Prevention of Low Birth Weight.* Washington, DC: National Center for Education on Maternal and Child Health; 1991: 39-54.
 16. Sherraden MS, Barrera RE. Poverty, family support, and well-being of children: Mexican immigrant women and childbearing. *J Sociol Soc Welfare.* 1996;23(2):27-54.
 17. Dunkel-Schetter C, Sagrestano LM, Feldman P, Killingsworth C. Social support and pregnancy. A comprehensive review focusing on ethnicity and culture. In: Pierce GR, Sarason BR, Sarason IG, eds. *Handbook of Social Support and the Family.* New York: Plenum Press; 1996:375-412.
 18. McLean DE, Hartfield-Timajchy K, Wingo PA, Floyd RL. Psychosocial measurement: implications for the study of preterm delivery in black women. *Am J Prev Med.* 1993; 9(6):39-81.
 19. Wadhwa PD, Sandman CA, Porto M, Dunkel-Schetter C, Garite TJ. The association between prenatal stress and infant birth weight and gestational age at birth: a prospective investigation. *Am J Obstet Gynecol.* 1993;169:858-865.
 20. Robins LN, Mills JL. Effects of in utero exposure of street drugs. *Am J Public Health.* 1993;83(Suppl):1-32.
 21. Abma JC, Mott FL. Substance use and prenatal care during pregnancy among young women. *Fam Plann Perspect.* 1991;23(3):117-128.
 22. Petitti DB, Coleman C. Cocaine and the risk of low birth weight. *Am J Public Health.* 1990;80(1):25-28.
 23. US Surgeon General's Report. *The Health Consequences of Smoking for Women.* Rockville, Md: US Department of Health and Human Services; 1988.
 24. Nordentoft M, Lou HC, Hansen D, et al. Intrauterine growth retardation and premature delivery: the influence of maternal smoking and psychosocial factors. *Am J Public Health.* 1996;86(3):347-354.
 25. National Center for Health Statistics. *Health United States 1995.* Rockville, Md: US Department of Health and Human Services; 1996. DHHS Publication No. (PHS) 96-1232.
 26. Balcazar H, Cole G, Hartner J. Mexican-Americans' use of prenatal care and its relationship to maternal risk factors and pregnancy outcome. *Am J Prev Med.* 1992;8(1):1-7.
 27. Sherraden MS, Barrera RE. Healthy babies against the odds: maternal support and cultural influences among Mexican immigrants. *Fam Soc.* 1996;77(5):298-313.
 28. Mercer R. *First-Time Motherhood.* New York: Springer; 1986.
 29. Zambrana RE, Scrimshaw SCM, Collins N, Dunkel-Schetter C. Prenatal health behaviors and psychosocial risk factors in pregnant women of Mexican origin: the role of acculturation. *Am J Public Health.* 1997;87(6):1022-1026.
 30. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24:385-396.
 31. Collins NL, Dunkel-Schetter C, Lobel M, Scrimshaw S. Social support in pregnancy: psychosocial predictors of birth outcome and postpartum depression. *J Pers Soc Psychol.* 1993;65(6):1243-1258.
 32. Lobel M, Dunkel-Schetter C. Conceptualizing stress to study effects on health: environmental, perceptual and emotional components. *Anxiety Res.* 1990;3:213-230.
 33. Belloc NB, Breslow L. Relationship of physical health status and mortality. *Prev Med.* 1972;2:67-81.
 34. Zuckerman B, Amaro H, Cabral H. Validity of self-reporting of marijuana and cocaine use among pregnant adolescents. *J Pediatr.* 1989;115(5):812-815.

35. Hobel CJ, Youkeles L, Forsythe A. Prenatal and intrapartum high-risk screening: risk factors assessed. *Am J Obstet Gynecol.* 1979;135:1051-1056.
36. Bentler PM. *EQS: Structural Equations Program Manual.* Los Angeles, Calif: BMDP Statistical Software; 1989.
37. DeVane D, Gary AR, Elftman S, Gallegos AA, Uretzky SA. *Babies and Mothers at Risk: Perinatal Needs Assessment for Los Angeles County.* Burbank, Calif: March of Dimes Birth Defects Foundations; 1992.
38. Lillie-Blanton M, Martinez RM, Taylor AK, Robinson BG. Latina and African American women: continuing disparities in health. *Int J Health Serv.* 1993;23(3):555-84.
39. Berenson AB, Stiglich NJ, Wilkinson GS, Anderson GD. Drug abuse and other risk factors for physical abuse in pregnancy among white non-Hispanic, black, and Hispanic women. *Am J Obstet Gynecol.* 1991;164(6):1491-1499.
40. Amaro H, Fried LE, Cabral H, Zuckerman B. Violence during pregnancy and substance use. *Am J Public Health.* 1990;80(5):575-579.
41. Main DM, Richardson D, Gahe SG, Strong S, Weller SC. Prospective evaluation of a risk scoring system for predicting preterm delivery in black inner city women *Obstet Gynecol.* 1987;6(9):61-66.
42. King G. Institutional racism and the medical/health complex: a conceptual analysis. *Ethnicity Dis.* 1996;6(1)2:30-46.
43. Foster HW, Thomas J, Semanya KA, Thomas J. Low birth weight in African Americans: does intergenerational well-being improve outcome? *J Natl Med Assoc.* 1993;85:516-520.
44. Cooper RS. Celebrate diversity—or should we? *Ethnicity Dis.* 1991;1(1):3-7.
45. Osborne NG, Feit MD. The use of race in medical research. *JAMA.* 1992;267(2):275-78.