ORIGINAL ARTICLE

Maternal Birthplace, Ethnicity, and Low Birth Weight in California

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Background: Although immigrants to the United States are usually ethnic minorities and socioeconomically disadvantaged, foreign-born women generally have lower rates of low birth weight infants than do US-born women.

Objective: To measure the relationship between maternal birthplace, ethnicity, and low birth weight infants.

Design: Retrospective cohort study of birth certificate data.

Setting: California, 1992.

Subjects: Singleton infants (n = 497 868) born to Asian, black, Latina, and white women.

Main Outcome Measures: Very low birth weight (500-1499 g), moderately low birth weight (1500-2499 g), and normal birth weight (2500-4000 g, reference category).

Results: Foreign-born Latina women generally had less favorable maternal characteristics than US-born Latinas, yet foreign-born Latina women were less likely to have moderately low birth weight infants (odds ratio, 0.91; 95% confidence interval, 0.86-0.96) than US-born Latinas after adjusting for maternal age, education, marital status, parity, tobacco use, use of prenatal care, and gestational age. While foreign-born Asian women generally had a less favorable profile of maternal characteristics than US-born Asians, there was no statistically significant difference in the odds of very low birth weight or moderately low birth weight infants between foreign- and US-born Asian women. Foreign-born black women had more favorable maternal characteristics than US-born women, but there was no significant nativity difference in very low birth weight or moderately low birth weight between foreign- and US-born black women after adjusting for maternal and infant factors.

Conclusions: The relationship between maternal birthplace and low birth weight varies by ethnicity. Further study is needed to understand the favorable pregnancy outcomes of foreign-born Latina women.

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Editor's Note: Why foreign-born Latina women have favorable perinatal outcomes compared with other immigrants is a mystery worth solving. It's time to do the next step of the study.

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IMMIGRANTS REPRESENT 9% of the US population, the highest proportion in the last 50 years.[1] In the early 20th century, immigrants were primarily from Europe; recent immigrants are primarily from Asia and Latin America.[2] Although immigrants are a diverse group, they are generally socioeconomically disadvantaged relative to the native-born population, with higher poverty rates and higher proportions of uninsured individuals.[3,4]

Nineteen percent of childbearing women in the United States are foreign born.[5] Among the 4 main racial/ethnic groups in the United States, most childbearing Asian and Latina women are foreign born, while less than 10% of childbearing black or white women are foreign born.[6] Even though foreign-born women would be expected to have less favorable perinatal outcomes than US-born women, foreign-born Asian, black, Latina, and white women generally have lower rates of low birth weight infants than US-born women.[7-9] To address the health needs of immigrants, it is important to define the likelihood of adverse outcomes in this subgroup of the population. The objective of this study was to measure the relationship between maternal birthplace, ethnicity, and low birth weight in California by analyzing the California birth certificate data set. Since 15% of all US births occur in California,[6] the California population of childbearing women is ethnically di-

SUBJECTS AND METHODS

SUBJECTS

From the 1992 California birth certificate database we selected singleton infants born to Asian, black, Latina, and white women, using the information on maternal race and Hispanic origin that was obtained during standard data collection. Virtually all Latina women were coded as white race (99.6%), and we excluded the small subset of Latina women who were coded as Asian, black, or Native American (0.4%).

We defined mutually exclusive dependent variables using infant birth weight: extremely low (<500 g), very low (VLBW) (500-1499 g), moderately low (MLBW) (1500-2499 g), normal (2500-4000 g), and high (>4000 g). For the multivariate analyses of low birth weight, we excluded infants weighing less than 500 g (0.1% of births) because we were concerned about the accuracy of recorded birth weights in this category, and we excluded births with missing data for any study variable (0.6% of births). We also excluded high birth weight infants from the multivariate analyses of low birth weight. Since high birth weight infants have different health outcomes than normal birth weight infants,[10] we used normal birth weight infants as the reference category.

Maternal birthplace and ethnicity were the primary independent variables. Women born in the 50 states or the District of Columbia were defined as US born; women born outside the United States, including Puerto Rico and other US territories, were defined as foreign born.[2] We categorized women according to maternal birthplace (foreign and US born) since the California birth certificate recorded country of origin for certain subgroups of Asian and Latina women, but not for black or white women.

We also analyzed maternal age, education, marital status, parity (number of previous live births), tobacco use, use of prenatal care, and gestational age. Marital status was imputed on the birth certificate, and the assignment of "apparently unmarried" was based on a comparison of parental surnames.[11] This method of coding aggregated parents who had the same surname and parents for whom a surname was missing. Tobacco use was coded on the birth certificate as a dichotomous variable in the pregnancy complications data field, which resulted in the aggregation of women who did not report tobacco use and women for whom this information was missing. Use of prenatal care was categorized according to Kotelchuck's[12] Adequacy of Prenatal Care Utilization Index: inadequate, intermediate, adequate, and adequate plus. Gestational age, recorded on the birth certificate, was categorized as very premature (<231 days), moderately premature (231-258 days), and not premature (>258 days).

STATISTICAL ANALYSIS

χ^2 Statistics were used for bivariate analyses of maternal characteristics and pregnancy outcomes between foreign- and US-born women within each ethnic group. Logistic regression was used to estimate unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for the association between maternal birthplace, ethnicity, VLBW, and MLBW outcomes. To measure the relationship between maternal birthplace, ethnicity, and low birth weight, we ran 2 types of multivariate analyses. First we conducted multivariate analyses for each ethnic group, analyzing maternal birthplace as the independent variable. Then we analyzed maternal birthplace and ethnicity as the independent variable, using US-born white women as the reference category. We used SAS[13] to adjust for maternal age, education, marital status, parity, tobacco use, use of prenatal care, and gestational age in the multivariate models.

verse,[6] and 25% of California residents are immigrants,[1] we analyzed the California birth certificate data set.

RESULTS

A total of 497 868 infants who weighed 500 to 4000 g and had complete information for all variables were included in the multivariate analyses of VLBW and MLBW. Information on maternal education was significantly more likely to be missing for foreign-born women in each ethnic group, relative to US-born women: Asians, 0.8% vs 0.1% ($P<.01$); blacks, 1.0% vs 0.6% ($P=.01$); Latinas, 0.8% vs 0.3% ($P<.01$); and whites, 1.2% vs 0.4% ($P<.01$). Foreign-born Asian women were also more likely to be missing information on use of prenatal care (1.7% vs 1.0%, $P<.01$) than US-born Asians. Foreign-born Latina women were more likely to be missing information on parity (0.08% vs 0.02%, $P<.01$) and use of prenatal care (2.2% vs 1.9%, $P<.01$) than US-born Latinas, although US-born Latina women were more likely to be missing information on gestational age (3.2% vs 2.4%, $P<.01$). Foreign-born white women were more likely than US-born white women to be missing information on parity (0.2% vs 0.05%, $P<.01$), birth weight (0.05% vs 0.01%, $P<.01$), and gestational age (3.2% vs 2.9%, $P=.01$).

NATIVITY COMPARISONS WITHIN ETHNIC GROUPS

Nearly 90% of Asian women were foreign born, and foreign-born Asian women had a mixed profile of maternal characteristics relative to US-born Asian women (**Table 1**). Foreign-born Asian women were less educated, more likely to be multiparous, and more likely to have inadequate use of prenatal care than US-born Asian women. On the other hand, foreign-born Asian women were less likely to be younger, unmarried, primiparous, or report tobacco use than US-born Asians. There was no difference in the unadjusted or adjusted odds of VLBW or MLBW infants between foreign- and US-born Asian women (**Table 2** and **Table 3**).

Six percent of black women were foreign born, and foreign-born women had a more favorable profile of maternal characteristics than US-born black women (Table 1). The mean birth weight of infants born to foreign-born black women was 164 g higher than for

Table 1. Maternal and Infant Characteristics, by Maternal Ethnicity and Birthplace: California, 1992

Characteristic, %	Maternal Ethnicity							
	Asian		Black		Latina		White	
	Foreign Born (n = 45 326)	US Born (n = 5157)	Foreign Born (n = 2490)	US Born (n = 41 513)	Foreign Born (n = 188 198)	US Born (n = 68 887)	Foreign Born (n = 18 896)	US Born (n = 202 766)
Age, y								
Younger (<18)	1.3	4.2*	1.9	8.3*	4.3	12.0*	0.9	2.7*
Intermediate (18-34)	79.8	76.8	84.5	83.6	86.9	81.8	81.6	83.1
Older (>34)	18.9	19.0	13.6	8.1	8.8	6.2	17.5	14.2
Education, y								
<12	20.3	7.9*	16.2	20.9*	71.1	36.0*	12.7	11.6*
≥12	79.7	92.1	83.8	79.1	28.9	64.0	87.3	88.4
Unmarried	11.6	21.2*	40.8	64.2*	43.9	47.3*	16.9	22.1*
Parity (No. of previous live births)								
Primiparous (0)	44.2	50.8*	36.5	36.6*	35.1	41.6*	42.9	42.8*
Intermediate (1-3)	51.2	47.7	56.6	54.8	56.5	53.1	53.4	54.3
Multiparous (>3)	4.6	1.5	6.9	8.6	8.4	5.3	3.7	2.9
Tobacco use reported	0.4	1.3*	1.1	4.4*	0.3	1.8*	1.9	4.6*
Utilization of prenatal care								
Inadequate	11.7	8.2*	14.3	18.9	26.5	17.4	9.0	8.7
Intermediate	10.1	6.7	10.7	8.7	16.9	11.3	10.2	10.0
Adequate	33.2	35.0	34.4	27.4	30.2	35.2	41.1	41.6
Adequate plus	45.0	50.1	40.6	45.0	26.4	36.1	39.7	39.7
Gestational age, d								
Very premature (<231)	1.6	1.4	2.8	4.6*	1.7	2.1*	1.2	1.3*
Moderately premature (231-258)	7.5	6.8	7.4	10.8	7.8	8.0	5.6	5.9
Not premature (>258)	90.9	91.8	89.8	84.6	90.4	89.9	93.2	92.8
Birth weight, g								
Extremely low (<500)	0.1	0.1	0.3	0.3*	0.1	0.1*	0.1	0.1*
Very low (500-1499)	0.7	0.8	1.6	2.1	0.7	0.8	0.6	0.6
Moderately low (1500-2499)	4.8	5.0	5.7	9.0	3.5	4.3	3.2	3.4
Normal (2500-4000)	88.7	87.5	82.0	82.6	85.2	84.4	83.4	81.5
High (>4000)	5.7	6.6	10.5	6.0	10.6	10.4	12.7	14.4
Mean (SD) birth weight, g	3253.7 (511)	3263.3 (526)	3321.9 (633)	3157.1 (638)*	3395.6 (537)	3373.5 (559)*	3438.8 (542)	3468.4 (556)*

** The distribution of characteristic varied between foreign- and US-born women within ethnic category at P<.01.*

infants born to US-born black women. In unadjusted analyses, foreign-born black women were 34% less likely to have MLBW infants than US-born black women (Table 3). However, after adjusting for maternal and infant characteristics, there was no longer a difference in the odds of VLBW or MLBW infants between foreign- and US-born black women.

Nearly three quarters of Latina women were foreign born, and immigrant Latina women were less educated, more likely to be multiparous, and more likely to have inadequate use of prenatal care than US-born Latinas (Table 1). On the other hand, foreign-born Latinas were less likely to be younger, primiparous, and to use tobacco than US-born Latinas. In unadjusted analyses, foreign-born Latina women were 20% less likely to have VLBW and MLBW infants than US-born Latinas (Table 2 and Table 3). After adjusting for maternal and infant characteristics, foreign-born Latina women were still less likely to have MLBW infants than US-born Latinas (OR, 0.91; CI, 0.86-0.96), indicating a protective effect for foreign-born women. On the other hand, there was no longer a nativity difference in VLBW infants among Latina women after multivariate adjustment.

Nine percent of white women were foreign born (Table 1). Maternal characteristics were generally similar between foreign- and US-born white women, although foreign-born women were less likely to be younger, unmarried, or use tobacco than US-born whites. There was no difference in the unadjusted or adjusted odds of VLBW or MLBW infants between foreign- and US-born white women (Table 2 and Table 3).

In multivariate analyses, the relationship between maternal and infant characteristics and VLBW varied by ethnicity (Table 2). In all 4 ethnic groups, primiparity, adequate plus use of prenatal care, very premature gestation, and moderately premature gestation were associated with increased odds of VLBW infants. Among Asian, Latina, and white women, older maternal age was also associated with higher odds of VLBW infants. Black and white women with inadequate use of prenatal care were more likely to have VLBW infants than women with adequate use, and black women who reported tobacco use were more likely to have VLBW infants than black women who did not report tobacco use.

There was also ethnic variation in the maternal and infant characteristics associated with MLBW

Table 2. Logistic Regression Unadjusted and Adjusted Odds Ratios (95% Confidence Intervals) for Very Low Birth Weight* in California in 1992, by Maternal Ethnicity

	Asian (n = 333)		Black (n = 883)		Latina (n = 1697)		White (n = 1276)	
Characteristic	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Birthplace								
Foreign	0.86 (0.61-1.20)	0.75 (0.48-1.18)	0.82 (0.61-1.11)	1.27 (0.83-1.95)	0.79 (0.71-0.87)†	0.92 (0.80-1.07)	0.92 (0.75-1.13)	1.02 (0.78-1.34)
United States	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡
Age, y								
Younger (<18)		1.78 (0.72-4.45)		0.72 (0.48-1.07)		0.93 (0.73-1.17)		1.06 (0.70-1.60)
Intermediate (18-34)		1.00‡		1.00‡		1.00‡		1.00‡
Older (>34)		1.90† (1.34-2.68)		1.33 (0.96-1.83)		1.92 (1.56-2.35)†		1.28 (1.04-1.57)†
Education, y								
<12		0.91 (0.61-1.36)		0.93 (0.72-1.21)		1.14 (0.99-1.31)		1.22 (0.93-1.53)
≥12		1.00‡		1.00‡		1.00‡		1.00‡
Marital status								
Unmarried		0.84 (0.55-1.26)		1.05 (0.85-1.29)		0.94 (0.83-1.07)		1.03 (0.86-1.22)
Married		1.00‡		1.00‡		1.00‡		1.00‡
Parity (No. of previous live births)								
Primiparous (0)		1.37 (1.01-1.86)†		1.27 (1.03-1.58)†		1.38 (1.20-1.58)†		1.65 (1.41-1.94)†
Intermediate (1-3)		1.00‡		1.00‡		1.00‡		1.00‡
Multiparous (>3)		0.78 (0.39-1.55)		1.26 (0.93-1.70)		1.08 (0.86-1.36)		1.60 (1.09-2.34)†
Tobacco use								
Reported		0.98 (0.22-4.42)		1.52 (1.02-2.27)†		1.54 (0.86-2.74)		1.09 (0.79-1.49)
Not reported		1.00‡		1.00‡		1.00‡		1.00‡
Utilization of prenatal care								
Inadequate		1.08 (0.63-1.84)		1.76 (1.30-2.39)†		0.86 (0.72-1.04)		1.36 (1.03-1.79)†
Intermediate		0.23 (0.09-0.57)†		0.94 (0.61-1.46)		0.62 (0.49-0.80)†		0.75 (0.51-1.10)
Adequate		1.00‡		1.00‡		1.00‡		1.00‡
Adequate plus		3.61 (2.45-5.33)†		3.59 (2.73-4.73)†		3.32 (2.80-3.92)†		5.33 (4.32-6.58)†
Gestational age, d								
Very premature (<231)		952.4 (674.6-1344.3)†		435.2 (347.4-545.3)†		818.5 (698.3-959.5)†		1270.2 (1052.0-1533.9)†
Moderately premature (231-258)		8.56 (5.49-13.35)†		6.07 (4.51-8.17)†		9.84 (8.03-12.07)†		13.76 (11.04-17.15)†
Not premature (>258)		1.00‡		1.00‡		1.00‡		1.00‡

*Very low birth weight: 500 to 1499 g.
†Statistically significant odds ratio and confidence interval.
‡Reference category.

(Table 3). In all 4 ethnic groups, women who were older, unmarried, and had inadequate or adequate plus use of prenatal care were more likely to have MLBW infants than women from the reference categories. Similarly, very premature and moderately premature infants were more likely to be MLBW than infants who were not premature in each ethnic group, although the magnitude of the relationship between gestational age and the low birth weight outcomes varied by maternal ethnicity. In contrast, younger black and white women were less likely to have MLBW infants than black and white women of intermediate age. Among Asians, primiparous women were more likely to have MLBW infants than women with intermediate parity. Black women who were older, multiparous, and reported tobacco use were more likely to have MLBW infants than black women from the reference groups. Latina women who had less than 12 years' education, were primiparous, and reported tobacco use had higher odds of MLBW infants than Latina women from the reference categories. Among whites, women who were younger, had less than 12 years' education, were primiparous, multiparous, and reported tobacco use were more likely to have MLBW infants than women from the reference categories.

Table 3. Logistic Regression Unadjusted and Adjusted Odds Ratios (95% Confidence Intervals) for Moderately Low Birth Weight* in California in 1992, by Maternal Ethnicity

	Asian (n = 2360)		Black (n = 3740)		Latina (n = 9182)		White (n = 7333)	
Characteristic	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Birthplace								
Foreign	0.96 (0.84-1.09)	1.03 (0.89-1.19)	0.66 (0.55-0.77)†	0.83 (0.70-1.00)	0.80 (0.77-0.84)†	0.91 (0.86-0.96)†	0.93 (0.85-1.01)	1.02 (0.93-1.12)
United States	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡	1.00‡
Age, y								
Younger (<18)		1.32 (0.97-1.78)		0.79 (0.67-0.93)†		0.95 (0.87-1.04)		0.75 (0.64-0.88)†
Intermediate (18-34)		1.00‡		1.00‡		1.00‡		1.00‡
Older (>34)		1.13 (1.01-1.27)†		1.40 (1.24-1.58)†		1.31 (1.21-1.43)†		1.21 (1.13-1.30)†
Education, y								
<12		0.91 (0.80-1.03)		1.10 (1.00-1.22)		1.14 (1.08-1.20)†		1.33 (1.23-1.44)†
≥12		1.00‡		1.00‡		1.00‡		1.00‡
Marital status								
Unmarried		1.24 (1.09-1.41)†		1.29 (1.19-1.40)†		1.11 (1.06-1.17)†		1.33 (1.26-1.42)†
Married		1.00‡		1.00‡		1.00‡		1.00‡
Parity (No. of previous live births)								
Primiparous (0)		1.38 (1.25-1.52)†		1.07 (0.98-1.16)		1.37 (1.31-1.44)†		1.34 (1.27-1.41)†
Intermediate (1-3)		1.00‡		1.00‡		1.00‡		1.00‡
Multiparous (>3)		1.01 (0.78-1.29)		1.29 (1.14-1.46)†		1.02 (0.93-1.12)		1.32 (1.15-1.52)†
Tobacco use								
Reported		1.45 (0.83-2.52)		1.77 (1.52-2.05)†		2.31 (1.92-2.79)†		1.74 (1.58-1.92)†
Not reported		1.00‡		1.00‡		1.00‡		1.00‡
Utilization of prenatal care								
Inadequate		3.24 (2.66-3.94)†		3.42 (2.98-3.93)†		2.25 (2.08-2.43)†		4.64 (4.15-5.18)†
Intermediate		0.75 (0.55-1.03)		1.08 (0.87-1.34)		0.68 (0.60-0.76)†		0.87 (0.73-1.05)
Adequate		1.00‡		1.00‡		1.00‡		1.00‡
Adequate plus		6.47 (5.56-7.54)†		4.61 (4.07-5.22)†		5.17 (4.82-5.55)†		7.60 (6.97-8.30)†
Gestational age, d								
Very premature (<231)		31.9 (25.8-39.4)†		19.3 (16.8-22.2)†		33.5 (30.8-36.5)†		46.8 (41.9-52.3)†
Moderately premature (231-258)		9.24 (8.36-10.21)†		6.38 (5.88-6.93)†		9.34 (8.90-9.82)†		12.03 (11.38-12.72)†
Not premature (>258)		1.00‡		1.00‡		1.00‡		1.00‡

**Moderately low birth weight: 1500 to 2499 g.*
†*Statistically significant odds ratio and confidence interval.*
‡*Reference category.*

COMPARISONS ACROSS ETHNICITY-NATIVITY GROUPS

There was substantial variation in maternal characteristics across ethnicity-nativity groups. Relative to US-born white women, foreign-born Asian, black, and Latina women were less educated, had higher parity, and less adequate use of prenatal care (Table 1). Foreign-born Asian and black women were less likely to be younger than US-born white women, while foreign-born Latinas were more likely to be younger. Foreign-born black and Latina women were also less likely to be primiparous than US-born white women.

US-born Asian, black, and Latina women were all more likely to be younger than US-born white women (Table 1). US-born Asian women were also more educated, less likely to be multiparous, and less likely to report tobacco use than US-born whites. US-born black and Latina women were less educated, more likely to be unmarried, had higher parity, and less adequate use of prenatal care than US-born white women.

The crude rates of low birth weight and premature infants varied by ethnicity-nativity group (Table 1). The unadjusted odds of VLBW were elevated for foreign- and US-born black women, relative to US-born white women, while foreign-born Asian, Latina, and white women were less likely to have VLBW infants than US-born whites (**Table 4**). After adjusting for potential confounders, foreign- and US-born black women remained at significantly higher odds of having VLBW infants relative to

Table 4. Logistic Regression Unadjusted and Adjusted Odds Ratios (95% Confidence Intervals) for Very Low and Moderately Low Birth Weight Outcomes in California in 1992, by Maternal Ethnicity-Nativity Groups

Characteristic	Very Low*		Moderately Low†	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Maternal ethnicity-birthplace				
Asian: Foreign born	0.83 (0.74-0.93)‡	0.86 (0.73-1.02)	1.13 (1.08-1.18)‡	1.26 (1.19-1.33)‡
Asian: US born	0.98 (0.71-1.35)	1.21 (0.80-1.83)	1.17 (1.03-1.33)‡	1.29 (1.13-1.49)‡
Black: Foreign born	2.30 (1.72-3.09)‡	2.44 (1.56-3.83)‡	1.45 (1.23-1.71)‡	1.59 (1.32-1.91)‡
Black: US born	3.24 (3.00-3.49)‡	1.85 (1.63-2.11)‡	2.44 (2.35-2.53)‡	1.88 (1.79-1.98)‡
Latina: Foreign born	0.77 (0.72-0.83)‡	0.92 (0.82-1.04)	0.78 (0.76-0.80)‡	0.96 (0.92-1.00)
Latina: US born	1.07 (0.98-1.17)	0.98 (0.85-1.13)	1.06 (1.02-1.10)‡	1.09 (1.03-1.14)‡
White: Foreign born	0.74 (0.61-0.90)‡	0.98 (0.76-1.28)	0.80 (0.73-0.87)‡	1.01 (0.92-1.11)
White: US born	1.00	1.00§	1.00	1.00§
Maternal age, y				
Younger (<18)		0.89 (0.74-1.06)		0.88 (0.82-0.94)‡
Intermediate (18-34)		1.00§		1.00§
Older (>34)		1.54 (1.36-1.74)‡		1.23 (1.18-1.29)‡
Maternal education, y				
<12		1.09 (0.98-1.22)		1.14 (1.10-1.19)‡
≥12		1.00§		1.00§
Apparently unmarried				
Yes		0.99 (0.90-1.08)		1.23 (1.19-1.27)‡
No		1.00§		1.00§
Parity (No. of previous live births)				
Primiparous (0)		1.43 (1.31-1.56)‡		1.32 (1.28-1.36)‡
Intermediate (1-3)		1.00§		1.00§
Multiparous (>3)		1.24 (1.06-1.46)‡		1.16 (1.08-1.23)‡
Tobacco use				
Reported		1.30 (1.05-1.62)‡		1.95 (1.82-2.10)‡
Not reported		1.00§		1.00§
Utilization of prenatal care				
Inadequate		1.13 (0.99-1.29)		3.04 (2.88-3.21)‡
Intermediate		0.68 (0.57-0.82)‡		0.81 (0.74-0.88)‡
Adequate		1.00§		1.00§
Adequate plus		3.93 (3.51-4.40)‡		5.91 (5.64-6.20)‡
Gestational age, d				
Very premature (<231)		859.0 (775.6-951.4)‡		34.1 (32.2-36.2)‡
Moderately premature (231-258)		10.2 (8.9-11.5)‡		9.6 (9.3-9.9)‡
Not premature (>258)		1.00§		1.00§

**Very low birth weight: 500 to 1499 g (n = 4193).*
†Moderately low birth weight: 1500 to 2499 g (n = 22 656).
‡Statistically significant odds ratio and confidence interval.
§Reference category.

US-born white women. For MLBW, the unadjusted and adjusted odds were significantly elevated among foreign- and US-born Asian women, foreign- and US-born black women, and US-born Latinas, relative to US-born white women (Table 3).

COMMENT

In this California study, maternal nativity was associated with low birth weight outcomes only among Latina women, and foreign-born Latina women were less likely to have MLBW infants than US-born Latinas. On the other hand, there was no difference in the likelihood of low birth weight infants between foreign- and US-born Asian, black, or white women. While the perinatal advantage of foreign-born Latina women in our study was relatively modest, the effect of maternal birthplace was not related to confounding by demographic, obstetric, health service, or infant factors. Our findings are consistent with previous studies of Latina women,[2,9,14-21] although our multivariate analysis of a large, recent population contributes new information about perinatal outcomes among immigrant Latina women. The perinatal advantage of foreign-born Latina women in the United States has been reported since the 1980s,[9,14,15] but our understanding of the relationship between maternal nativity and perinatal outcomes is limited.

Nativity differences in behavioral, medical, nutritional, or cultural factors are hypothesized to contribute to the perinatal advantage of foreign-born Latina women.[9,15,17,20,22] While foreign-born Latina women in our study were less likely to report tobacco use during pregnancy than US-born Latinas, the perinatal advantage of foreign-born Latinas persisted after adjusting for tobacco use. Foreign-born adult Latina women consume more nutritious diets than US-born Latinas,[22] but we were unable to assess the relationship between nutritional or medical factors and low birth weight outcomes because of the lack of appropriate data on the California birth certificate. Cultural factors such as social support are hy-

pothesized to buffer immigrant Latina women from adverse pregnancy outcomes,[15,17] but there is little empirical evidence to support this hypothesis. In a recent study of births in Chicago, Ill, foreign-born Latina women residing in low-income areas were less likely to have low birth weight infants than were US-born Latinas residing in the same communities,[20] which supports the hypothesis of cultural factors. Further study of cultural, medical, and nutritional factors is needed to understand the perinatal advantage of foreign-born Latina women.

In our study, use of prenatal care was associated with the likelihood of low birth weight infants among Latina women. Since one quarter of the Latina women in our study had inadequate use of prenatal care, we would expect that improving use of prenatal care would reduce the incidence of MLBW infants. On the other hand, Latina women with intermediate use of prenatal care were less likely to have VLBW or MLBW infants than women with adequate use. We speculate that Latina women with intermediate use of prenatal care are a select group of low-risk women, but further study is needed to test this hypothesis.

Nearly 90% of childbearing Asian women in the United States are foreign born,[5] but, to our knowledge, only a few studies have analyzed the relationship between maternal birthplace and perinatal outcomes among Asian women. In our study, there was no difference in the likelihood of low birth weight infants between foreign- and US-born Asian women, although our statistical power may have been limited by a small sample of VLBW Asian infants. Still, the lack of a nativity effect was partially related to the fact that the distribution of several risk factors was similar between foreign- and US-born Asian women. Previous studies have reported conflicting results on perinatal outcomes between foreign- and US-born Asian women. Foreign-born Asian/Pacific Islander women in the United States,[7] women of Japanese origin in the United States,[23] and women of Chinese origin in New York, NY,[2] had lower rates of low birth weight infants than US-born women, but there was no nativity difference in low-birth-weight rates among Filipino-origin women in Hawaii or New York,[2,24] or Japanese-origin women in New York.[2] In California, we found that the risk of low birth weight infants among Asian women varied by national origin subgroup.[25] Immigrant Asian women may differ according to the circumstances and timing of immigration to the United States, which ultimately influences perinatal outcomes among immigrant Asian women. Further study of Asian women is needed to define the relationship between Asian national origin subgroup, maternal birthplace, and perinatal outcomes.

Foreign-born black women in our study were less likely to have MLBW infants than US-born black women, but the perinatal advantage of foreign-born black women disappeared after adjusting for maternal and infant characteristics. Contrary to expectations,[26] we found that younger age and maternal education were not associated with higher odds of low birth weight infants among black women. In fact, younger maternal age was associated with a lower risk of MLBW infants, relative to intermediate maternal age, which is consistent with the "weathering hypothesis" of perinatal outcomes among black women.[27] Previous studies of black women in Boston, Mass,[28] New York City,[29] Washington State,[30] and the United States[2,8] reported that foreign-born black women have more favorable maternal characteristics and lower rates of low birth weight infants than US-born black women, but most studies have not adjusted for confounding variables.

A recent study of births in Illinois comparing African- and US-born black women with US-born white women found that African-born black women were less likely to have low birth weight infants than were US-born black women, relative to US-born white women.[31] However, in subgroup analyses of women with low-risk sociodemographic characteristics, there were no nativity differences in the risk of low birth weight among African- and US-born black women.[31] The addition of reproductive factors to the analyses resulted in a nativity difference.[31] The difference in results between the Illinois study and our study may be due to different study populations or due to the fact that sociodemographic and reproductive characteristics were not consistently associated with low birth weight outcomes in our study. We found that tobacco use and use of prenatal care were associated with low birth weight outcomes among black women, and these factors were not analyzed in the Illinois study.

The relationship between maternal and infant characteristics and low birth weight outcomes varied by ethnicity. Several characteristics were associated with low birth weight in each ethnic group, although the magnitude of the association varied. On the other hand, younger black and white women were less likely to have MLBW infants than black or white women of intermediate age, while there was no significant association between younger maternal age and low birth weight among Asian or Latina women. The relationship between gestational age and low birth weight varied by ethnicity, but these results should be validated before conclusions can be made about ethnic variation in the risk of prematurity. Our results suggest that accepted risk factors for adverse pregnancy outcomes[26] may not be consistently applicable across ethnic groups, or that other unmeasured factors explain the ethnic variation in risk factors for low birth weight. The role of factors such as stress[30] and discrimination[2] among foreign- and US-born black women must also be analyzed to address the unique issues associated with black ethnicity in the United States.

Certain limitations should be considered. In our study, we categorized maternal race/ethnicity into 4 groups since the California birth certificate contains information on national origin heritage for certain subgroups of Asian and Latina women, but not for black or white women. Within the group of Asian and Latina women, there is subgroup variation in perinatal outcomes.[25,32] When considering the effect of maternal birthplace and national origin subgroup on perinatal outcomes among Latina women, previous studies have reported that foreign-born women from each of the 4 major Latino subgroups have lower rates of low birth

weight infants than US-born women.[3,9,32,33] In our sample, 98% of the Latina women were of Central or South American or Mexican origins.[34] Our understanding about perinatal outcomes among foreign- and US-born Asian women is limited, and further study is needed to define the relationship between Asian ethnicity, birthplace, and perinatal outcomes. Misclassification of information may have affected our results. For example, marital status was coded according to a comparison of parental surnames on the California birth certificate, and the accuracy of this classification may differ between foreign- and US-born women, if married foreign-born women are less likely to take their husband's surname than married US-born women. The rates of tobacco use among foreign- and US-born women in our study were lower than reported rates in other studies,[2] which suggests that tobacco use may be underreported on the California birth certificate. However, any underreporting of tobacco use would be expected to bias our results toward finding no association. Finally, socioeconomic status may differ between immigrant and US-born women. We analyzed maternal education as a proxy measure for socioeconomic status, but it is possible that better adjustment for individual or community socioeconomic status could alter our findings of the relationship between maternal birthplace and birth weight outcomes.

Despite these limitations, our study demonstrates that the association of maternal birthplace and infant birth weight varies by ethnicity. Further study is needed to identify the factors that underlie the favorable perinatal outcomes among foreign-born Latina women. Ultimately, further study of immigrant women may identify new opportunities for clinical interventions and health policies that will improve perinatal outcomes for both immigrant and nonimmigrant women.

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