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## Prepregnancy Risk Factors for Preterm Birth and the Role of Maternal Nativity in a Low-Income, Hispanic Population

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### Abstract

The aim of this study was to assess potential prepregnancy risk factors for preterm birth in a low-income, Hispanic population in Southern California. Additionally, the study assessed whether the prevalence of preterm birth and any associations between risk factors and preterm birth differed between U.S.- and foreign-born mothers. The study sample included 1,174 mothers participating in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) within 1 year postpartum, including an augment sample of mothers who delivered preterm. Maternal sociodemographic traits, prepregnancy health-related characteristics and behaviors, and birth outcomes were collected by telephone survey. Odds ratios for associations between risk factors and preterm birth were estimated by logistic regression with sampling weights. Effect measure modification of any association by maternal nativity was also assessed using interaction terms. After adjustment for confounding, significant prepregnancy risk factors for preterm birth included maternal age  $\geq 35$  y (OR = 2.00; 95% CI: 1.04, 3.84) compared to age 18–24 y, and experience of a financially stressful life event among U.S.-born, but not foreign-born, women (OR = 2.61; 95% CI: 1.43, 4.77). The weighted prevalence of preterm birth was 15.1% and did not significantly differ by maternal nativity ( $P = 0.19$ ). Further investigation with large, prospective studies is needed to better understand the risk factors for and disparities in preterm birth among the growing

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Hispanic population in the U.S. so that women who are at risk pre-pregnancy can be identified and provided risk-specific services.

## Keywords

premature birth; preconception care; Hispanic Americans; emigrants and immigrants

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## Introduction

Preterm birth is the leading cause of infant death in the United States and puts infants at increased risk of a number of health and developmental problems.<sup>1-3</sup> Preterm birth also carries a large economic burden for both families and society, with the annual economic burden in the U.S. estimated to be over \$26 billion in 2005.<sup>1</sup> Despite increased access to prenatal care in recent decades, an estimated 11.4% of infants in the U.S. are born preterm (before 37 wk gestation), compared to 10.6% of infants born in 1990.<sup>4</sup> Additionally, major racial-ethnic and socioeconomic disparities persist in preterm birth rate for largely unknown reasons.<sup>1,3</sup> It has been suggested that reducing preterm birth rates and disparities will require improved health care for women not only during pregnancy and delivery, but also before conception.<sup>1,5</sup> A better understanding of the pre-pregnancy risk factors for preterm birth is needed so women at high risk can be identified and provided targeted services to mitigate their risk.<sup>1,3,5</sup>

Identification of pre-pregnancy risk factors can also increase our understanding of the complex causes of preterm birth.<sup>3,4</sup> Some risk factors have been identified, particularly low socioeconomic and educational status, short spacing between pregnancies, and high and low maternal age.<sup>1,3</sup> However, the complexity and overlap of risk factors is not well understood.<sup>3</sup> Additionally, many studies of preterm birth have not included women of Hispanic origin even though racial-ethnic disparities in the prevalence of preterm birth suggest that risk factors may differ by race-ethnicity.<sup>1,4,6</sup>

Within racial-ethnic groups, low socioeconomic status is a major risk factor for preterm birth and other adverse birth outcomes.<sup>1</sup> However, Hispanic women in the U.S. have risks of low birth weight and infant mortality that are comparable to non-Hispanic white women, despite their socioeconomic disadvantages.<sup>4,7</sup> This epidemiologic paradox is not well-understood and has not been consistently observed in studies of preterm birth.<sup>6-7</sup> In a recent meta-analysis on racial-ethnic disparities in the risk of preterm birth, Schaaf et al.<sup>6</sup> found three studies that reported a significantly lower risk of preterm birth in Hispanic women compared to non-Hispanic white women in the U.S., and three studies that reported a significantly higher risk. These conflicting results underscore the need for additional research to better understand if and how preterm birth risk may differ between Hispanic and non-Hispanic populations.

It has also been proposed that risk of preterm birth may be lower in Hispanic women born outside the U.S. than those born in the U.S.<sup>1</sup> Women who immigrate to the U.S. may be particularly healthy and possess social and cultural protective factors that contribute to relatively positive birth outcomes.<sup>7</sup> Supporting this theory, higher levels of acculturation to

American norms have been associated with higher rates of low birth weight in Hispanic women living in the U.S.<sup>7</sup> A few studies have also found that Hispanic women who were foreign-born or recent immigrants were at lower risk of delivering preterm than other Hispanic women.<sup>9–11</sup> Overall, however, information about if and how nativity affects risk of preterm birth is lacking. The Institute of Medicine concluded in its 2007 report on preterm birth that the potential causes of racial-ethnic disparities in preterm births are not well-understood and the effects of nativity even less so.<sup>1</sup>

Improved understanding of preterm birth is particularly pressing for the U.S. Hispanic population, which has been growing rapidly over the past several decades. There are approximately 53 million Hispanics living in the U.S., comprising 17% of the total population.<sup>12</sup> Additionally, Hispanics have the highest fertility rate among racial-ethnic groups in the U.S. and the U.S.-born Hispanic population has been growing at a faster rate than the immigrant Hispanic population since 2000.<sup>4,12</sup> In California, 48% of all infants born in 2013 were Hispanic and Hispanic children now outnumber non-Hispanic white children.<sup>4,13</sup> With the growth of the Hispanic population, health practitioners and agencies—including the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)—will increasingly be providing services to Hispanic families. More information is needed to help such providers, as well as policy makers, identify Hispanic women who are at increased risk of preterm birth and provide prepregnancy services to mitigate this risk.

The aim of this study was to assess potential prepregnancy risk factors for preterm birth in a Hispanic population of WIC participants in Southern California, based on characteristics that have been recognized as likely risk factors in non-Hispanic populations.<sup>1,3</sup> Additionally, the study assessed whether the prevalence of preterm birth and any associations between risk factors and preterm birth differed between U.S.-born and foreign-born Hispanic women.

## Methods

### Study Population and Samples

Two samples were taken from a population of postpartum women participating in the Public Health Foundation Enterprises WIC program, which serves over 53,000 postpartum women each month in Los Angeles and Orange Counties in California. A main sample was selected by random sampling from the entire study population and an augment sample was randomly selected from only those mothers who, according to WIC records, had a recent preterm birth. Duplicate subjects were removed by comparing a WIC identification variable between the two samples. Sample size was determined to detect significant differences in health and behavior characteristics between preterm and full-term births in the full WIC population.

Women were considered eligible for this study if they self-identified as being of Hispanic or Latino origin, spoke English or Spanish, had a working phone line, were not currently pregnant, and did not give birth within the past year. Contact by telephone was attempted for 4,309 women, of whom 3,132 were eligible for the study. Of those eligible, 1,398 women were successfully contacted and 1,236 completed interviews. Therefore, the cooperation rate (cases interviewed out of all eligible subjects ever contacted) was 84.7%. The response rate (cases interviewed out of all eligible subjects) was 38.7%.

From the women who completed interviews, 62 were excluded from the study because they had multiple births within the past year ( $n = 55$ ) or did not self-report if their most recent delivery was preterm ( $n = 7$ ). A total of 1,174 participants, consisting of 834 from the main sample and 340 from the preterm augment sample, were included in the final analyses.

This research was approved by the Ethical and Independent Review Services Institutional Review Board and verbal consent was obtained from each respondent.

### Survey Development and Administration

The research team used existing validated questionnaires to create the study's survey questions. The study questionnaire was written in English and translated into Spanish; both language versions were programmed into a computer-assisted telephone interviewing (CATI) system. Before beginning full-scale data collection, the English and Spanish questionnaires were pre-tested among a small convenience sample of postpartum WIC participants. The research team revised the questionnaires and survey administration accordingly following the pre-testing. The final survey was piloted among 10 English-speaking and 10 Spanish-speaking mothers, whose data are included in this study.

All interviewers received training to conduct the survey, including mock interviews and a briefing session. Additional debriefing and retraining sessions were held during the data collection period. Interviewers used a CATI system to administer the survey between July 30 and August 17, 2010. Each interview took approximately 20 minutes.

### Measures

The study questionnaire was used to collect information on participants' sociodemographic traits, health-related characteristics and behaviors before pregnancy, and birth outcomes. The outcome of interest was preterm birth, defined as <37 wk gestation, using self-report of delivery more than 3 weeks before the due date.

Survey questions included in this study as potential prepregnancy risk factors for preterm birth included maternal sociodemographic characteristics (age, education, and health insurance coverage), health-related behaviors (alcohol use, multivitamin or folic acid supplementation, exercise frequency, and whether pregnancy was intended), and mental and physical health characteristics (depression, stressful life events, diabetes or high blood sugar, high blood pressure or hypertension, teeth or gum problems, body mass index (BMI), and gravidity.) Maternal nativity was also investigated for effect measure modification of the associations between prepregnancy risk factors and preterm birth (statistical interaction).

Maternal age was categorized into 18–24 y, 25–29 y, 30–34 y, and 35 y. Education levels were grouped into less than high school completion, high school graduate, and at least some college or trade school. Prepregnancy health insurance status was categorized as any or none and maternal alcohol consumption was categorized as weekly or less than weekly.

Multivitamin or folic acid supplementation before pregnancy was grouped as daily or not daily. Frequency of at least 30 minutes of exercise for leisure was reported as 5 d/wk, 1–4 d/wk, <1 d/wk, or never. Participants self-reported whether their pregnancy was intended, unintended, or their intentions kept changing.

Prepregnancy depression was assessed by 2 questions adapted from the Patient Health Questionnaire-2.<sup>14</sup> Subjects were asked if within the past 2 years and before pregnancy, (1) they ever felt sad, empty, or depressed for most of the day and/or (2) they lost interest in most things they usually enjoyed doing, for a period of 2 weeks or longer. Depression was scored as 0, 1, and 2 for no depressive characteristics, one characteristic but not the other, and both characteristics, respectively. Prepregnancy stress was assessed based on the Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire<sup>15</sup> by asking if 12 different stressful life events occurred over the past 2 years and before pregnancy (yes or no). Previously, researchers used principal components analysis to group stress items in PRAMS that are measuring the same underlying construct.<sup>16,17</sup> The 12 stress items in this study were grouped using the same 4 constructs previously created from PRAMS data: emotional (e.g. someone close to you died), financial (e.g. you lost your job even though you wanted to go on working), partner-related (e.g. you got separated or divorced from your partner), and traumatic (e.g. you or your partner were in jail) and each construct was scored as yes (one or more items endorsed) or no (no items endorsed).

Prepregnancy diabetes or high blood sugar, high blood pressure or hypertension, and teeth or gum problems were self-reported as yes or no if they occurred at any time over the past 2 years and before pregnancy. Prepregnancy BMI values were calculated from self-reported maternal heights and weights from the month before pregnancy. BMI values were categorized into normal- or underweight (<25 kg/m<sup>2</sup>), overweight (25–29.9 kg/m<sup>2</sup>), and obese (≥ 30 kg/m<sup>2</sup>), because of few underweight participants (n = 54). Gravidity was grouped into no previous pregnancies (primigravida) and any previous pregnancies (multigravida). Maternal nativity was self-reported by responding if born in the U.S. or outside the U.S. Participants born outside the U.S. also reported their country of birth.

### Statistical Analysis

The distributions of the potential prepregnancy risk factors and the prevalence of preterm birth were estimated among all study participants. Associations between each risk factor and preterm birth were assessed with bivariate logistic regression models. All risk factors were evaluated for multicollinearity.

Effect measure modification of each association between a risk factor and preterm birth by maternal nativity was assessed with logistic regression models that included the risk factor, nativity, and their two-way interaction term. Any interaction term with a statistically significant and stable effect estimate was added to the final multivariate model, which included all risk factors as predictors to adjust for confounding.

All statistical analyses used sampling weights to realign the distribution of the study sample with the true population proportions of full-term and preterm births. Differences were considered statistically significant at  $P < 0.05$ . Statistical analyses were conducted using SAS (version 9.3; SAS Institute Inc., Cary, NC, 2011).

## Results

The prevalence of preterm birth in the study population was 15.1%. Overall, 34.4% of women were born outside of the U.S., of whom 77.7% were born in Mexico and 20.1% in Central America. Most women in the study population were under 30 y, had a high school degree or less, and did not have any healthcare coverage before becoming pregnant (Table 1). Before pregnancy, 5.5% of women drank alcohol at least weekly, 28.7% exercised for 30 minutes or more at least 5 d/wk, 24.1% took multivitamins or folic acid supplements daily, and half of pregnancies were intended. Within the preceding 2 years and before pregnancy, 11.7% of women experienced 1 of the 2 depressive characteristics and 9.7% experienced both depressive characteristics. Additionally, 12% of women experienced an emotionally stressful life event, 42.8% experienced a financially stressful event, 7.9% experienced a partner-related stressful event, and 4.4% experienced a traumatic stressful event. One percent of participants had diabetes or high blood pressure before pregnancy and 5.4% had teeth or gum problems. The majority of women were overweight (30.4%) or obese (25.8%), and 28.5% were primigravida.

In unadjusted analyses, maternal age of  $\geq 30$  y, experience of financial stress, and high blood pressure prepregnancy were significantly associated with increased odds of preterm birth (Table 2). Compared to women 18–25 y, the odds of preterm birth were 1.6 times the odds in women 30–34 y and 1.8 times the odds in women  $\geq 35$  y. The odds of preterm birth in women who experienced financial stress were 1.6 times the odds in those who did not, and the odds in women with high blood pressure were 3.6 times the odds in those without high blood pressure. There was no multicollinearity detected among the predictor variables.

Maternal nativity was not significantly associated with preterm birth (unadjusted OR=1.26; 95% CI: 0.89, 1.77). However, the weighted prevalence of preterm birth was numerically higher in women born outside the U.S. (16.3% vs. 13.5%). The association between financial stress and preterm birth differed significantly by maternal nativity. Among women born in the U.S., those reporting a financial stressor pre-pregnancy had 2.6 times the odds of a preterm birth compared to those not experiencing a financial stressor during the prepregnancy period (Table 2). There was no association between financial stress and preterm birth in women born outside the U.S. ( $P = 0.21$ ). There were possibly higher odds of preterm birth in foreign-born participants with diabetes or high blood pressure prepregnancy, but the low number of foreign-born women with these characteristics made these estimates unreliable. In the final multivariate model, significant predictors of preterm birth included maternal age of 35 y or older in all women ( $P = 0.037$ ) and experience of a financial stressor in U.S.-born women ( $P = 0.002$ )(Table 2).

## Discussion

Prepregnancy risk factors for preterm birth in this low-income, Hispanic population included maternal age of 35 years or older for all women and experience of a financially stressful life event among U.S.-born, but not foreign-born, women. These findings add to our limited knowledge of preterm birth and its maternal risk factors in this understudied and growing demographic. Overall, the prevalence of preterm birth in this study population (15.1%) was



higher than the national prevalence in Hispanic women (11.8%) during the same year.<sup>20</sup> The study population's low socioeconomic status may account for this difference, given the strong association between low socioeconomic status and preterm birth observed in other studies.<sup>1,3</sup> Despite being a highly disadvantaged population, preterm birth was still less prevalent in this study population than among non-Hispanic black women of all socioeconomic statuses in national surveillance data (17.1%).<sup>20</sup> These results therefore provide some support for the epidemiologic paradox that has been observed in Hispanics for relatively low risk of infant mortality and low birth weight.

Advanced maternal age has been consistently identified as a risk factor for preterm birth in other populations.<sup>1,3</sup> Age was a significant predictor in this study even when adjusting for diabetes and hypertension, which have been hypothesized to explain the association between older age and preterm birth.<sup>1</sup> As maternal age has been increasing nationally in all races and ethnicities, including Hispanics, these results support the need for further research on the causes of preterm birth in older mothers and the inclusion of maternal age as a confounder in causative research on preterm birth.<sup>4</sup>

The results corroborate those of studies in other populations, which have found highly stressful life events to be significant predictors of preterm birth.<sup>18,19</sup> However, Lu and Chen<sup>18</sup> found with national-level PRAMS data that the same financial stress construct for 12 months before delivery was not significantly related to preterm birth and did not affect racial-ethnic disparities in preterm birth. Similarly, Ahluwalia et al.<sup>16</sup> found only traumatic stress in pregnancy—not financial stress—to be significantly related to risk of small for gestational age.

The contrasting results of this study suggest that the effect of stressful life events on risk of preterm birth may differ by ethnicity, type of stress, and whether before or during pregnancy. Stressful life events may also contribute to differences in preterm birth risks between Hispanic women born in the U.S. and those who immigrate to the U.S. Financially-stressful events between pregnancies may help identify some women who are at increased risk of preterm birth, although it is unknown why financial stress was only a risk factor for U.S.-born women in this study population.

In contrast to studies in other populations, there was no association found between maternal education and preterm birth in this study.<sup>1,3,10</sup> All women in this study population were low-income and nearly half did not finish high school. Maternal education may not be protective against preterm birth in such disadvantaged populations of Hispanic women.

Additionally, this study adds to the mixed evidence on the relationship between maternal nativity and preterm birth. Maternal nativity was not significantly associated with preterm birth in this study, although prevalence was numerically lower in U.S.-born women and the power to detect a difference was limited by the study's sample size. Most non-native women in this study were born in Mexico, and studies have shown maternal birth in Mexico to have a modestly beneficial influence on preterm birth.<sup>10,11,21,22</sup> In a national study, Singh et al.<sup>12</sup> found the prevalence of preterm birth to be 11.8% in U.S.-born Mexican-Americans vs. 10.0% in foreign-born Mexican-Americans. Similarly, in a study in New York City by



Kaufman et al.,<sup>10</sup> the prevalence of preterm birth was 6.34% in U.S.-born Mexican-Americans and 6.32% in foreign-born Mexican-Americans. These findings highlight the need for more research on the effect maternal nativity may or may not have on preterm birth.

Inference in this study is limited by its cross-sectional design and sample size. Because of the study's limited sample size, there was insufficient power to adequately detect differences in some factors. For instance, the difference in preterm birth prevalence between U.S.-born and foreign-born mothers of 2.8 percentage points may be clinically significant but not be identified as statistically significant because of limited power. The same limitation applies to comparisons of risk factors between preterm and full-term births, such as diabetes and high blood pressure. Understanding of these relationships would benefit from prospective follow-up studies with large numbers of U.S.-born and foreign-born Hispanic participants. The self-reported data in this study also may have introduced misclassification, although a previous study validated self-reported survey data in the same study population.<sup>23</sup>

A major strength of this study is its augmented sample, which enabled comparisons between preterm and full-term births that are often not possible in similar study designs. The study's detailed questionnaire also enabled analysis of many potential risk factors for preterm birth in the study population.

This study contributes to the understanding of risk factors for preterm birth, particularly in Hispanic women served by WIC. Many health and human service providers in the U.S., like WIC, already serve a predominantly Hispanic population and the number of Hispanics nationwide, especially U.S.-born, is expected to continue to rise.<sup>12,13</sup> The results of this study suggest that prepregnancy risk factors for preterm birth may be different for Hispanic women than for women of other ethnicities, and may also differ by maternal nativity. Particularly, experiencing financially-stressful life events before pregnancy may be a significant risk factor for Hispanic women born in the U.S. and advanced maternal age may be the strongest risk factor overall. Understanding such prepregnancy risk factors for preterm birth in U.S.-born and foreign-born Hispanic women can inform public health efforts to reduce preterm birth rates and disparities among sociodemographic groups.

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**Table 1**

Distribution of potential prepregnancy risk factors for preterm birth among included study participants (n = 1174)<sup>a</sup>.

<b>Variables</b>	<b>% (weighted)</b>
Age (n = 1163)	
18–24 y	37.6
25–29 y	25.0
30–34 y	21.7
35 y	15.7
Education	
Less than high school completion	42.9
High school graduate	32.9
At least some college or trade school	24.2
Any healthcare coverage (n = 1168)	44.9
Not born in the U.S.	34.4
Alcohol use $\geq 1$ d/wk (n = 1164)	5.5
Exercise frequency (n = 1171)	
5 d/wk	28.7
1–4 d/wk	47.7
< 1 d/wk	11.2
Never	12.4
Daily folic acid or multivitamin supplement (n = 1168)	24.1
Pregnancy intention (n = 1159)	
Intended	49.7
Intention kept changing	14.7
Not intended	35.5
Depressive symptoms (n = 1171)	
0	78.6
1	11.7
2	9.7
Stressful life event	
Emotional	12.0
Financial	42.8
Partner-related	7.9
Traumatic	4.4
Diabetes (n = 1173)	1.1
High blood pressure	1.0
Teeth or gum problem	5.4
Body mass index (n = 865)	
Normal- or underweight (< 25 kg/m <sup>2</sup> )	43.8
Overweight (25.0–29.9 kg/m <sup>2</sup> )	30.4
Obese ( $\geq 30$ kg/m <sup>2</sup> )	25.8

<b>Variables</b>	<b>% (weighted)</b>
Primigravida	28.5

<sup>a</sup>N = 1174 for all variables in the table unless otherwise indicated.

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**Table 2**Logistic regression<sup>a</sup> results for associations between potential pregnancy risk factors and preterm birth.

Variables	Unadjusted OR (95% CI) <sup>b</sup>	Adjusted OR (95% CI) <sup>b</sup>
Age		
18–24 y	1.00	1.00
25–29 y	1.04 (0.67, 1.62)	0.78 (0.42, 1.45)
30–34 y	1.57 (1.01, 2.45) <sup>d</sup>	1.29 (0.70, 2.37)
35 y	1.83 (1.15, 2.91) <sup>d</sup>	2.00 (1.04, 3.84) <sup>d</sup>
Education		
Less than high school graduate	1.00	1.00
High school graduate	1.01 (0.7, 1.47)	1.30 (0.82, 2.08)
More than high school graduate	0.85 (0.56, 1.3)	0.98 (0.56, 1.72)
Health insurance (any)	1.10 (0.79, 1.52)	1.02 (0.68, 1.55)
Alcohol use ( < 1 d/wk)	0.81 (0.37, 1.76)	0.75 (0.30, 1.95)
Exercise frequency		
5 d/wk	1.00	1.00
1–4 d/wk	0.95 (0.66, 1.39)	1.04 (0.66, 1.65)
< 1 d/wk	0.55 (0.30, 1.02)	0.56 (0.26, 1.22)
Never	0.74 (0.43, 1.28)	0.80 (0.41, 1.58)
Folic acid or multivitamin use (daily)	1.41 (0.98, 2.04)	1.37 (0.87, 2.15)
Pregnancy intention		
Intended	1.00	1.00
Intentions kept changing	0.65 (0.39, 1.07)	0.56 (0.31, 1.02)
Not intended	0.82 (0.57, 1.16)	0.78 (0.50, 1.21)
Depressive symptoms		
0	1.00	1.00
1	1.37 (0.83, 2.25)	0.80 (0.39, 1.65)
2	1.57 (0.93, 2.63)	0.81 (0.40, 1.63)
Stressful life event		
Emotional	1.26 (0.79, 2.01)	1.45 (0.82, 2.57)
Financial <sup>c</sup>	1.57 (1.14, 2.17)	N/A
In U.S. born	2.46 (1.44, 4.21) <sup>d</sup>	2.61 (1.43, 4.77) <sup>d</sup>
In foreign born	1.29 (0.87, 1.93)	0.96 (0.56, 1.64)
Partner-related	1.08 (0.61, 1.92)	0.95 (0.47, 1.91)
Traumatic	1.33 (0.65, 2.72)	1.27 (0.50, 3.22)
Diabetes	2.67 (0.8, 8.94)	1.34 (0.26, 6.84)
High blood pressure	3.6 (1.08, 12.02) <sup>d</sup>	2.69 (0.53, 13.7)
Teeth or gum problem	1.1 (0.53, 2.21)	0.71 (0.22, 2.28)
Body mass index		
Normal- or underweight	1.00	1.00
Overweight	0.96 (0.62, 1.5)	0.93 (0.59, 1.48)

Variables	Unadjusted OR (95% CI) <sup>b</sup>	Adjusted OR (95% CI) <sup>b</sup>
Obese	1.26 (0.79, 1.99)	1.15 (0.69, 1.92)
Gravidity (primigravida)	0.75 (0.52, 1.08)	0.99 (0.59, 1.68)

<sup>a</sup> Sampling weights were used to realign the distribution of the study sample with the true population proportions of full-term and preterm births

<sup>b</sup> n = 1159 for each unadjusted model except the body mass index model (n = 865); n = 840 for the adjusted model

<sup>c</sup> Unstratified and stratified results presented for unadjusted models and stratified results presented for adjusted model because of significant effect measure modification by maternal nativity

<sup>d</sup> P < 0.05

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