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Association Between Life Event Stressors And Risk Of Low Birth Weight Among African American And White Mothers ------A Multilevel Analysis Of The Los Angeles Mommy And Baby (lamb) Surveys

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Association between Life Event Stressors and Risk of Low Birth Weight among African American and White Mothers ------A Multilevel Analysis of the Los Angeles Mommy and Baby (LAMB) Surveys

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ABSTRACT

We examined the association between life events stressors during pregnancy and low birth weight (LBW) among African Americans and Whites, while systematically controlling for potential confounders including individual characteristics and city-level variations and clustering. Data from 4970 women with singleton births from the 2007 and 2010 Los Angeles Mommy and Baby Surveys were analyzed. Multilevel logistic regression was used to assess the association between emotional, financial, spousal and traumatic stressors and LBW among African Americans and Whites. Potential confounders included were: city-level Economic Hardship Index, maternal demographics, pre-pregnancy conditions, insurance, behavioral risk factors and social support. African Americans were significantly more likely to experience any domain of stressors during their pregnancy, compared to Whites ($p<0.001$). Only the association between financial stressors and LBW was significantly different between African Americans and Whites (P for interaction=0.015). Experience of financial stressors during pregnancy was significantly associated with LBW among African Americans (adjusted Odds Ratio=1.49; 95% Confident Interval=1.01, 2.22) but not Whites. Differential impact of financial stressors during pregnancy may contribute to racial disparities in LBW among African Americans and Whites. We showed financial life event stressors, but not other domains of stressors, were more likely to impact African Americans than Whites. Financial stress during pregnancy is an important area for public health to address in order to improve birth outcomes among African Americans.

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INTRODUCTION

For many years a significant amount of research and public health efforts have been devoted to understanding the risk factors of low birth weight (LBW) and disparities among African Americans and Whites [1-4]. However, the rates and disparities of LBW have changed little in the past decades. Nationwide, the percentage of LBW in 2000 was 6.6 among non-Hispanic Whites and 13.1 among non-Hispanic Blacks [5]. In 2010, the percentages were 7.1 for non-Hispanic White and 13.5 for non-Hispanic Blacks [5]. Similar patterns were seen in Los Angeles County (LAC; 6.3 versus 12 in 2000 and 6.8 versus 13.3 in 2010 for White and Black, respectively; [6]).

While many early studies in this field focused on individual health behaviors and conditions that may be risk factors for LBW [1], an increasing number of studies has started to examine how interactions between individuals and the environment they live impact birth outcomes [7, 8]. Life event stressors, such as a close relative being hospitalized or a pregnant woman's husband's losing a job, are significant events that relate to individuals as well as their families, spouses, neighborhood and the social environment [9]. These events may happen to any women during their pregnancy, regardless of their race/ethnicity, age and socioeconomic status. As acute stressors during pregnancy, major life events may elicit a multifaceted impact on women's physical and mental health, behaviors, and living conditions that ultimately lead to an increased risk of delivering a LBW baby [9].

A number of epidemiologic studies have explored the association between life event stressors and LBW [10-16]. Results from these studies are inconsistent, which may be due to several factors. First, early studies on this association are limited by low number of LBW babies

included in the analyses [10-13]. Second, many studies are unable to fully adjust for potential confounders based on their data sources [15, 16]. Third, inconsistencies in the previously published papers may have been due to heterogeneity of the study populations. As prior studies have suggested, effects of potential risk factors on LBW may vary significantly among different racial/ethnic groups [17]. Fourth, measurements of life events are not unified, and analytical methods to quantify the experience of life events vary from study to study. Finally, as described earlier, experience of life event stressors is not independent from the social and neighborhood environment where a woman lives. Numerous studies have shown that neighborhood-level measures such as income and employment may be important determinants for many health problems including LBW [11, 18]. Only one previous study has accounted for neighborhood-level influence while investigating this association [15]. Nonetheless, this study was based on a heterogeneous population comprised of both African Americans and Whites, and did not examine the association between stress and LBW among African Americans and Whites separately.

To date, no published research study has compared the impact of life event stressors on LBW between different racial/ethnic groups. In addition, potential mediators such as adverse health behaviors and gestational weight gain have not been formally evaluated for their roles in this relationship [23]. Furthermore, few studies have adjusted for neighborhood clustering while investigating this relationship.

In this study, we aimed to investigate whether association between each domain of life event stressors and LBW are different for non-Hispanic Whites and African Americans, while carefully considering the influence of individual- and neighborhood-level covariates as well as potential mediators on this relationship, through a multilevel analysis approach. This study will

hopefully shed some light on the nature of racial disparity in LBW and ways to reduce such disparity through evidence-based public health and community programs.

METHODS

Data Source

The data used in this study are from three sources. The individual-level data was obtained from the 2007 & 2010 Los Angeles Mommy and Baby (LAMB) Survey and birth certificates. LAMB is a cross-sectional, population-based survey conducted by the Los Angeles County Department of Public Health (DPH) every two to three years since 2005. Modeled after the CDC Pregnancy Risk Assessment Monitoring System (PRAMS) survey [20], LAMB collects information about preconception, prenatal and postpartum attitudes and experiences of women shortly after their most recent birth that are useful for surveillance and research on maternal and child health outcomes. LAMB employs stratified random sampling based on Service Planning Areas (SPAs), race/ethnicity and maternal age. Minority women, women less than 20 years old as well as women living in SPAs 1 and 6 (where the percentage of LBW is highest in Los Angeles County) were oversampled, and sample weights were assigned to correct for oversampling and allow representation of the population estimates. The overall response rate for LAMB was 56% in 2007 and 57% in 2010. Birth certificate data of the respondents was linked to their LAMB survey data by DPH. The neighborhood-level data is the Economic Hardship Index compiled by the Office of Health Assessment and Epidemiology in DPH. An Economic Hardship Index value was calculated for each city or each LA City Council District in Los Angeles County with population larger than 10,000 based on six census tract-level variables, including: per capita income, percent of persons with less than high school diploma for population 25 years and older, percent of persons at less than 200% of Federal Poverty Level, the

percentage of the civilian population over the age of 16 that were unemployed, the percent of the population that are under the age of 18 or over the age of 64, the percent of occupied housing units with more than one person per room. Details on how Economic Hardship Index was calculated using these six factors have been published elsewhere [21].

Study Sample

This study consisted of 4929 Los Angeles County resident mothers who gave birth to a live-born singleton in 2007 or 2010, and participated in the LAMB surveys in respective years. Of this sample, 2053 were non-Hispanic African Americans, while 2876 were non-Hispanic Whites. The sample weights described above were applied and the study sample represented 21110 non-Hispanic African Americans and 44647 non-Hispanic Whites, in total 65757 eligible Los Angeles County mothers.

Measures

Outcome Variables

The main outcome in this study was LBW, defined as infants weighting less than 2500g at birth. Birth weight of the infants was obtained from birth certificates, and LBW infants were compared to infants weighing 2,500 - 4,500g.

Life Event Stressors

The primary independent variable is stressful life events, measured by a 13-item modified version of the Life Events Inventory adopted from PRAMS [22, 23]. Responses to each item were either "Yes" or "No". This inventory has fairly good internal consistency and reliability, as the standardized coefficient (Cronbach α) is 0.65. Following previously published methods [15, 23], life event stressors were categorized into four domains: financial stressor (mom lost job, husband lost job, could not pay bills), emotional stressor (was homeless, moved to a new address, was in a car accident), traumatic stressor (family member ill and went to hospital, someone close died), and spousal stressor (divorced, argued with partner more often, was in a physical fight, partner or the women went to jail, someone close had drinking or drug problems). Respondents were classified as having one category of stress if they responded "Yes" to any questions in that group. Otherwise, they are coded as "No" for that stress type.

Sociodemographic Factors

Sociodemographic factors included in the analyses were: race/ethnicity (non-Hispanic African American, non-Hispanic White), parity (1, 2, >2), baby's sex (female, male), maternal education (less than high school, high school graduate, some college, completed college and beyond), maternal age (<20 years, 20-24 years, 25-29 years, >=30 years), cohabitation status at birth (living together with partner, living apart from partner), insurance before pregnancy (Yes, No).

Medical risk Factors

Pre-pregnancy condition was coded as "Yes" if the respondents reported having any of the following conditions before pregnancy: asthma, hypertension, diabetes, anemia, heart

problems, or problems with gums or teeth. Otherwise it was coded as "No". Other medical risk factors considered in the analyses were gestational diabetes (Yes, No) and gestational hypertension (Yes, No).

Other Individual-level Covariates

Other individual-level covariates included: neighborhood support, neighborhood quality, perceived social support, satisfaction on partner support, and use of social services. The neighborhood support scale measures neighborhood social cohesion (e.g., neighbors are willing to help each other) and reciprocal exchange (e.g., neighbors watch over each other's property). Details of this scale have been described elsewhere [18], and it has high internal consistency (Cronbach's α=0.9) based on our data. The neighborhood quality scale was from the Los Angeles Family and Neighborhood Survey (L.A.FANS), and measures the overall quality of the neighborhood from nine aspects such as safety, cleanliness and municipal services (Cronbach's α=0.92). The perceived social support scale was adopted from PRAMS, and asked whether the respondents would be able to get the seven essential kinds of support (e.g., borrow $50) from others when they needed them (Cronbach's α=0.85). Satisfaction on partner support was categorized as either Neutral/Dissatisfied or Somewhat/Very satisfied. Use of social services (e.g., Special Supplemental Nutrition Program for Women Infants and Children or WIC, food stamps) was categorized as Yes, No or Did not need.

Mediators

Variables that were considered as mediators in the relationship between life event stress and LBW were: adverse health behaviors such as smoking (primary or second-hand), drinking or substance abuse during pregnancy, and gestational weight gain. All four health behavior

variables were coded as binary variables. Among these, substance abuse was coded as "Yes" if a participant indicated using marijuana, amphetamines, cocaine or tranquilizers during pregnancy. Gestational weight gain was coded at three levels based on the 2009 Institute of Medicine guideline [26]: above guideline, within guideline and below guideline.

Analytic approach

We first examined population characteristics and bivariate associations between study variables and LBW in African Americans and Whites with chi-squared test. To conduct multilevel analysis, we imputed the dataset using multiple imputation (Markov chain Monte Carlo) method. After clustering the 13 life event stressors into four domains, we compared the association between each domain of stressors and LBW in African Americans and Whites through unadjusted multilevel logistic models and multilevel logistic models adjusted for neighborhood and individual demographic variables (including: Economic Hardship Index, maternal age, education, cohabitation, and parity; thereafter referred to as "core model"). For each domain of stressor, in separate core models containing both racial groups, we added an interaction term between race and the stressor to test if the association between that stressor and LBW was significantly different for the two racial groups. If a domain of stressor is significant in the core model for either racial group (in our case, financial stressor), its association with LBW was further analyzed in fully-adjusted models.

The fully-adjusted models were developed as follows. First, all possible confounders suggested by literature and bivariate analysis ($p<0.1$), including demographic factors (those adjusted in the core model), medical risk factors, behavioral risk factors, support factors and other categories of life event stressors, were entered into the multilevel logistic model. Selection

of the final model was done by removing non-significant covariates one-by-one (significance of confounder was judged by whether removing a covariate caused coefficient of financial stressors to change by roughly 10%). Variables adjusted in the core model were retained in the model regardless of statistical significance to ensure comparability with published results. We did not force the final models for African Americans and Whites to have the same covariates, because the role each variable plays in this association may differ for these two groups. After final model for each racial group was obtained, we tested for mediation effect of proposed mediators that remained in the model (smoking, exposure to second-hand smoking and substance use) by distribution of the product of the coefficients method (PRODCLIN) to determine if they should remain in the model [25]. PRODCLIN is a recommended method to test for mediation effect in logistic and multilevel models [25].

All analyses were conducted in SAS (version 9.3 SAS Institute, N.C.).

RESULTS

Table 1 shows important characteristics of the population being studied. Overall, 67.9% of the study population are Whites, while 32.1% are African Americans. Percentage of LBW is almost twice as high in African Americans as in Whites. Interestingly, African Americans are also about twice likely to experience financial or spousal life event stressors than Whites. Compared to Whites, African Americans are significantly more likely to experience emotional, or traumatic stressors as well ($p<0.001$). Teenage mothers are more prevalent in African Americans, while more than half of the White mothers who gave birth in 2007 or 2010 are greater than or equal to 30 years old. Education level is generally higher in Whites. Almost all the White mothers indicated that they lived with a partner during pregnancy, whereas only a little more than half of the African Americans mothers said so. Proportions of primary or second-hand smoking as well as substance abuse are much higher among African Americans, whereas drinking during pregnancy seems to be a greater problem for Whites.

Table 2 displays significance of unadjusted association between study variables and LBW. Crude associations between any categories of stressors and LBW are not significant for both Whites and African Americans. Strength of association between some variables and LBW vary for African Americans and Whites. For instance, cohabitation is significantly associated with LBW for African Americans but not for Whites, when other factors are not adjusted for. Among African American mothers, percentage of LBW is much higher for those not living with a partner (13.6%) compared with those that did (9.6%). Some variables are significantly associated with LBW for both racial groups. For example, with increase in gestation weight gain from below to normal and then to above IOM guideline, percent LBW decreases significantly for

both Whites and African Americans. Nevertheless, such decrease is more substantial for Whites than for African Americans.

Table 3 shows the association between each domain of stressor and LBW for African Americans and Whites, based on the multilevel models. Interestingly, the significance level of unadjusted association from multilevel models differed from the results based on chi-squared tests shown in Table 2. Results from the multilevel models may be more accurate, because it adjusted for neighborhood clustering. Crude association between financial stressor and LBW is significant in both African Americans and Whites. However, after adjusting for neighborhood and individual demographic variables, the association only remained significant in African Americans. Crude association between spousal stressor and LBW is significant in whites, and borderline insignificant in African Americans. Nevertheless, based on the core model, the association between any category of stressor and LBW in both racial groups was insignificant, except for the association between financial stressor and LBW in African Americans. Besides, the magnitude of association is also the greatest for financial stressor compared with the other domains of stressors. Adjusting for demographic covariates, the odds of delivering a LBW baby among African American women who experienced at least a financial stressor during their pregnancy were almost 50% greater compared to those African American women who did not experience a financial stressor. Finally, as suggested by the p-value for interaction, association between life event stressor and LBW only differed significantly between African Americans and Whites for financial stressor, but not for all other domains of stressors.

Table 4 compares the association between financial stressor and LBW among the two racial groups in the unadjusted, core and final model. After adjusting for additional potential confounders beyond demographic variables, the magnitude of association between financial

stress and LBW did not change much. Second-hand smoke and neighborhood quality were only adjusted in Whites because they were not significant confounders for African Americans. Interestingly, for both racial groups, EHI was not significant (p=0.8288 for African Americans; p=0.3631 for Whites). Besides, none of the other three categories of life event stressors significantly confounded the association between financial stressor and LBW. Smoking, second-hand smoke or substance use was not a significant mediator in this relationship, for both African Americans and Whites.

DISCUSSION

In this research we demonstrated that financial stressors studied have differential impact on LBW among African Americans and Whites, even after adjusting for significant confounders for each race including demographic, medical, behavioral, and support factors. Experience of financial stressors was significantly associated with risk of LBW for African Americans but not Whites. This might be due to several reasons. First, it is possible that financial stress induces different response pathways in American Americans and Whites. It is known that African Americans are more likely to experience chronic stress related to stigmatization and discrimination than Whites, due to the different social environment that these two races live in. These experiences might have sensitized reactions of African Americans to financial stress, leading to augmented physiologic responses. Second, the level of social support and partner support to mitigate impact of financial stress when they experience it might be different for African American and White mothers. Indeed, as we see in our data, both percentage satisfaction on partner support and percent of the population able to obtain all the seven categories of social support were significantly greater in Whites than African Americans ($p<0.001$ for both variables). Finally, the three financial stressors studied might not have adequately measured significant financial stress experienced by the White population living in LAC. Even though these financial life events have been used in White Population in previous studies [15], perhaps a modified set of stressors should be considered for those living in LAC. Future research is needed to further investigate whether and how financial stressors contribute to racial disparities in LBW between African Americans and Whites.

Economic Hardship Index was not significant in the models for African Americans and Whites. There could be at least two explanations. It is possible that the effects of this neighborhood-level measure were manifested through individual covariates controlled in this study. Better measures are needed to capture the unique impact of neighborhood beyond individual-level factors. Also, our geographic definition of neighborhood is based on city, which is the unit of measure the Economic Hardship Index was developed for. A smaller geographic unit, such as census tract, might be more appropriate for this relationship. Nevertheless, the result that the neighborhood variable in this study was not statistically significant would not contradict the appropriateness of use of a multilevel approach to control for individual clustering in neighborhoods.

Several physiologic pathways are known to mediate stress response [26, 27]. Stress can activate the hypothalamic-pituitary-adrenal axis, which increases secretion of corticotropin-releasing hormone and estrogen. Rise in the level of these hormones have been linked to earlier onset of contractions and labor [26], which may result in LBW. Maternal stress was also associated with release of catecholamines leading to placental hypoperfusion and consequential fetal growth restriction and/or preterm delivery [27], giving rise to a LBW baby.

Among the four domains of stressor, only financial stressor turned out to be significantly associated with LBW for at least one racial groups. Our results raised the possibility that financial stressors might influence risk of LBW through additional pathways beyond physiologic impact. Previous research suggested that adverse health behaviors during pregnancy may mediate the effects of life event stressors on LBW [19]. However, in our analyses, adverse health behaviors were not shown to be significant mediators for this relationship. Future studies are

needed to elucidate the underlying mechanisms through which financial stress increases risk of LBW.

Strengths

This is the first study to demonstrate a differential impact of financial stressors on LBW among African Americans and Whites using a relatively large population-representative sample. We used a systematic approach to control for potential confounders that were significant for individual race in our dataset, in order to have a more accurate estimate of the effect of financial stressors in each race. To achieve this, we also formally tested for mediation effect of factors proposed in the literature that remained in the final model including smoking during pregnancy and second-hand smoke. We were able to show that these factors are independent risk factors of LBW relative to financial stressors. Taken together, our results pointed out the importance of investigating the impact of financial stress in homogenous racial/ethnic groups in future research.

Only one previous study has used a multilevel approach to evaluate the association between financial stressors and LBW while controlling for neighborhood variation and clustering [15]. In that study [15], the authors showed significant associations between all four categorical of life event stressors (emotional, financial, spousal, and traumatic) and LBW for a population with almost equal percentage of Whites and African Americans in South Carolina. At the individual-level, this study only adjusted for select maternal demographic factors, whereas our study additionally adjusted for medical, behavioral and support factors, which could have contributed to the difference in results. Additionally, that study did not evaluate individual predictors separately for each race category as our study did.

Limitations and future research

First of all, this is a cross-section study, which provides important information for future research and program direction but does not assess causality in the relationship between life event stressors and LBW. However, because the survey specifically asked about the experience of life event stressors during pregnancy right after participating women gave birth, the exposure assessed in this study presumably preceded the study outcome.

Second, the responses of the participants were collected through mailed surveys retrospectively. As such, reporting errors, recall bias and social desirability bias may have been involved. Large-scale prospective studies are needed to verify the strength of association between life event stressors and birth outcomes in each race.

Third, because the Economic Hardship Index we used was only calculated for cities in LAC that had population larger than 10,000, generalizability of our result is limited to these relatively larger cities in LAC. Applying our results to populations living in other geographic areas should be done with caution. We used city as our geographic area, as opposed to census tract, to increase interpretability of our results. Other types of geographic area could be explored in the future to understand the impact of segregation and clustering of population on this association.

Last, in this study, we compared the relationship between life event stressors and LBW among African Americans and Whites. Future studies should also examine such association in other races/ethnicities and mechanisms of the association.

Public health implications

In this study, we showed that, at least for African Americans, there was significantly increased risk of LBW for those exposed to financial stress during pregnancy. Additional research should explore the underlying mechanisms that may lead to this association. Meanwhile, there needs to be enhanced collaboration among multiple agencies such as Department of Public Health, Department of Health Services, and Department of Social Services to develop more effective programs and initiatives aimed at mitigating the negative impact of financial stress in this population. Such programs and initiatives may contribute to reducing disparities in birth outcomes between African Americans and Whites.

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TABLES

Table 1. Description of the Population

Characteristic	Weighted Total (%)†	White	Black
Weighted N	65757	44647 (67.9%)	21110 (32.1%)
Birthweight (grams), mean ± SE	3284.2 ± 11.2	3353.4 ± 14.3	3137.7 ± 17.1
LBW (excluding macrosomia and non-singletons)	4881 (7.4)	2524 (5.7)	2357 (11.2)
Emotional stressor	18724 (29.3)	11319 (26.0)	7405 (36.6)
Financial stressor	18556 (28.7)	9381 (21.4)	9174 (44.1)
Spousal stressor	22375 (35.6)	11547 (26.8)	10828 (54.5)
Traumatic stressor	15952 (24.9)	9424 (21.6)	6528 (32.0)
Maternal age			
<20	3625 (5.5)	901 (2.0)	2724 (12.9)
20-24	9505 (13.3)	4182 (9.4)	5323 (25.2)
25-29	15441 (23.5)	10013 (22.4)	5428 (25.7)
>=30	37186 (56.6)	29552 (66.2)	7634 (36.2)
Baby's Sex			
Male	33569 (51.1)	23072 (51.7)	10497 (49.7)
Female	32188 (48.9)	21575 (48.3)	10612 (50.3)
Parity			
1	31609 (48.1)	21945 (49.2)	9664 (45.8)
2	20792 (31.6)	15126 (33.9)	5667 (26.9)
>2	13338 (20.3)	7565 (16.9)	5774 (27.4)
Maternal education			
Less than high school	4499 (6.9)	1138 (2.6)	3361 (16.0)
High school graduate	12965 (19.8)	6221 (14.0)	6744 (32.0)
At least some college	17454 (26.7)	9884 (22.3)	7570 (36.0)

College graduate or beyond	30453 (46.6)	27083 (61.1)	3370 (16.0)
Without insurance	10034 (15.3)	5203 (11.7)	4831 (23.0)
Cohabitation	53904 (83.0)	41835 (94.6)	12070 (58.4)
Had at least one preconception condition	18778 (28.8)	8644 (19.5)	10134 (48.3)
Gestational hypertension	8081 (12.4)	3916 (8.9)	4165 (20.1)
Gestational diabetes	5191 (8.0)	3156 (7.1)	2035 (9.8)
Smoked during pregnancy	3895 (6.0)	1747 (3.9)	2148 (10.4)
Exposed to second-hand smoke during pregnancy	4829 (7.6)	1933 (4.4)	2896 (14.5)
Drank during pregnancy	11849 (18.2)	9757 (22.0)	2092 (10.0)
Substance use	1516 (2.4)	796 (1.8)	719 (3.5)
Gestational weight gain			
Below guideline	11750 (18.3)	7253 (16.5)	4496 (22.1)
Within guideline	22619 (35.3)	16834 (38.4)	5784 (28.5)
Above guideline	29794 (46.4)	19763 (45.1)	10030 (49.4)
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)			
Yes	24835 (39.1)	8202 (19.2)	16632 (79.8)
No	21069 (33.1)	18164 (42.5)	2905 (13.9)
Did not need	17675 (27.8)	16373 (38.3)	1302 (6.2)
Supplemental Nutrition Assistance Program (SNAP)			
Yes	11247 (17.5)	2648 (6.1)	8599 (41.6)
No	28583 (44.4)	19896 (45.5)	8687 (42.0)
Did not need	24601 (38.2)	21213 (48.5)	3387 (16.4)
Welfare (CalWORKs)			
Yes	9337 (14.5)	1988 (4.5)	7349 (35.6)

No	29959 (46.5)	20361 (46.5)	9598 (46.4)
Did not need	25139 (39.0)	21419 (48.9)	3719 (18.0)
Partner support			
Not at all/Somewhat satisfied/Neutral	10612 (16.4)	3901 (8.8)	6712 (32.8)
Somewhat/Very satisfied	54084 (83.6)	40309 (91.2)	13775 (67.2)
Neighborhood support			
Low	31041 (48.7)	18636 (42.8)	12405 (61.7)
High	32656 (51.3)	24945 (57.2)	7711 (38.3)
Neighborhood quality			
Very Poor/Poor/Neutral	13145 (20.5)	5806 (13.2)	7338 (36.1)
Good/Very Good	51052 (79.5)	38077 (86.8)	12975 (63.9)
Social support			
Adequate	41184 (63.2)	30456 (68.9)	10728 (51.4)
Inadequate	23931 (36.8)	13776 (31.1)	10155 (48.6)

† Numbers may not sum to 65,757 due to missing data, and percentages may not sum to 100% due to rounding.

Table 2. Unadjusted associations between study variables and LBW

Characteristic	% low birthweight (White)	p†	% low birthweight (Black)	p†
Financial stressor		0.277		0.151
Yes	4.6		12.7	
No	6.0		10.0	
Emotional stressor		0.848		0.627
Yes	6.0		10.7	
No	5.7		11.6	
Spousal stressor		0.293		0.935
Yes	4.8		11.2	
No	6.1		11.0	
Traumatic stressor		0.570		0.685
Yes	6.5		11.8	
No	5.6		11.0	
Maternal age		0.393		0.069
<20	11.7		10.0	
20-24	4.7		9.2	
25-29	5.6		9.3	
>=30	5.6		14.3	
Baby's Sex		0.919		0.229
Male	5.6		10.1	
Female	5.7		12.3	
Parity		0.032		0.332
1	7.3		11.7	
2	3.5		9.0	
>2	5.3		12.4	
Maternal education		0.863		0.150

Less than high school	4.3		15.8	
High school graduate	6.2		10.4	
At least some college	5.0		10.9	
College graduate or beyond	5.8		8.9	
Insurance		0.909		0.632
Yes	5.6		11.4	
No	5.8		10.3	
Cohabitation		0.702		0.032
Yes	5.7		9.6	
No	5.0		13.6	
Preconception condition		0.257		<0.001
Yes	7.1		14.4	
No	5.3		8.2	
Pre-pregnancy underweight status		0.002		0.004
Yes	13.6		24.2	
No	5.1		10.7	
Gestational hypertension		<0.001		<0.001
Yes	13.7		22.8	
No	4.6		8.3	
Gestational diabetes		0.011		0.077
Yes	1.7		16.2	
No	5.7		10.5	
Smoked during pregnancy		0.043		<0.001
Yes	2.0		21.3	
No	5.9		9.7	
Exposure to second-hand smoke during pregnancy		0.135		0.845

Yes	3.0		10.7	
No	5.9		11.3	
Drank during pregnancy		0.895		0.742
Yes	5.9		9.5	
No	5.7		11.3	
Substance use		0.320		0.001
Yes	9.6		67.1	
No	5.7		43.1	
Gestational weight gain		<0.001		0.003
Below guideline	14.0		16.2	
Within guideline	4.9		12.9	
Above guideline	2.6		8.3	
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)		0.614		0.111
Yes	5.8		11.4	
No	4.6		12.3	
Did not need	5.9		5.3	
Supplemental Nutrition Assistance Program (SNAP)		0.349		0.428
Yes	3.4		11.0	
No	5.0		12.2	
Did not need	6.1		8.9	
Welfare (CalWORKs)		0.684		0.869
Yes	6.0		11.4	
No	4.9		11.4	
Did not need	5.8		10.2	
Partner support		0.227		0.386

Not at all/Somewhat dissatisfied/Neutral	3.9		12.2	
Somewhat/Very satisfied	5.9		10.5	
Neighborhood support		0.405		0.854
Low	5.1		11.7	
High	6.2		11.3	
Neighborhood quality		0.411		0.042
Very Poor/Poor/Neutral	6.9		13.7	
Good/Very Good	5.5		9.7	
Social support		0.792		0.974
Adequate	5.8		11.2	
Inadequate	5.5		11.1	

† P-value for χ^2 test.

Table 3. Association between each domain of stressor and LBW in unadjusted and core models[†].

African American			White		
	Unadjusted OR (95% CI)	**Core model – Adjusted OR (95% CI)**		**Unadjusted OR (95% CI)**	**Core model – Adjusted OR (95% CI)**
Emotional stressor	1.06 (0.81, 1.07), p=0.422	1.13 (0.78, 1.66), p=0.515	Emotional stressor	1.07 (0.96, 1.20), p=0.237	1.04 (0.59, 1.84), p=0.891
Financial stressor	1.28 (1.15, 1.42), p<0.001	1.48 (1.04, 2.12), p=0.0293	Financial stressor	0.73 (0.65, 0.82), p<0.001	0.76 (0.44, 1.33), p=0.342
Spousal stressor	0.88 (0.77, 1.00), p=0.057	0.93 (0.66, 1.32), p=0.697	Spousal stressor	0.88 (0.79, 0.98), p=0.024	0.89 (0.49, 1.65), p=0.719
Traumatic stressor	1.09 (0.97, 1.23), p=0.159	1.10 (0.83, 1.46), p=0.498	Traumatic stressor	1.07 (0.96, 1.20), p=0.225	0.94 (0.45, 1.98), p=0.878

[†] P for interaction in core models that contained both racial group: financial stressors: 0.015; emotional stressors: 0.065; traumatic stressors: 0.864; spousal stressors: 0.523

Table 4. **Association between financial stressor and LBW in unadjusted, core, and final models.**

Population	Weighted N	Unadjusted OR (95% CI)	Core model – Adjusted OR (95% CI)	Final model – Adjusted OR (95% CI) †
African American	21110	1.28 (1.15, 1.42), p<0.001	1.48 (1.04, 2.12), p=0.0293	1.49 (1.01, 2.22), p=0.0485
White	44647	0.73 (0.65, 0.82), p<0.001	0.76 (0.44, 1.33), p=0.342	0.77 (0.47, 1.33), p=0.382

† Final model adjusted for Economic Hardship Index, maternal age, education, cohabitation, parity, insurance status, preconception conditions, hypertension during pregnancy, smoking status during pregnancy, substance abuse, and social support (second-hand smoke and neighborhood quality were additionally adjusted in Whites).