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The "Latina Epidemiologic Paradox" Revisited: The Role of Birthplace and Acculturation in Predicting Infant Low Birth Weight for Latinas in Los Angeles, CA

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Abstract

The "Latina epidemiologic paradox" refers to the observation that despite socioeconomic disadvantages, Latina mothers in the United States (US) have a similar or lower risk for delivering an infant with low birth weight (LBW) compared to non-Latina White mothers. An analogous paradox may exist between foreign-born (FB) and US-born (USB) Latinas. Our goal was to assess differences in LBW in USB Latinas, FB Latinas, and non-Latina Whites in Los Angeles County in 2003 using birth records and survey data. Using logistic regression, we estimated associations between LBW and birthplace/ethnicity in a birth cohort and nested survey responder group and between LBW and acculturation in responders to a follow-up survey. USB Latinas and FB Latinas had a higher prevalence of LBW infants compared to Whites (odds ratio [OR] = 1.34, 95% confidence interval [CI] = (1.17, 1.53) and OR = 1.32, 95% CI = (1.18, 1.49), respectively); when we adjusted for additional maternal risk factors these point estimates were attenuated, and interval estimates were consistent with a modest positive or inverse association. Among Latinas only, LBW was more common for high-acculturated FB and USB Latinas compared to low-acculturated FB Latinas, and there was limited evidence that environmental or behavior risk factors had less impact in low-acculturated Latinas. In summary, adjusting only for demographics, Latinas in our study were more likely to have LBW infants compared to Whites, in contrast to the Latina paradox hypothesis. Furthermore, adjusting for environmental or behavioral factors attenuated the positive association, but there was little evidence that Latinas had a lower prevalence of LBW regardless of the variables included in the models. Finally, among Latinas, there was limited evidence that associations between known risk factors and LBW were modified by acculturation.

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Conflict of Interests None declared.

Keywords

Low birth weight; Latina; Hispanic; US-born; foreign-born; Acculturation; Two-phase analysis

Theoretical/Conceptual Framework

Theories of why ethnic minorities in the United States (US) may be at higher risk for poor birth outcomes have emphasized demographic, social, and economic factors [1], but do not specifically account for environmental risk factors and health-related behaviors [1, 2, 3] Studies of low birth weight (LBW) in US Latina populations have found that while Latinas may have less education, less access to medical services, and later initiation of prenatal care [4, 5], they may actually have a similar or even lower prevalence of LBW infants compared to non-Latina Whites (hereafter referred to as Whites) [6, 7]. This observation has been termed a Latina "epidemiologic paradox" [8, 9].

A similarly paradoxical observation has been made within the Latina ethnic group, with foreign-born (FB) Latinas reported to be at lower risk of having LBW infants compared to US-born (USB) Latinas despite FB mothers having a higher prevalence of risk factors for adverse birth outcomes [5, 6, 10, 11]. This could reflect higher migration rates among healthy individuals, cultural factors, better nutrition, lower rates of smoking and alcohol consumption, or a more supportive social environment among low-acculturated FB Latinas [7, 11, 12, 13].

The literature on birth outcomes across racial/ethnic groups in the US has tended to focus on the perinatal period [14]. However, some of the most powerful influences on pregnancy outcome are related to influences on women's health that occur long before pregnancy begins [14]. For example, nutritional status during pregnancy may be strongly influenced by childhood practices [15, 16]. Behavioral and environmental factors during pregnancy may thus be markers for culturally-determined factors, and not just pregnancy characteristics, that predispose or protect women from having LBW infants.

Background

Latinos are the largest racial/ethnic minority group in the US and account for 50 million people (i.e. 16% of the total U.S. population) [17]. The Mexican descent population accounts for the majority of all Latinos in the U.S. (i.e. 60% of the total). Births have surpassed immigration as the main driver of the dynamic growth in the nation's Mexican–American population [18]. From 2000 to 2010, the Mexican–American population grew by 7.2 million as a result of births and 4.2 million as a result of new immigrant arrivals. This is a departure from the previous two decades when the number of new immigrants either matched or exceeded the number of births in the US. The Latino has a high fertility rate, averaging 2.5 births per woman compared to 1.9 for non-Hispanic women [18]. The relative youth and high fertility of Mexican–American women have contributed to the increase in births among the Latino population over the past 10 years, but research on the "Latina Paradox" has not followed more recent trends in birth outcomes.

Birth outcomes among Latinas have been the subject of considerable epidemiologic research, particularly around the Latina paradox for LBW, and large variation in the strength of association between LBW and national origin or immigrant status have been reported [19–24] which may reflect in part varying levels of acculturation between USB and FB Latina sub-groups. Measures of acculturation [25] may use simple or multidimensional measures to create rating scales that are based on theoretical models that view acculturation as a multi-dimensional process involving language, cultural beliefs and values, and the integration of members of the minority group into the social structure of the majority group [25–28]. Measures of acculturation may thus be correlated with environmental and behavioral factors that can impact birth outcomes, including LBW.

To investigate the impact of ethnicity, birthplace, and acculturation—and related environmental and behavioral risk factors—on LBW, most studies have relied on vital statistics data, e.g., birth records, that are widely available, inexpensive, and population-based. However, birth records have important limitations, and in particular, data on covariates relevant to studying the Latina birth weight paradox may be missing (e.g. income, acculturation), 'inferred' (e.g. marital status), or underreported (e.g. tobacco use). In the current study, we used California State birth records to define a population-based cohort of births in Los Angeles (LA) County, California in 2003; however, to examine a broader range of variables related to maternal birthplace and ethnicity, we augmented the birth record data with baseline survey data collected as part of a study of environmental determinants of birth outcomes and a second follow-up survey that included questions on acculturation.

We contrasted the prevalence of LBW in USB and FB Latina mothers vs. White mothers in the birth cohort, using birth record data, and the group of responders to a survey, using birth record and survey data. For the birth cohort, we had a well-defined, population-based study group but a limited set of covariates, whereas in the survey responder group we had rich covariate data but possible bias due to selection and survey non-response. By analyzing both the birth cohort and survey responder groups, we sought to assess whether the differences in LBW between groups reflected different dimensions—as indicated by demographic, environmental, or behavioral covariates—along which Latina and White mothers might differ. We also used the nested structure of our data, in which survey responders were a subset of the cohort, to assess whether our results that were adjusted for survey covariates were vulnerable to selection/response bias. Finally, using the follow-up survey data in addition to birth record and baseline survey data, we constructed measures of acculturation among Latinas; by examining the relations between demographic, environmental, and behavioral risk factors and LBW across birthplace and acculturation groups, we sought to determine whether acculturation modified the relation between these risk factors and LBW.

We hypothesized that mothers of Latina ethnicity would have a lower prevalence of LBW compared to White mothers, that differences in LBW could be due to specific measured environmental or behavioral risk factors for LBW that are also markers for aspects of ethnicity, birthplace, and acculturation that are relevant to LBW and that the presence of such risk factors could be detected by comparing results with and without adjustment for these variables. We also hypothesized that among Latinas, low acculturation could be a proxy for factors that confer protection against the effects of measured environmental or behavioral risk factors for LBW. Thus, we would expect to see the strongest associations between the environmental and behavioral risk factors and LBW among the high-acculturated USB Latinas, more modest associations for the low-acculturated FB Latinas, with intermediate results for the high-acculturated FB Latinas.

Methods

Participants

We identified a cohort of singleton births (hereafter referred to as the "birth cohort") occurring in 2003 to mothers residing in one of 111 LA County zip codes. This birth cohort was originally used as the sampling frame for the University of California, Los Angeles (UCLA) Environment and Pregnancy Outcomes Survey (EPOS), a nested case–control study of environmental risk factors for adverse birth outcomes as described in detail elsewhere [29]. In this analysis, we considered three different study groups: the birth cohort, the responders to the baseline EPOS survey, and the survey responders who also completed the EPOS follow-up survey. This study was approved by the Office for Protection of Research Subjects at the University of California, Los Angeles and by the California State Committee for the Protection of Human Subjects.

Data Collection

We used California birth records to identify the birth cohort. From the birth cohort we sampled women who were then invited to participate in the EPOS survey. From the 2,543 responders (hereafter referred to as the "EPOS responders"), we collected additional data via a telephone, mail, or in-person interview. Of the EPOS responders, 2,470 agreed to be re-contacted, and 3–4 years after the initial contact, 1,217 mothers (49%) were located and responded to a follow-up survey that included items on acculturation (hereafter referred to as the "EPOS follow-up group").

Measures

Data used in this analysis included variables from the birth records, the baseline EPOS survey, and the EPOS follow-up survey. From the birth certificates we abstracted our outcome LBW (defined as an infant weighing <2,500 g at birth), maternal race and ethnicity, birthplace, age, parity, education, source of payment for prenatal care, pregnancy complications, and gestational age. Mothers were defined as "Latina" if they self-identified as Hispanic/Latina. We excluded women with missing/unknown status for Hispanic origin ($n = 13$) and women reporting Asian race and Latina ethnicity (<1% of Latinas personal communication, David Hayes-Bautista [30]). Mothers born in the US or District of Columbia were considered USB; all others were considered FB. Based on the "Hispanic origin" and birthplace data for the birth cohort, the majority (75%) of FB Latinas were born in Mexico. Among the EPOS responders, over 50% of the respondents were Latinas, and among the Latinas, more than 50% were immigrants, mostly from Mexico.

In the EPOS survey (conducted in either English or Spanish), we ascertained total household income in 2002, maternal height and weight, marital status, tobacco and alcohol use, fast food consumption, vitamin intake, partner support, and chronic stress; the categories for these variables are shown in Table 1, and a detailed description of these variables has been reported elsewhere [31]. We created a variable for recommended weight gain during pregnancy using Institute of Medicine (IOM) standards with additional guidelines for obese women [32, 33]. Women were categorized as gaining a "less than recommended", "recommended", or "more than recommended" amount of weight during pregnancy based on reported height, preconceptional weight, and pregnancy weight gain. Note that in our study, FB Latinas were more likely to report "don't know" for their height on the EPOS survey, thus there was a large proportion of missing data for BMI and gestational weight gain among FB Latinas (as listed in Table 1).

In the EPOS follow-up survey we used the "Short Acculturation Scale for Hispanics" (SASH) to determine level of acculturation for Latinas based on language preference (English and Spanish) [28]. We categorized USB and FB Latinas into groups of "low" acculturation (average SASH score between 1 and 2.99) and "high" acculturation (average SASH score between 3 and 5). There were 216 high-acculturated USB Latinas, 28 low-acculturated USB Latinas, 92 high-acculturated FB Latinas, and 389 low-acculturated FB Latinas available for analysis; due to their limited numbers, low-acculturated USB Latinas were excluded.

Analysis

We performed analyses for three groups: the birth cohort, the EPOS responders, and the EPOS follow-up group. In analyses for the birth cohort, we compared all LBW infants to all normal weight infants. In analyses for the EPOS responders and EPOS follow-up, both of which were taken from a nested case–control group, the study design resulted in an oversample of preterm normal weight births. To account for the sampling design and for possible bias due to survey non-response, we used sampling/response fractions and performed a weighted-likelihood two-phase analysis, as described in detail elsewhere [29, 34, 35]. The two-phase analysis was appropriate when considering exposures available for both the birth cohort and nested EPOS responders group (i.e., ethnicity and birthplace).

We estimated crude and adjusted prevalence odds ratios (ORs) and 95% confidence intervals (CIs) for LBW using separate logistic regression models to compare: (1) USB Latinas to Whites and (2) FB Latinas to Whites. We did not adjust for gestational age, consistent with the assumption that since gestational age and LBW share etiologic pathways, adjustment is inappropriate in general [35, 36]; in a sensitivity analysis for our EPOS responder group, we added gestational age but found the inclusion of this variable had a negligible impact on our results. For analyses based on acculturation, we estimated ORs for risk factors for LBW within strata defined for high-acculturated USB and FB Latinas and low-acculturated FB Latinas. Because we lacked acculturation or language measures for the entire birth cohort, we could not use a two-phase analysis for these comparisons.

Variables retained in the final models were those whose inclusion changed the OR point estimate by 10% or more. Our final ‘base’ models included the following: maternal age, parity, education, and payment for prenatal care. We then added pregnancy complications, diabetes, and each of the following EPOS survey variables to the base model: marital status, smoking and alcohol use, living with a smoker, pre-pregnancy weight, weight gain during pregnancy, fast food consumption, partner support, and chronic stress.

Results

In the birth cohort, both the USB and FB Latinas had a prevalence of LBW of 5% and a prevalence of preterm birth of 11%. Whites had a similar prevalence of LBW (4%) and a lower prevalence of preterm birth (7%).

Based on data from our EPOS survey, USB Latinas preferred English to complete the survey, whereas FB Latinas preferred Spanish; other differences among the birthplace/ethnicity groups are shown in Table 1. In univariate models, both USB and FB Latina mothers in our study had a higher prevalence of LBW and preterm birth, and when we adjusted for measured environmental or behavioral risk factors, the OR point estimates were attenuated but consistently greater than 1.0 (Table 2). We note that for some of the analyses the adjustment for multiple covariates yielded estimates that were relatively imprecise and in some cases the 95% confidence intervals did include 1.0. In results adjusted for birth record and EPOS survey variables, the point estimates were generally similar to the crude estimates but the CIs were wider, reflecting the reduction in sample size in the survey responders compared to the birth cohort. To investigate possible heterogeneity in the relations between demographic, environmental, and behavioral risk factors and LBW by acculturation, we estimated ORs for these risk factors within strata for high-acculturated USB and FB Latinas and low-acculturated FB Latinas. Under the predictions of the Latina paradox, we expected to see the strongest associations between the risk factors and LBW among the high-acculturated USB Latinas, the lowest associations for the low-acculturated FB Latinas, with intermediate results for the high-acculturated FB Latinas. For high parity and income this pattern generally held, and living in a house with a smoker was associated with increased

LBW for high-acculturated US-born Latinas but not for the other groups of Latinas; for other risk factors the results, though imprecise, showed no clear pattern (Table 3).

Discussion

The “Latina paradox” refers to the observation made in previous studies that despite having lower access to care and resources, Latina mothers are often at similar or even *lower* risk for delivering infants with low birth weight compared to White mothers. We assessed whether there was evidence that the paradox exists for mothers who gave birth in Los Angeles County in 2003. We conceptualized our measures of demographic, environmental, and behavioral factors as capturing different aspects of ethnicity or birthplace that can impact a woman’s risk for having a LBW infant. To assess whether the measured variables (e.g., marital/partner status, smoking or ETS exposure) captured the aspects of ethnicity and birthplace related to demographics, environment, and behavior, we estimated the odds ratios for ethnicity/birthplace and LBW with and without adjustment for covariates. There was a slight attenuation of the point estimates for the odds ratio when we adjusted for covariates, but the main impact on the results was to decrease the precision of our estimates.

Our interpretation of these results is that there is some limited evidence that Latinas have slightly higher odds for LBW, particularly for the entire birth cohort, but little indication that Latinas have similar or *lower* odds for LBW (that is, little indication that our results demonstrate a “Latina paradox”). Due to the imprecision of some of our estimates, however, we cannot rule out the possibility that we were unable to detect associations consistent with the Latina paradox. Among Latinas, the odds for LBW were similar for those US-born and foreign-born—in other words, our results do not provide consistent evidence of a “paradox” between Latinas and Whites whether or not we adjusted for demographic, environmental, or behavioral factors, but our results do not contradict the paradox for US-born and foreign-born Latinas.

In a study of 1982–1983 Chicago births, FB Latina mothers (of whom 71.3% were from Mexico) had fewer years of education, were older, and were more likely to be married than USB Latina mothers (of whom 44.7% were of Mexican ancestry), though in contrast to our results USB Latina mothers had increased risk for LBW delivery compared to FB Latinas, even after taking poverty into account [6]. In another study from North Carolina, Mexican-born Latinas experienced fewer medical risk factors and used less tobacco or alcohol during pregnancy, but conversely had less education and lower access to prenatal care than USB Latinas, yet the prevalence of LBW was low and similar between the groups compared in this study [37]. Likewise, we found little advantage among Latinas when measured risk factors were included in the models. Our birth cohort results for FB Latinas are not consistent, however, with earlier findings for California Latina women in 1990–1993 [38] in which Mexican-born Latinas had a lower risk of delivering a LBW baby compared to White mothers; the disagreement between our results and those from the earlier study could be due to differences between Latinas in Los Angeles versus other parts of California or secular changes between the early 1990s and the early 2000s that led to Latinas and White mothers having a comparable prevalence of LBW in our study.

Based on SES factors we might expect poor birth outcomes in immigrants, but in contrast, low acculturation to the US lifestyle may be protective against adverse birth outcomes [25, 39]. This is corroborated by previous findings that while FB Mexicans had an adverse socio-demographic profile, they nevertheless had a lower prevalence of LBW compared to USB Mexican–American Latinas [5], suggesting a negative impact of adopting risky behaviors or the loss of protective behaviors with increasing acculturation. In comparing the associations between measured risk factors and LBW across strata defined by acculturation and nativity, we found limited support for our hypothesis that low acculturation may "buffer" the effects of these risk factors: Only parity and income followed the hypothesized pattern.

Both the low-acculturated FB Latinas and the high-acculturated USB Latinas had pre-pregnancy weight or pregnancy weight gain that may have increased the risk for LBW, albeit in different ways: Low-acculturated FB Latinas had low pre-pregnancy weight and gained less than the recommended weight during pregnancy, whereas USB Latinas were more likely to be obese before pregnancy, which could have increased the risk for preterm delivery and thus LBW [40]. In our study, the most obese women were USB Latinas who reported the highest frequency of fast-food consumption in our survey population, which may reflect their relatively low SES and adoption of American lifestyle patterns. While our conclusions are tentative given the greater amount of missing data for BMI in FB (26%) compared to USB Latinas (6%), these findings are consistent with previous work showing national origin and immigrant generational status were associated with increased BMI among Latinos [41].

A strength of our study is the use of detailed survey data on risk factors that are poorly measured or absent from birth records. The 40% response rate to the EPOS survey makes non-response a potential source of error; however, use of a two-phase analysis allowed us to assess and correct for potential bias to the extent that measured variables predicted who responded. The two-phase analysis also allowed us to increase the precision of the estimates of the effect of maternal birthplace/ethnicity. Unfortunately, we did not have measures of acculturation for the entire birth cohort and therefore could not use the two-phase analysis to estimate the effect of acculturation. As reflected in our results presented in Table 3, this resulted in a limited ability to estimate the acculturation effects, and we cannot rule out the possibility that underlying associations exist that we had insufficient data to estimate with precision. Measurement error was also a concern, particularly for the survey variables; to minimize this error, EPOS interviewers were blinded to case status, administered the questionnaire following a standard protocol, and interviewed each mother no more than 3–6 months after giving birth. Finally, acculturation may not be adequately captured by measures that rely on language preference alone [25]. However, our simplified measure provides some insight into the relation between acculturation and associated risk factors for LBW and suggests areas for further research.

In our study, Latinas were a heterogeneous group with substantial differences in risk factor profiles according to birthplace and acculturation. The similar prevalence of LBW we observed for FB and USB Latinas suggests a need to better understand the factors that may give rise to the previously observed Latina epidemiologic paradox. In particular, for some variables such as partner support and chronic stress, our measures referred to experiences during pregnancy that may be weak proxies for the relevant exposures over the lifecourse. Future studies may therefore need longitudinal assessments of environmental and behavioral risk factors to better detect the complex relations between these risk factors and LBW. Latina populations in the US are growing [42], and future population-based studies of LBW should consider USB Latinas separately from FB Latinas, employ finer measures of acculturation in surveys, and collect data on a broad range of factors related to acculturation.

New Contribution to the Literature

Most research on the Latina epidemiologic paradox and LBW has relied on birth record data that lack information on important risk factors and has not distinguished between USB and FB Latinas. This study compares infant LBW among USB Latina, FB Latina, and White mothers in Los Angeles County, California during 2003 using both birth certificate and detailed survey data. Compared to Whites, Latina mothers had a higher prevalence of LBW, and the prevalence of LBW among Latina mothers did not differ by birthplace despite the unequal distribution of environmental or behavioral risk factors. Overall, our results are not consistent with the "Latina epidemiologic paradox", though there is some evidence that FB and USB Latinas have a similar risk for LBW despite their differences in measured risk factors. Among Latinas only, LBW was more common for high-acculturated FB and USB Latinas compared to low-acculturated FB Latinas, and there was limited evidence that low-acculturated Latinas may have less sensitivity to the effects of some environmental or behavioral risk factors for LBW.

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Table 1

Distribution of selected maternal characteristics among low birth weight cases and normal weight control infants in EPOS responders, Los Angeles County, CA, 2003

	US-Born Latinas		Foreign-born Latinas		Whites	
	Cases *n* = 110	**Controls *n* = 385**	**Cases *n* = 230**	**Controls *n* = 979**	**Cases *n* = 76**	**Controls *n* = 355**
	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Maternal age						
13–20	31 (28)	77 (20)	23 (10)	97 (10)	1 (1)	5 (1)
20–24	40 (36)	121 (31)	65 (28)	216 (22)	4 (5)	26 (7)
25–29	21 (19)	118 (31)	55 (24)	276 (28)	14 (18)	75 (21)
30–34	12 (11)	55 (14)	55 (24)	250 (26)	27 (36)	134 (38)
35–47	6 (6)	14 (4)	32 (14)	140 (14)	30 (40)	115 (32)
Parity						
Nulliparous	57 (52)	156 (41)	80 (35)	299 (31)	51 (67)	183 (52)
1–2 previous live births	44 (40)	189 (49)	123 (54)	513 (52)	23 (30)	157 (44)
≥3 previous live births	8 (9)	40 (10)	27 (12)	167 (17)	2 (3)	15 (4)
Maternal education (*years*)						
<12	37 (34)	106 (28)	131 (58)	554 (58)	3 (4)	11 (3)
12	40 (37)	159 (41)	57 (25)	274 (28)	10 (13)	45 (13)
≥13	32 (29)	117 (31)	40 (18)	136 (14)	52 (83)	296 (84)
Payment for prenatal care						
Private insurance/self-pay	33 (30)	178 (46)	38 (17)	176 (18)	66 (88)	315 (89)
Medical/medicare/other/no care	77 (70)	207 (54)	191 (83)	801 (82)	9 (12)	39 (11)
Had a pregnancy complication *	16 (15)	22 (6)	28 (12)	41 (4)	18 (24)	24 (7)
Household income in 2002						
<$10,000	25 (23)	78 (20)	65 (28)	256 (26)	4 (5)	15 (4)
$10,000 to $19,999	25 (23)	80 (21)	68 (30)	300 (31)	2 (3)	24 (7)
$20,000 to $39,999	25 (29)	99 (30)	30 (17)	154 (20)	8 (11)	45 (14)
≥$40,000	11 (13)	72 (22)	18 (10)	65 (9)	61 (81)	243 (74)
Missing	24	56	49	204	1	28
Married during pregnancy	35 (32)	169 (44)	116 (51)	509 (52)	61 (80)	298 (84)

	US-Born Latinas		Foreign-born Latinas		Whites	
	Cases *n* = 110	**Controls *n* = 385**	**Cases *n* = 230**	**Controls *n* = 979**	**Cases *n* = 76**	**Controls *n* = 355**
	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Used alcohol during pregnancy	16 (15)	36 (9)	14 (6)	47 (5)	18 (24)	66 (19)
Smoked during pregnancy	8 (7)	19 (5)	5 (2)	11 (1)	9 (12)	26 (7)
Lived with a smoker in the home	32 (29)	84 (22)	41 (18)	139 (14)	17 (23)	49 (14)
Pre-pregnancy weight (*lbs.*)						
<110	10 (9)	23 (6)	34 (15)	60 (7)	10 (14)	28 (8)
110–159	67 (62)	212 (57)	135 (61)	654 (71)	55 (76)	237 (68)
160–199	19 (18)	92 (25)	42 (19)	180 (20)	6 (8)	66 (19)
≥200	12 (11)	44 (12)	11 (5)	31 (3)	1 (1)	18 (5)
Missing	2	14	8	54	4	6
Recommended pregnancy weight gain						
Less than recommended	35 (33)	115 (32)	46 (27)	243 (33)	27 (39)	128 (37)
Recommended	39 (37)	68 (19)	76 (44)	219 (30)	22 (31)	54 (16)
More than recommended	31 (30)	179 (50)	49 (29)	266 (37)	21 (30)	165 (48)
Missing	5	23	59	251	6	8
Fast food consumption during pregnancy						
Never	3 (3)	20 (5)	28 (12)	102 (11)	13 (18)	67 (19)
Once a month to once a week	64 (60)	228 (60)	163 (72)	727 (75)	46 (62)	235 (67)
≥3 times a week	40 (37)	135 (35)	36 (16)	141 (15)	15 (20)	49 (14)
Low partner support	20 (19)	52 (14)	14 (6)	64 (7)	4 (6)	13 (4)
Chronic stress						
Low	48 (46)	169 (45)	87 (40)	422 (45)	40 (53)	237 (68)
Moderate	39 (38)	135 (36)	89 (40)	385 (41)	30 (40)	88 (25)
High	17 (16)	72 (19)	45 (20)	135 (14)	6 (8)	24 (7)

* Pregnancy complications included: hypertension, renal, lung, or cardiac disease, pyelonephritis, diabetes, gestational diabetes, RH sensitivity, hemoglobinopathy, uterine bleeding, hydramnios, incomplete cervix, STDs, Hepatitis B, Rubella, tocolysis, and induction of labor

** Percentages are calculated for non-missing values

Table 2

Odds ratios (95% CI) for low birth weight using a two-phase analysis for EPOS responders and conventional logistic regression for the birth cohort

	EPOS responders		**Birth cohort**	
	US-born Latinas versus Whites *n* = 495 USB, 431 White	**Foreign-born Latinas versus Whites *n* = 1209 FB, 431 White**	**US-born Latinas versu Whites *n* = 10772 USB, 9129 White**	**Foreign-born Latinas versus Whites *n* = 28320 FB, 9129 White**
Crude OR	1.34 (1.17, 1.54)	1.32 (1.17, 1.48)	1.34 (1.17, 1.53)	1.32 (1.18, 1.49)
Model 1 (base model): age, parity, education, prenatal care payment source	1.18 (0.86, 1.62)	1.38 (0.95, 2.01)	1.23 (1.03, 1.47)	1.24 (1.05, 1.46)
Model 1 + pregnancy complications	1.16 (0.83, 1.63)	1.16 (0.83, 1.88)	1.20 (1.00, 1.43)	1.16 (0.98, 1.36)
Model 1 + marital status	1.16 (0.85, 1.59)	1.16 (0.94, 1.99)		
Model 1 + smoking + alcohol	1.28 (0.92, 1.78)	1.28 (1.00, 2.17)		
Model 1 + ETS	1.21 (0.89, 1.65)	1.21 (0.98, 2.06)		
Model 1 + pre-pregnancy weight	1.34 (0.97, 1.84)	1.34 (0.85, 1.89)		
MODEL 1 + recommended weight gain	1.29 (0.91, 1.84)	1.29 (0.74, 1.76)		
Model 1 + fast food consumption	1.21 (0.88, 1.68)	1.21 (0.94, 2.00)		
Model 1 + partner support	1.18 (0.85, 1.63)	1.18 (0.93, 2.00)		
Model 1 + chronic stress	1.18 (0.85, 1.62)	1.18 (0.91, 1.93)		

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Table 3

Odds ratios and 95% confidence intervals for low birth weight by selected maternal characteristics and stratified by acculturation status in the EPOS follow-up group

	High-acculturated US-born Latinas (*n* = 216)	**High-acculturated Foreign-born Latinas (*n* = 92)**	**Low-acculturated Foreign-born Latinas (*n* = 389)**
Maternal age			
13–20	3.33 (1.23, 9.02)	1.52 (0.37, 6.30)	–
20–24	1.75 (0.70, 4.39)	0.32 (0.07, 1.40)	3.91 (1.69, 9.01)
25–29	1.0	1.0	1.0
30–34	1.26 (0.43, 3.69)	0.41 (0.10, 1.58)	1.61 (0.68, 3.79)
35–47	2.44 (0.63, 9.50)	0.85 (0.14, 5.37)	2.47 (1.04, 5.90)
Parity			
Nulliparous	1.13 (0.57, 2.27)	1.54 (0.56, 4.21)	0.87 (0.47, 1.62)
1–2 previous live births	1.0	1.0	1.0
≥3 previous live births	3.24 (1.00, 10.43)	2.00 (0.32, 12.51)	0.37 (0.15, 0.92)
Maternal education (*years*)			
<12	3.08 (1.28, 7.41)	1.33 (0.36, 4.97)	0.89 (0.47, 1.67)
12	1.0	1.0	1.0
≥13	1.05 (0.47, 2.31)	0.95 (0.30, 3.01)	1.52 (0.66, 3.50)
Payment for prenatal care			
Private insurance/self-pay	1.0	1.0	1.0
Medical/medicare/other/no care	2.68 (1.36, 5.28)	0.65 (0.25, 1.73)	1.13 (0.54, 2.35)
Had a pregnancy complication*	2.19 (0.90, 5.30)	1.06 (0.11, 10.78)	3.59 (1.54, 8.39)
Household income in 2002			
<$10,000	0.56 (0.19, 1.63)	1.00 (0.18, 5.63)	1.14 (0.59, 2.20)
$10,000 to $19,999	0.32 (0.12, 0.84)	0.57 (0.11, 3.09)	1.13 (0.52, 2.45)
$20,000 to $39,999	0.24 (0.08, 0.70)	1.09 (0.24, 5.07)	1.42 (0.42, 4.80)
≥$40,000	1.0	1.0	1.0
Married during pregnancy	0.41 (0.21, 0.81)	1.01 (0.39, 2.64)	0.88 (0.52, 1.49)
Used alcohol during pregnancy	1.34 (0.55, 3.22)	–	2.78 (1.13, 6.84)
Smoked during pregnancy	1.12 (0.29, 4.24)	–	–
Lived with a smoker in home	2.74 (1.34, 5.60)	0.76 (0.19, 3.00)	0.84 (0.38, 1.89)
Pre-pregnancy weight (*lbs.*)			
<110	0.66 (0.14, 3.18)	0.82 (0.09, 7.73)	2.79 (1.12, 6.95)
110–159	1.0	1.0	1.0
160–199	0.83 (0.33, 2.07)	1.08 (0.33, 3.52)	1.21 (0.61, 2.40)
≥200	0.72 (0.25, 2.05)	12.27 (1.16, 129.62)	1.72 (0.53, 5.53)
Recommended pregnancy weight gain			
Less than recommended	2.07 (0.92, 4.68)	1.05 (0.33, 3.39)	2.35 (1.09, 5.07)
Appropriate	1.0	1.0	1.0
More than recommended	0.46 (0.20, 1.07)	0.30 (0.07, 1.22)	1.52 (0.68, 3.36)
Fast food consumption during pregnancy			
Never	1.0	1.0	1.0

	High-acculturated US-born Latinas (*n* = 216)	**High-acculturated Foreign-born Latinas (*n* = 92)**	**Low-acculturated Foreign-born Latinas (*n* = 389)**
Once a month to once a week	1.29 (0.50, 3.32)	0.63 (0.20, 1.93)	0.87 (0.50, 1.54)
≥3–4 times a week	1.36 (0.51, 3.65)	0.83 (0.24, 2.87)	1.00 (0.42, 2.39)
Partner support			
Low	1.0	1.0	1.0
Moderate/high	0.65 (0.24, 1.79)	0.94 (0.18, 5.02)	4.20 (0.55, 31.94)
Chronic stress			
Low	1.0	1.0	1.0
Moderate	1.20 (0.58, 2.49)	0.88 (0.29, 2.66)	1.78 (0.98, 3.26)
High	1.22 (0.47, 3.22)	0.97 (0.23, 4.16)	2.08 (0.92, 4.69)

*Pregnancy complications include: hypertension, renal, lung, or cardiac disease, pyelonephritis, diabetes, gestational diabetes, RH sensitivity, hemoglobinopathy, uterine bleeding, hydramnios, incomplete cervix, STDs, Hepatitis B, Rubella, tocolysis, and induction of labor

– Due to sample size limitations, some odds ratios and 95% confidence intervals could not be estimated