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Racial and Ethnic Disparities in Low Birthweight Among Urban Unmarried Mothers

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Abstract
Objectives We examined racial and ethnic disparities in low birthweight (LBW) among unmarried mothers and the extent to which demographic, economic, psychosocial, health, health care, and behavioral factors explain those disparities.
Methods Using a sample of 2,412 non-marital births from a national urban birth cohort study, we estimated multiple logistic regression models to examine disparities in LBW between non-Hispanic white (NHW), non-Hispanic black (NHB), U.S.-born Mexican-origin (USMO), and foreign-born Mexican-origin (FBMO) mothers.
Results NHW mothers were almost as likely as NHB mothers to have LBW infants. USMO mothers had 60% lower odds and FBMO mothers had 57% lower odds than NHW mothers of having LBW infants. FBMO mothers had no advantage compared to USMO mothers. Controlling for prenatal health and behaviors substantially reduced the LBW advantages for USMO and FBMO mothers. The odds of LBW for NHB mothers relative to NHW mothers increased with the addition of the same covariates.
Conclusions Racial and ethnic disparities in LBW among unmarried mothers—an economically disadvantaged population—do not mirror those in the general population. Prenatal health and behaviors are strongly associated with LBW in this group and explain a sizable portion of the Mexican-origin advantage. The lack of a significant black-white disparity in this group suggests that poverty plays an important role in shaping racial disparities in the general population. The finding that controlling for prenatal health and behaviors widens rather than narrows the racial disparity suggests that efforts to ameliorate black-white disparities in LBW should focus on social and health risks throughout the life course.

Keywords Low birthweight · Racial disparities · Ethnic disparities · Non-marital birth · Unmarried mothers

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Introduction

There are large disparities in low birthweight (<2500 g) by race and ethnicity in the U.S., especially between blacks and whites. Low birthweight (LBW) is a leading risk factor for infant mortality and is associated with a number of health conditions and developmental problems among infants who survive [1, 2]. In 2003, 13.6% of infants born to non-Hispanic black mothers and 6.9% of those born to non-Hispanic white mothers were LBW [3]. Women of Hispanic descent have rates on par with those of non-Hispanic whites (the rate for Hispanics in 2003 was 6.7%), but within that broad group rates vary widely. Women of Mexican and Cuban descent had rates of 6.3% and 7.0% in 2003, while Puerto Ricans had a rate of 10.0% [3]. Across virtually all racial/ethnic groups in the U.S., foreign-born mothers have lower rates of LBW than their U.S.-born counterparts [4, 5].

LBW is strongly associated with low socioeconomic status [6], and members of most minority groups are more likely than non-Hispanic whites to be poor [7]. Therefore, some of the observed racial/ethnic disparities in LBW may reflect differences in socioeconomic status across groups.

In particular, blacks have rates of poverty that are three to four times those of whites [7]. However, some groups defy this pattern. Mexican-origin mothers have favorable birth outcomes despite generally low socioeconomic status—a finding that has been referred to as an ''epidemiological paradox'' [8]. Similarly, the favorable birth outcomes of immigrants do not reflect their low socioeconomic status relative to native-born mothers [7]. Proposed explanations for the favorable birth outcomes of Mexican-origin and immigrant women involve cultural factors, such as healthy diets and low rates of substance use [9]; social support [10, 11]; and immigrant selectivity [12].

Not accounting for differences in socioeconomic status across groups may result in over- or underestimates of racial/ethnic disparities. However, data on income is either unavailable (e.g., in U.S. natality files) or unreliable [13] in most datasets that can be used to study disparities in birth outcomes. Moreover, current income may not always be a good proxy for socioeconomic status, particularly among women giving birth. Some studies have addressed this challenge by comparing birth outcomes of college-educated black women to those of college-educated white women [14, 15]. Those studies found evidence of racial disparities in LBW even among college-educated women, suggesting that socioeconomic status may not fully account for black–white disparities in LBW. However, if poverty results in health disadvantages that transcend generations, it may compromise birth outcomes even among women who are college-educated. Few studies have examined disparities in LBW at the other end of the income distribution—within economically disadvantaged populations.

Non-marital births represent a sizeable and growing share of births in the U.S. In 2003, 34.6% of all births were to unmarried women, up from 18.4% in 1980 [3]. Unmarried mothers have high rates of both poverty and adverse birth outcomes. The poverty rate for families with female heads, at 29%, was approximately five times the corresponding rate for married-couple families in 2002 [7]. In that same year, the rate of LBW among unmarried women was 9.9%, compared to 6.7% among married women [16]. Unmarried mothers are the focus of much public policy attention. They represent the dominant clientele of programs designed to improve birth outcomes and the target of recent welfare reform and marriage promotion efforts.

Attaining Healthy People 2010 objectives on improving birth outcomes for the overall population requires a clearer understanding of the factors affecting outcomes in disadvantaged populations, as achieving those goals for the overall population requires large reductions in adverse outcomes for the most disadvantaged groups. Unmarried mothers represent an easily identifiable, economically disadvantaged, policy relevant group. Past research has found that marital status and race have an interactive effect on LBW [17], suggesting that racial/ethnic disparities in LBW and the determinants of those disparities may be different for unmarried mothers than for the population as a whole. In this study, we use data from a national birth cohort survey that have been linked to medical records to examine racial/ethnic disparities in LBW and risk factors among infants born to unmarried mothers in large U.S. cities, as well as the contributions of demographic, economic, psychosocial, medical, and behavioral risk factors to those disparities.

Methods

Sample

The Fragile Families and Child Wellbeing (FFCWB) study is an ongoing longitudinal birth cohort study. Here, we briefly describe the research design and sample, which are described elsewhere in detail [18]. Between the spring of 1998 and the fall of 2000, parents were interviewed in 75 hospitals in 20 U.S. cities shortly after their children were born. Cities were selected from all 77 cities in the U.S. with over 200,000 people, using a stratified random sample. In 18 of the cities, all hospitals within the city boundaries that had maternity wards were included. In the other two (the largest) cities, hospitals were randomly sampled. Within each hospital, births were randomly sampled from birth logs. Non-marital births were oversampled.

While still in the hospital after giving birth, mothers were approached by a professional survey interviewer and screened for eligibility. Mothers were eligible for the study if they and the infant's father were at least 18-years-old (this restriction did not apply in approximately one-third of the hospitals, where they were considered emancipated minors), if they were able to complete the interview in either English or Spanish, if the father of the newborn was living, and if they were not planning to place the child for adoption. If they were eligible, mothers were asked to participate in a national survey about the conditions and capabilities of new parents, their relationships, and their children's well-being. The infants' fathers were also asked to participate. Informed consent was obtained. A total of 4,898 mothers (3,712 unmarried; 1,186 married) were interviewed after they gave birth. The number of unmarried mothers interviewed in each hospital, which ranged from 8 to 193, was proportional to that hospital's share of non-marital births in the city. The 3,712 unmarried mothers represent 87% of the sampled unmarried mothers who were eligible for the study. About 75% of the partners of those 3,712 mothers (the infants' fathers) completed interviews at that time.

As part of an ''add on'' study to the core survey, additional information was collected from medical records

(from the birth) for the mother and child in 17 of the cities in which interviews were conducted. Data were abstracted from the medical records using a detailed standardized instrument. The availability of medical record data depended on administrative processes of hospitals rather than decisions on the part of survey respondents to make their medical records available.

The analyses in this study were based on the sample of non-marital births, which is representative of non-marital births in U.S. cities with at least 200,000 people. The analysis sample consisted of 2,412 births. Medical record data, which were needed for the analysis, were available for only 2,714 of the 3,712 non-marital births in the FFCWB sample. Of those 2,714 cases, we excluded 45 because of missing data on race/ethnicity; another 55 because the mother was not Hispanic, white, or black (there were too few mothers in other racial/ethnic groups for meaningful analysis); another 46 which were multiple births; and another 156 because of missing data on covariates. A comparison of our analysis sample of 2,714 births to all 3,712 non-marital births in the FFCWB sample indicated negligible differences on the basis of race/ethnicity, nativity, maternal age, education, and LBW.

Exposure/Outcome Variable Definitions

We disaggregated Mexican-origin mothers into U.S.- and foreign-born. There were too few foreign-born mothers in other racial/ethnic groups for separate categorization in this way. The analysis groups are U.S.-born Mexican-origin (USMO), foreign-born Mexican-origin (FBMO), non-Hispanic black (NHB), non-Hispanic white (NHW), and other Hispanic mothers. For simplicity, we refer to these as ''racial/ethnic'' groups even though Mexican-origin mothers were disaggregated by nativity. Race, ethnicity, and nativity were based on mothers' self-reports. Over half (1,375 mothers, or 57% of our sample) were NHB; 415 (17%) were Mexican-origin, 340 (14%) were NHW, and 282 (12%) were other Hispanic. Of the Mexican-origin mothers, 242 (58%) were born in the U.S. (Table 1).

Birthweight was obtained from the medical records and coded as a dichotomous variable indicating whether the child was LBW (<2500 g) or not. For 16 cases, birthweight was not available from the medical records, so mothers' reports of birthweight were used. Correlation of birthweights from the two sources was .95. The rate of low birthweight in our sample of unmarried mothers was 11.5% (Table 1).

Covariate Definitions

The covariates are classified as ''Demographic, Economic, and Psychosocial'' (to encompass the social conditions of the mother prior to the pregnancy); ''Health Insurance, Prenatal Care, and Pre-Existing Health Conditions'' (to encompass access to health care and pre-pregnancy health); and ''Health and Behavior During Pregnancy'' (to encompass risk factors that can potentially be remediated by prenatal care).

Demographic, Economic, and Psychosocial Characteristics

The infant's sex was obtained from the medical records. Past research has found that maternal age patterns in birth outcomes differ by race [19, 20], and that paternal age above 34 years is a risk factor for LBW among disadvantaged populations [21]. Both maternal age (<20 years and 35+ years, versus 20–34 years) and paternal age (35+, versus <35 years) were based on mothers' post-partum reports.

Because there are strong associations between socioeconomic status and birthweight (as discussed earlier) and large racial/ethnic differences in socioeconomic status [22], the mother's level of education (<high school and high school graduate, versus more than high school) was included in the analyses. Fathers' financial contributions have been associated with rates of LBW among unmarried mothers [23] so we included the father's education (<high school, versus at least a high school education), whether the father was employed at the time of the birth, and whether the father had ever been incarcerated. The father's education and employment measures were taken from the father's initial interview. Father's incarceration was based on reports by both parents at follow-up interviews 1 year after the birth. Because this information was not available for all births, we included an indicator for missing data on father's incarceration. We also included an indicator for whether the father did not complete an initial interview.

Because of the heterogeneous and complex family structures and relationship characteristics among unmarried parents [24], speculation that partner relationships may underlie racial/ethnic disparities in birth outcomes [25], and past research showing associations between living arrangements and birth outcomes among unmarried mothers [23, 26, 27], the following characteristics (all from the mother's post-partum interview) were included: whether the parents had other children together, whether the mother had children with another partner, whether the father had children with another partner, the parents' living arrangement (romantically involved but not cohabiting and not romantically involved, versus cohabiting), and whether the parents knew each other for less than 1 year at the time of the child's conception.

Unwanted pregnancy varies by race/ethnicity [28], and is positively related to LBW among economically

Table 1 Percentages of mothers with low birthweight infants, selected characteristics, and risk factors by race/ethnicity

	U.S.-born Mexican-origin (*n* = 242)	Foreign-born Mexican-Origin (*n* = 173)	Non-Hispanic white (*n* = 340)	Non-Hispanic black (*n* = 1375)	Other Hispanic (*n* = 282)	All mothers (*N* = 2,412)
Low birthweight (<2500 g)	5.4	5.8	12.4	13.5	9.6	11.5
Demographic, economic, and psychosocial characteristics						
Female infant	54.1	48.0	47.7	46.8	46.1	47.7
Mother's age**						
<20	24.0	11.0	25.0	23.2	26.6	23.1
20–34	73.1	81.5	69.1	71.4	66.3	71.4
>34	2.9	7.5	5.9	5.5	7.1	5.6
Father's age >34**	5.0	12.7	14.7	14.8	14.5	13.6
Mother's education***						
<High school	49.2	75.1	32.1	37.5	51.1	42.2
High school graduate	27.3	17.3	36.2	37.5	29.4	33.9
>High school	23.6	7.5	31.8	25.0	19.5	23.9
Father's education***						
<High school	36.0	54.9	26.8	27.0	40.4	31.4
High school graduate	64.1	45.1	73.2	73.0	59.6	68.6
Father employed***	89.3	93.6	89.4	75.6	84.4	81.3
Father's incarceration history***						
Ever incarcerated	39.3	14.5	36.2	35.1	30.1	33.6
Never incarcerated	53.7	73.4	57.4	56.4	61.7	58.1
Information missing	7.0	12.1	6.5	8.5	8.2	8.3
Father not interviewed	19.0	25.4	19.7	24.5	24.8	23.4
Parents have other children together***	27.7	30.1	13.2	21.6	24.5	22.0
Mother has children with other partner***	32.2	27.2	29.7	40.7	32.3	36.3
Father has children with other partner***	29.8	19.1	30.9	39.5	38.3	35.7
Parents' relationship status***						
Cohabiting	55.8	67.6	64.1	39.9	55.0	48.6
Romantically involved, not cohabiting	28.9	16.2	18.5	43.7	30.5	35.2
Not romantically involved	15.3	16.2	17.4	16.4	14.5	16.2
Length of time mother knew father*						
<1 year	21.5	20.8	24.1	16.9	21.3	19.2
1+ years	78.5	79.2	75.9	83.1	78.7	80.9
Mother considered abortion***	28.9	12.1	26.8	43.1	24.8	35.0
Father suggested abortion***	17.4	8.7	17.7	20.1	12.1	17.7
Mother's religious attendance***						
Never	16.5	11.0	20.0	16.1	19.9	16.8
<Once per week	70.3	60.1	69.4	64.6	66.3	65.7
≥Once per week	13.2	28.9	10.6	19.4	13.8	17.5
Mother considered neighborhood unsafe**	17.8	22.5	13.2	21.8	18.8	19.9
Health insurance, prenatal care, and pre-existing health conditions						
Health insurance***						
Private	24.8	13.3	24.1	16.2	11.7	17.4
Public	69.4	71.7	67.1	74.3	80.1	73.3

Table 1 continued

	U.S.-born Mexican-origin (*n* = 242)	Foreign-born Mexican-Origin (*n* = 173)	Non-Hispanic white (*n* = 340)	Non-Hispanic black (*n* = 1375)	Other Hispanic (*n* = 282)	All mothers (*N* = 2,412)
None	5.8	15.0	8.8	9.5	8.2	9.3
Prenatal care**						
First trimester	44.2	42.8	55.3	44.8	47.9	46.4
Second trimester	44.2	49.7	35.6	44.2	45.4	43.5
Third trimester	9.9	6.9	7.9	8.2	6.0	8.0
No care	1.7	0.6	1.2	2.9	0.7	2.1
Mental illness***	7.9	5.2	18.8	12.4	8.5	11.9
Obesity*	25.6	16.2	17.7	24.1	20.2	22.3
Other health condition***	39.3	36.4	63.8	64.3	50.0	58.0
Health and health behavior during pregnancy						
HIV or STI***	16.5	8.1	20.3	30.7	14.9	24.3
Genitourinary infection***	28.5	38.7	36.8	43.0	35.1	39.4
Gestational hypertension	6.2	6.9	7.7	8.8	8.5	8.2
Gestational diabetes	3.3	4.6	3.2	3.7	6.7	4.0
Poor nutritional status*	2.1	4.6	6.2	5.7	8.5	5.6
Anemia**	21.1	33.0	17.9	24.2	19.5	23.1
Tobacco***	17.8	4.6	53.8	28.4	20.2	28.2
Alcohol***	13.6	8.1	24.1	15.9	13.1	16.0
Illicit drugs***	10.7	0.6	11.8	16.6	8.9	13.3

*$P < .05$, **$P < .01$, ***$P < .001$ for differences across racial/ethnic groups, on the basis of χ^2 tests for equal distributions

disadvantaged mothers [29]. We included whether the mother considered having an abortion when she found out she was pregnant and whether the father had suggested that she have an abortion (both from mother reports in the post-partum interview). Religious attendance varies by race/ethnicity in the U.S. [30], and has been hypothesized to be associated with LBW [31]. We included a measure (from mother post-partum reports) of how often the mother attended religious services (<once per week and never, versus once per week or more). Based on documented racial/ethnic segregation in the U.S., especially within large urban areas [32], and past research indicating that stress [33], and social environments of neighborhoods [34], are related to LBW, we also included whether the mother reported in the post-partum interview that she considers her neighborhood unsafe.

Health Insurance, Prenatal Care, and Pre-Existing Health Conditions

There are large differences by race/ethnicity in health insurance coverage [35], and the use of traditional prenatal care [3]. Type of insurance (public and none, versus private) and the timing of prenatal care (second trimester, third trimester, and no care, versus first trimester) were included. This information was taken from the medical records when it was available and from the mother's post-partum interview otherwise.

Health and Health Behavior During Pregnancy

Medical and behavioral risk factors that are associated with both race/ethnicity and birthweight were included [2]. We used dichotomous indicators for each of the following pre-pregnancy maternal conditions: any mental illness (excluding substance use diagnoses), obesity (BMI ≥ 30), and other condition (including chronic lung disease, cardiac problems, chronic diabetes, and pre-existing hypertension). We included a dichomotous indicator for any of the following infections: human immunodeficiency virus (HIV), syphilis, chlamydia, genital herpes, gonorrhea, and human papilloma virus. We grouped HIV with the others, which are sexually transmitted infections (STIs), because HIV can be acquired through sexual contact and there were only eight cases of HIV in our sample. Also included were dichotomous indicators for bacterial vaginosis or other genitourinary infection, gestational hypertension, gestational diabetes, inadequate nutritional status, anemia (Hct < 30/Hgb < 10), any tobacco use, any alcohol consumption, and any illicit drug use during pregnancy. Information on medical conditions was obtained from the medical records. Mothers were coded as

having used substances on the basis of evidence in the medical records or positive post-partum self-reports; combining the two is a strategy that others have found to be the best way to ascertain prenatal substance use [36].

Analysis

We examined the percentages of mothers with specific characteristics in the different racial/ethnic groups, as well as in the sample overall. Chi-square tests for differences in characteristics across groups were conducted. Multiple logistic regression was used to estimate the associations between the racial/ethnic categories and LBW and between the covariates and LBW. All standard errors were adjusted for clustering in hospitals and cities. Stata/SE version 9 software (StataCorp LP, College Station, Texas) was used to conduct all statistical analyses.

We present odds ratios (OR) and 95% confidence intervals (CIs) for the logistic regression estimates. NHW mothers served as the reference racial/ethnic group. Results from five different models are presented. The first model included only the racial/ethnic variables to provide the baseline differences. The second, third, and fourth models included the racial/ethnic variables plus specific sets of factors (described earlier) in order to assess the importance of those sets of factors in explaining LBW and disparities in LBW among unmarried mothers. Specifically, the second model included the racial/ethnic categories plus the demographic, economic, and psychosocial factors in order to assess the contribution of social conditions to LBW and disparities. The third model included the racial/ethnic categories plus measures of health care, prenatal care, and pre-pregnancy health conditions in order to assess the contributions of factors related to health care and pre-pregnancy health. The fourth included the racial/ethnic categories plus medical risk factors diagnosed during the pregnancy and prenatal behaviors to assess the contributions of factors that are present after conception has taken place. Model 5, which we refer to as our full model, includes all of the variables. Understanding where in the process (e.g., preconception, post-conception) disparities emerge and the nature of the sources of disparities (e.g., social, medical, behavioral) has important implications for the appropriate content and timing of interventions to improve birth outcomes.

Results

Unadjusted Associations

Low Birthweight

The rates of LBW of U.S.-born and foreign-born Mexican-origin mothers were 5.4% and 5.8%, respectively, compared to 12.4% for NHWs, 13.5% for NHBs, and 9.6% for other Hispanics (Table 1). Thus, among urban unmarried mothers in the U.S., NHWs have a rate of LBW close to that of NHBs, and FBMO mothers do not have an advantage relative to their USMO counterparts.

Other Analysis Measures

For all characteristics other than infant's sex, father not interviewed, gestational hypertension, and gestational diabetes, there were statistically significant differences across groups. Overall, Mexican-origin mothers had the most favorable, and NHB mothers had the least favorable, risk factor profile.

Demographic, Economic, and Psychosocial Characteristics: FBMO mothers had the lowest percentage of mothers less than age 20, and USMO mothers had the lowest percentages of mothers and fathers aged 35+. FBMO mothers and their children's fathers had the lowest levels of education, but also had the highest percentage of fathers who were employed, the lowest percentage of fathers who had ever been incarcerated, and the highest rate of cohabitation (67.6%). NHB mothers and their children's fathers had the highest rates of multiple-partner fertility (children with other partners) and were the least likely to cohabit (39.9%), but were also the least likely to have known each other for less than 1 year.

FBMO mothers were the least likely to report that they never attended religious services and to report that the father had suggested an abortion. NHB mothers were the most likely to report that they themselves had considered having an abortion. FBMO and NHB mothers were more likely than mothers in the other groups to report living in an unsafe neighborhood.

Health Insurance, Prenatal Care, and Pre-Existing Health Conditions: FBMO mothers had a much higher rate of no health insurance than the other groups, but had a rate of public insurance (71.7%) similar to that of the other groups. USMO and NHW mothers had the highest rates of private insurance, although those rates were low (24.8 and 24.1%, respectively). NHW mothers were the most likely to have a history of mental illness, but had the highest rate of first trimester prenatal care (55.3%). FBMO and NHW mothers were the least likely to be obese (16.2 and 17.7%, respectively).

Health and Health Behavior During Pregnancy: USMO mothers had the lowest proportions with genitourinary infections, poor nutritional status, and gestational hypertension (the difference in gestational hypertension across groups was not statistically significant, however). FBMO mothers had the lowest rates of HIV or STI and prenatal substance use, but the highest rate of anemia. NHB mothers had the highest rates of HIV or STI and illicit drug use, and

NHW mothers had the highest rates of alcohol and tobacco use.

Multivariate Results

The multivariate results (Table 2) indicate that USMO mothers had 60% lower odds, and that FBMO mothers had 57% lower odds, than NHW mothers of having LBW infants (Model 1, ORs: .40 and .43, respectively). NHB mothers were more likely, and other Hispanic mothers were less likely, than NHW mothers to have LBW infants, but the differences from NHWs were not statistically significant.

Adding detailed demographic, economic, and psychosocial measures reduced the associations (increased the odds ratios for the Mexican-origin groups) only slightly (Model 2), as did adding measures of health care and pre-pregnancy health conditions instead of demographic, economic, and psychosocial measures (Model 3, compared to Model 1). However, controlling for pregnancy health conditions and prenatal behaviors—instead of the other sets of covariates—substantially reduced the advantages of USMO and FBMO mothers relative to NHW mothers (OR for USMO mothers increased from .40 in Model 1 to .55 in Model 4; OR for FBMO mothers increased from .43 in Model 1 to .72 in Model 4). The Mexican-origin LBW advantages relative to NHW were no longer statistically significant. Supplemental analyses (not shown) indicated that the reduction in Mexican-Origin LBW advantage resulted primarily from the inclusion of prenatal smoking and drug use. The gap between NHB and NHW mothers *increased* with the addition of the pregnancy health conditions and behaviors, but did not reach statistical significance.

Model 5, the full model, includes all of the sets of variables. Despite some small cell sizes, the odds ratios of the racial/ethnic variables in Model 5 are slightly larger than those in Model 4 (though none are statistically significant in Model 5, perhaps owing to the large number of covariates in the model), which controlled only for health and health behaviors during pregnancy, and most of the covariate estimates are very similar to those in Models 2, 3, or 4. The latter result indicates that the racial/ethnic and covariate estimates in Models 2, 3, and 4 are generally not sensitive to the inclusion of the other sets of variables.

Several of the covariates were important predictors of LBW. Maternal age <20 years was a significant risk factor for LBW even when all other variables were included, as was never attending religious services, public health insurance, no prenatal care, gestational hypertension, and tobacco; obesity was negatively associated with LBW (Model 5). Paternal age >34 years and the father having suggested an abortion were positively associated with LBW, as was the mother having no health insurance, having mental illness, and using illicit drugs, but these factors were not statistically significant in the full model (Model 5), perhaps owing to the large number of variables included.

Supplementary Results

We assessed the sensitivity of the results to alternative model specifications (results not shown). We estimated sets of models (1) predicting birthweight in grams, (2) restricting the sample to full-term (at least 37 weeks' gestation) births, (3) predicting gestational age (in weeks), and (4) predicting preterm birth (<37 weeks). In the first two cases, the patterns were the same as when predicting LBW—the Mexican-origin advantages vis-à-vis NHWs diminished or were eliminated when controlling for pregnancy health conditions and prenatal behaviors, but the NHB disadvantage became more pronounced. For (3), there were very small racial/ethnic differences in gestational age, and the covariates explained none of the Mexican-origin advantages or NHB disadvantage. For (4), there was no USMO advantage and no black disadvantage in preterm birth, but controlling for pregnancy health conditions and prenatal behaviors explained a substantial proportion of the FBMO advantage. To the extent that gestational age from the medical records is reliable or, at least, is not systematically unreliable by race/ethnicity, racial/ethnic disparities in LBW in this sample appear to reflect differences in fetal growth rather than differences in length of gestation.

We estimated sets of models that included indicators for mother's city of residence, as past research has found substantial variation in racial/ethnic disparities in LBW across cities [37], and that used self-reported measures of prenatal health and behaviors instead of our composite measures. In both specifications, the estimates were very similar to those presented in Table 2. Finally, we estimated a set of models with non-Hispanic black as the reference category, and found that the factors examined explained very little of the Mexican-origin advantages relative to non-Hispanic blacks.

Conclusions

The two key contributions of this study of racial/ethnic disparities in LBW are that it: (1) focused on unmarried mothers, who represent a large and growing share of all births in the U.S., a socioeconomically disadvantaged group, and the target of much public health and family policy; and (2) used a population-based data set with rich data from both surveys and medical records to

Table 2 Multiple logistic regression estimates of associations between race/ethnicity and low birthweight and between covariates and low birthweight (N = 2,412)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)
Race/Ethnicity (ref = Non-Hispanic white)					
U.S.-born Mexican-origin	.40 (.19, .84)*	.42 (.20, .91)*	.45 (.22, .92)*	.55 (.26, 1.17)	.63 (.30, 1.34)
Foreign-born Mexican-origin	.43 (.25, .77)**	.49 (.28, .86)*	.47 (.27, .81)**	.72 (.40, 1.31)	.84 (.47, 1.51)
Non-Hispanic black	1.11 (.75, 1.64)	1.08 (.71, 1.65)	1.10 (.73, 1.66)	1.26 (.86, 1.86)	1.29 (.82, 2.03)
Other Hispanic	.75 (.52, 1.09)	.74 (.50, 1.10)	.78 (.55, 1.11)	1.01 (.71, 1.42)	1.03 (.71, 1.49)
Demographic, economic, and psychosocial characteristics					
Female infant	1.19 (.89, 1.60)	1.18 (.89, 1.57)	1.20 (.87, 1.64)	1.15 (.85, 1.55)	1.16 (.85, 1.56)
Mother's age (ref = 20–34 years)					
<20		1.39 (1.00, 1.92)*			1.42 (1.02, 1.96)*
>34		1.39 (.79, 2.45)			1.40 (.77, 2.55)
Father's age >34 years		1.97 (1.38, 2.81)***			1.49 (.98, 2.26)
Mother's education (ref = some college)					
<High school		1.38 (.90, 2.12)			1.00 (.66, 1.53)
High school grad, No college		1.29 (.89, 1.86)			1.11 (.77, 1.60)
Father < High school		1.08 (.81, 1.44)			1.01 (.76, 1.35)
Father employed		.99 (.70, 1.40)			.91 (.62, 1.33)
Father's incarceration history (ref = never incarcerated)					
Ever incarcerated		1.17 (.87, 1.56)			1.09 (.80, 1.48)
Information missing		1.34 (.82, 2.20)			1.21 (.73, 2.02)
Father not interviewed		1.11 (.82, 1.50)			1.09 (.80, 1.48)
Parents have other children together		.77 (.57, 1.04)			.73 (.52, 1.02)
Mother has children w/other partner		1.05 (.82, 1.35)			1.02 (.79 1.32)
Father has children w/other partner		1.00 (.74, 1.36)			.97 (.72, 1.31)
Parents' relationship status (ref = cohabiting)					
Romantically involved, not cohabiting		1.08 (.77, 1.51)			1.06 (.75, 1.51)
Not romantically involved		1.08 (.73, 1.58)			.96 (.62, 1.47)
Mother knew father <1 year		1.04 (.76, 1.43)			1.00 (.72, 1.38)
Mother considered abortion		1.19 (.89, 1.58)			1.08 (.80, 1.46)
Father suggested abortion		1.32 (1.03, 1.70)*			1.30 (.99, 1.71)
Mother's religious attendance (ref = at least once per week)					
Never		1.63 (1.17, 2.27)**			1.52 (1.04, 2.20)*
<Once per week		1.30 (.91, 1.87)			1.26 (.89, 1.79)
Mother considered neighborhood unsafe		1.15 (.87, 1.53)			1.09 (.80, 1.48)
Health insurance, prenatal care, and pre-existing health conditions					
Health insurance (ref = private)					
Public			1.88 (1.23, 2.86)**		1.63 (1.04, 2.57)*
None			1.87 (1.09, 3.20)*		1.63 (.93, 2.86)
Prenatal care (ref = first trimester)					
Second trimester			.99 (.77, 1.27)		.88 (.67, 1.14)
Third trimester			.78 (.47, 1.29)		.67 (.37, 1.21)
No care			3.18 (1.80, 5.64)***		2.25 (1.20, 4.22)*
Mental illness			1.82 (1.30, 2.56)**		1.32 (.90, 1.92)
Obesity			.65 (.47, .91)*		.67 (.47, .95)*
Other health condition			1.13 (.88, 1.45)		1.05 (.80, 1.39)
Health and health behavior during pregnancy					
HIV or STI				1.22 (.88, 1.70)	1.24 (.91, 1.68)

Table 2 continued

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)
Genitourinary infection				1.03 (.79, 1.33)	1.03 (.77, 1.39)
Gestational hypertension				2.80 (2.08, 3.78)***	2.87 (2.05, 4.02)***
Gestational diabetes				.62 (.28, 1.36)	.62 (.29, 1.31)
Poor nutritional status				1.34 (.84, 2.14)	1.27 (.78, 2.08)
Anemia				1.08 (.78, 1.50)	1.08 (.76, 1.54)
Tobacco				2.09 (1.54, 2.84)***	1.95 (1.39, 2.71)***
Alcohol				1.07 (.78, 1.47)	.98 (.70, 1.37)
Illicit drugs				1.64 (1.09, 2.48)*	1.25 (.81, 1.92)
–2 log likelihood	1698.0	1651.5	1644.7	1614.2	1562.2
Degrees of freedom	5	26	13	14	43

*$P < .05$, **$P < .01$, ***$P < .001$; CI = Confidence interval; OR = odds ratio

systematically explore racial/ethnic disparities in LBW in a representative population. We included measures of prenatal substance use from both medical records and self-reports, yielding much lower rates of false negatives than when using survey reports alone [38]; measures of mother's pre-existing health status, pregnancy health conditions, and nutritional status that were documented in medical records; and measures of father's involvement with the mother, father's ability to provide support, complex family structures, both parents' consideration of aborting the pregnancy, mother's religious attendance, and mother's perceptions of neighborhood safety.

We found that among urban unmarried mothers, the black–white disparity in LBW is quite small and that Mexican-origin mothers have favorable rates of LBW compared to other racial/ethnic groups. Mexican-origin mothers who are immigrants do not have a LBW advantage relative to their U.S.-born ethnic counterparts. Pregnancy health conditions and prenatal behaviors explain a large share of the overall Mexican-origin advantage in LBW, particularly that of Mexican-origin mothers who are foreign-born. Controlling for those same conditions *increased* the black–white disparity in LBW, however. The results for Mexican-origin versus non-Hispanic white mothers are consistent with past studies that did not focus on unmarried mothers, which found that Hispanics (Mexican immigrants in particular) are more likely to engage in healthy behavior and less likely to engage in risky prenatal behavior (i.e., have better dietary practices and smoke less) than non-Hispanic whites [9, 39]. The finding that the (small) disparity between non-Hispanic blacks and whites increased when controlling for health and behaviors is consistent with other research not focusing on unmarried mothers that found that observed black–white differences in infant mortality widened when controls for maternal behaviors were included [40].

Maternal age less than 20 years is a significant risk factor for LBW in our sample. Thus, the ''teen advantage'' in birth outcomes among black or disadvantaged populations found by Geronimus [19, 20] does not characterize unmarried urban mothers in the late 1990s. Public health insurance, no prenatal care, gestational hypertension, and prenatal tobacco use—consistent predictors of LBW in many studies—are strong predictors of LBW in our sample. In addition, never attending religious services is positively associated, and maternal obesity is negatively associated, with LBW.

Focusing on unmarried mothers allowed us not only to study an increasingly important and policy relevant demographic group, but it also allowed us to study a group for whom outcomes must improve if the U.S. is to make progress in improving birth outcomes overall. Few studies of racial or ethnic disparities in LBW have focused on economically disadvantaged groups. One study found that the association between race and LBW is considerably smaller among poor individuals than in the overall population [41]. Another found a substantial disparity in LBW between poor white and black mothers in one Alabama county [42]. The second study found that many risk factors for LBW were more common among white than black women, and that those therefore did not explain the racial disparity in LBW. The results from the former study are consistent with our results for unmarried mothers. The finding of a substantial racial disparity in the latter study is not consistent with our results, but that study focused on a highly select sample and the finding that controlling for risk factors and behaviors widens the disparity is consistent with what we found. A third study used data on unmarried mothers from the FFCWB study and, consistent with our findings, found that self-reported prenatal behaviors, health, and other factors explained little of the Mexican-origin LBW advantage relative to non-Hispanic blacks [23].

U.S. natality files are the only nationally representative source of data with which to analyze racial/ethnic disparities in birth outcomes in the U.S. Unless linked to other data, however, natality data cannot be used to explore the roles of psychosocial risks, behaviors, and medical risk factors because they either do not include those characteristics or the measures have low rates of sensitivity that vary by LBW [43]. In particular, natality files contain reasonably accurate data on only one prenatal behavior—cigarette smoking [43], notoriously poor data on medical risk factors [43], and no data on psychosocial risks.

The few previous studies that have examined the extent to which racial and/or ethnic disparities in birthweight or LBW can be explained by detailed psychosocial, medical, and behavioral factors have relied on select local samples with self-reported medical conditions (versus those from medical records) [44] and/or self-reported prenatal behaviors [42, 44, 45]. One study found that maternal substance use, stress, and positive attitudes accounted for observed differences in mean birthweight between black and Mexican-origin women receiving care in community-based prenatal care clinics in Los Angeles [45]. Another found that none of a number of demographic, behavioral and lifestyle, psychosocial, or medical risk factors studied contributed to black/white disparities in LBW among high risk women enrolling for care in community health clinics in Birmingham, AL [42]. The third found that none of a number of demographic, medical, economic, psychosocial, and behavioral factors studied contributed to racial/ethnic disparities in mean birthweight in clinics located in New York City and Chicago [44]. The results from our study, which (1) used data from a national population-based economically disadvantaged sample, (2) did not rely exclusively on self-reports of prenatal behaviors, and (3) used measures of medical risk factors that were documented in medical records, are consistent with the results of those other studies.

Our study was subject to certain limitations. The sample was exclusively urban; the findings may not pertain to unmarried mothers in rural areas, suburbs, or small cities. However, urban births are important in their own right, as most health conditions and health care provision problems in the country are the most severe in large cities [46]. Parents under age 18 were underrepresented. The inferences were based on relatively small samples, particularly for the Mexican-origin groups. Sample sizes precluded us from examining additional racial/ethnic groups, disaggregating groups other than Mexican-origin mothers by nativity, and examining the category of very low birthweight (<1500 g). We were not able to explore the roles of biological predispositions (other than by including measures of mother's pre-pregnancy health history), which may vary by racial/ethnic group, or to directly explore the roles of stress, neighborhoods, and discrimination.

Our finding that pregnancy health conditions and prenatal behaviors are strongly associated with LBW among urban unmarried mothers suggests that improving health and health behavior during pregnancy has the potential to reduce aggregate rates of LBW. However, since health behaviors and some health conditions are unlikely to originate during pregnancy (e.g., mothers who use illicit drugs or smoke during pregnancy are likely to have done so before conception), the focus should be on lifelong health care rather than care that begins after conception has occurred.

The results also confirm that healthy behaviors among Mexican-origin mothers, particularly those who are foreign-born, help to offset economic disadvantages they face in the U.S. However, it will be important to pay attention to increasing rates of smoking in immigrant sending countries, such as Mexico, which may erode health advantages of Mexican-origin mothers over time, as well as negative influences of acculturation on health behavior among immigrants in the U.S. [47].

Our finding of no significant black-white disparity in LBW among unmarried mothers—an economically disadvantaged group—suggests that poverty plays an important role in shaping racial disparities in birth outcomes in the general population. Our finding that controlling for health and behaviors during pregnancy widens rather than narrows the racial disparity suggests that efforts to understand the adverse birth outcomes of blacks and ameliorate racial disparities should focus on risks throughout the life course rather than near the time of the pregnancy and birth. That is, a life-course approach is needed to understand the long-term processes, such as intergenerational health disadvantages, environmental exposures, and cumulative stress, by which poverty may translate to adverse birth outcomes [48, 49].

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