The Differential Effect of Foreign-Born Status on Low Birth Weight by Race/Ethnicity and Education

Dolores Acevedo-Garcia, PhD, MPA-URP; Mah-J Soobader, PhD; and Lisa F. Berkman, PhD

ABSTRACT. *Objectives.* **This article investigates whether foreign-born status confers a protective effect against low birth weight (LBW) and whether this protective effect varies across racial/ethnic groups and by socioeconomic status (ie, education) within various racial/ethnic groups.**

Methods. **Logistic regression analyses of the Detail Natality Data, 1998 (n = 2 436 890), were used to examine differentials in LBW by nativity across racial/ethnic groups and by education level.**

Results. **Although foreign-born status does not protect against LBW among white women (95% confidence interval [CI]: 0.96, 1.03) and it increases the risk among Asian women by 24% (95% CI: 1.13, 1.36), it reduces the risk by ~25% among black women (95% CI: 0.72, 0.78) and by ~19% among Hispanic women (95% CI: 0.78, 0.84). By educational attainment, for whites, blacks, and Hispanics the protective effect of foreign-born status is stronger among women with low education (ie, 0–11 years) than among women with more education. The educational gradient in LBW is less pronounced among foreign-born white, black, and Hispanic women than among their US-born counterparts.**

Conclusions. **Foreign-born status is associated with LBW. The direction and strength of this association varies across racial/ethnic groups, and within those groups it varies by educational level. Future research may test hypotheses regarding the mechanisms underlying these variations in LBW, including health selection of immigrants, cultural factors, social support, and social environment.** *Pediatrics* **2005;115:e20–e30. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-1306;** ***low birth weight, immigrants, race/ethnicity, socioeconomic status.***

ABBREVIATIONS. LBW, low birth weight; SES, socioeconomic status; OR, odds ratio; CI, confidence interval.

Preventing low birth weight (LBW) and diminishing disparities in LBW among racial/ethnic groups are significant public health goals.[1–3] The importance of understanding racial/ethnic differences in LBW is highlighted by a 2003 National Institutes of Health request for research proposals in this area: "Reducing Preterm and Low Birthweight in Minority Families" (PA-04-027).[3] The National Institutes of Health has called for research that can elucidate the mechanisms that underlie racial/ethnic disparities in LBW as well as interventions to reduce them. A first step in this direction is epidemiologic work with existing data to uncover the extent and sources of variation in LBW among and within various racial/ethnic groups.

This research was undertaken to provide insight into 3 critical issues in the area of LBW within the context of the United States: (1) whether foreign-born status confers a protective effect against LBW; (2) whether this protective effect varies across racial/ethnic groups (non-Hispanic whites, non-Hispanic blacks, non-Hispanic Asians, and Hispanics [of any race]); and (3) whether the effect of foreign-born status varies by socioeconomic status (SES), ie, education, within various racial/ethnic groups. In this article, we use the terms foreign-born and immigrant interchangeably.

Past studies of LBW among immigrants have documented that, given similar SES and clinical risk factors, in some areas of the United States (eg, Arizona, California, Colorado, Florida, Illinois, New Jersey, New Mexico, New York, Texas) foreign-born women are less likely to have LBW infants than their US-born counterparts.[4–19] However, this result varies across racial/ethnic and national-origin groups.[4–19] Using 1985–1987 national data, a previous study documented that there were significant differentials between US-born and foreign-born women in LBW and that these differentials varied across major US racial/ethnic groups.[20] Our article contributes to this body of research by using more recent (ie, 1998) national data to address the effects of nativity, race/ethnicity, and SES, and their interaction, on LBW.

A central issue in immigrant health studies is the choice of an appropriate reference group. Some studies have compared immigrants with the majority (ie, US-born, non-Hispanic white) population,[8] whereas others have compared immigrants to their racial/ethnic group US-born counterparts (eg, foreign-born Mexicans to US-born Mexicans).[16] Recent sociological research on immigrant adaptation suggests that both comparisons are important. Although assimilation to the white majority remains a possible pathway, preservation of ethnic identity and assimilation into a US-born ethnic minority group constitutes an alternative pathway.[21–24] Therefore, this study sequentially presents both comparisons.

From the Department of Society, Human Development, and Health, Harvard School of Public Health, Boston, Massachusetts.
Accepted for publication Sep 14, 2004.
doi:10.1542/peds.2004-1306
No conflict of interest declared.
Address correspondence to Dolores Acevedo-Garcia, PhD, MPA-URP, Department of Society, Human Development, and Health, Harvard School of Public Health, 677 Huntington Ave, Kresge 722, Boston, MA 02115-6096. E-mail: dacevedo@hsph.harvard.edu

In addition to considering the effect of foreign-born status, we systematically examine the effect of SES on LBW among various racial/ethnic groups as well as its interaction with foreign-born status. Our objective is twofold. First, we examine whether the effect of foreign-born status varies by education level. Second, we assess whether the education gradient in LBW varies by race/ethnicity and nativity.

The interaction effect of SES and nativity on LBW is closely related to the "epidemiologic paradox," a salient term in immigrant health that denotes that, despite having lower SES, foreign-born women tend to have better birth outcomes than US-born women.[5,7,9,16,25–29] Epidemiologic paradoxes such as this one are sometimes defined in relation to the average SES of a population. In other cases, the term "paradox" is used to denote a residual protective effect of foreign-born status that cannot be accounted for by measured demographic, socioeconomic, behavioral, and/or medical risk factors. We believe that a better test of a paradoxical effect is whether foreign-born status confers a protective effect (particularly) among individuals of low SES. Therefore, we test for an interaction effect between foreign-born status and education.

METHODS

Study Data

The sample was restricted to singleton births. LBW was defined as <2500 g or ~5 lb, 8 oz. The sample was further restricted to women ≥20 years old because of the complexity of factors influencing prenatal outcomes in younger mothers.[30]

This study used data from the 1998 Detail Natality data set,[31] which includes 3 945 192 births within the United States to US-born and foreign-born women from all states, territories, and the District of Columbia. After excluding births to mothers <20 years old (494 622), nonsingleton births (181 374), those records for which maternal nativity was missing (10 156), and those births to individuals not residing in the United States (3639), our sample was 3 307 684. Excluding all observations for which the covariates of interest were missing reduced the sample further to 2 436 890, largely because of the exclusion of observations for which tobacco (ie, smoking [20.5%]) and alcohol (15%) use during pregnancy was missing. With the exception of prenatal care (4.9% missing), the percent missing for all the other covariates did not exceed 1.4%. Smoking and drinking alcohol showed large differential missing rates between US-born and foreign-born women (10.8% vs 31.1% and 16.9% vs 34.2%, respectively). Also, missing rates for these variables were higher among Asian and Hispanic mothers than among white and black mothers. Both patterns resulted primarily from large missing rates for California and New York, 2 states with large concentrations of Asian and Hispanic immigrants.

Among both US-born and foreign-born women, the LBW rate was lower for those with missing information on smoking than for those with complete information (4.9% vs 5.7% and 4.5% vs 5.2%, respectively; $P < .001$). Similarly, among both US-born and foreign-born women, the LBW rate was lower for those with missing information on drinking than for those with this information (4.8% vs 5.7% and 4.4% vs 5.2%, respectively; $P < .001$). However, the differential between US-born and foreign-born women for whom smoking and drinking statuses were missing was comparable to the respective differential among women for whom this information was recorded. The LBW rate ratio of foreign-born women to US-born women was 0.92 for those with missing information on smoking and 0.91 for those with information on smoking. Similarly, for drinking, the respective LBW rate ratios were 0.92 (missing) and 0.91 (not missing). In sum, although the LBW rates for both foreign-born and US-born women are higher in the portion of the data used in this analysis (ie, after excluding women with missing information on smoking and drinking) than in the original data, the magnitude of the LBW rate differential between these 2 groups is similar. Therefore, our results on the estimation of the effect of foreign-born status on LBW are not likely to be biased. As described below, we confirmed this by conducting all the analyses reported here on the complete data without controlling for tobacco and alcohol use (results not shown).

Variables

The outcome variable was LBW and coded as "1" if the infant was <2500 g and coded as "0" if the infant was ≥2500 g. Demographic variables included maternal age, race/ethnicity, nativity (ie, place of birth), and marital status. Maternal age was characterized as 20 to 34 and ≥35 years to allow for the assessment of increased risk of LBW in the older age group. The mothers' self reported race, ethnicity, and birthplace were used to characterize US-born and foreign-born non-Hispanic whites, non-Hispanic blacks, non-Hispanic Asians, and Hispanics (of all races). Marital status of the mothers compared "married" to "other." The mother's SES was characterized by education (0–11, 12, 13–15, and ≥16 years).

Additionally, the mothers' information included prenatal care, health behaviors, and complications during pregnancy. Prenatal care was measured by using the Kessner index, which is based on the month care began, the number of visits made, and the length of gestation. This measure accounts for women with short gestations who have less time to receive prenatal care than do women with long gestations. Therefore, the Kessner index is a better assessment of prenatal care use than either the timing of the first visit or the number of visits alone. This variable was dichotomized as receiving adequate care versus intermediate and inadequate care.

Health behaviors during pregnancy included tobacco and alcohol use. Controlling for these behaviors introduced some complexity into the study, because California, Indiana, South Dakota, and New York (partial data collection: 50%) did not collect information on tobacco use in 1998. Additionally, California and South Dakota did not collect information on alcohol use. Given the high proportion of immigrants in California and New York, excluding women for whom tobacco and alcohol use were not recorded could potentially bias our results. Excluding observations with missing data on tobacco and alcohol for California resulted in losing 30.2% of the foreign-born women in the original sample. Excluding the respective observations for New York represented losing only 2.7% of the foreign-born women in the original data because of a higher rate of reporting tobacco and alcohol use among foreign-born women in New York than among US-born women. On the other hand, not controlling for tobacco and alcohol use would prevent us from assessing whether health behaviors during pregnancy account for some of the protective effect of foreign-born status on LBW. To address these issue, our first analysis was restricted only to women with complete information on tobacco and alcohol use, whereas our second analysis comprised the total population but models did not control for behavioral risk factors. Here we present the results of the first analysis, because the effect of foreign-born status was similar in both analyses and it was useful to control for health behaviors. Additionally, regarding racial/ethnic variations in the effect of foreign-born status, the results presented in this article, which exclude California, are comparable to those of Fuentes-Afflick et al,[4–6,8,9] who have published a series of studies of LBW using exclusively data for that state.

Chronic hypertension, anemia, diabetes, and pregnancy-associated risk factors such as preeclampsia, eclampsia, placenta previa, and placenta abruption were used to measure medical risk factors. The prevalence of these risk factors is different across racial/ethnic and nativity groups (Table 1), which suggests the importance of controlling for them in statistical analyses.

Statistical Analysis

We followed a sequential modeling strategy using the logistic regression procedure in SAS statistical software (SAS Institute, Cary, NC). The outcome variable in all models was LBW (coded as "1" if the infant weighed <2500 g and "0" otherwise). In Table 2, models 1 to 3 are based on the total sample to examine the association between race/ethnicity, nativity, LBW. The total sample analysis provided justification for stratification by race/ethnicity. Model 1 controls for the mothers' age, race/ethnicity, education, medical risk factors, behavioral risk factors, and child's

TABLE 1. Descriptive Statistics of Births Among Mothers ≥20 Years Old by Race/Ethnicity and Nativity: United States, 1998

	White			Black			Asian			Hispanic		
	Total	US-Born	Foreign-Born	Total	US-Born	Foreign-Born	Total	US-Born	Foreign-Born	Total	US-Born	Foreign-Born
Population, *n* (*N* = 2 436 890)	1 654 407	1 574 088	80 319	362 723	322 510	40 213	85 263	10 646	74 617	334 497	130 267	204 230
LBW	4.5	4.6	4.0	10.8	11.2	7.9	6.1	5.5	6.1	5.2	6.0	4.7
Female	48.7	48.7	48.5	49.3	49.3	49.2	48.8	49.5	48.7	48.9	48.9	48.9
First-born	29.7	29.4	32.2	20.8	20.1	26.3	36.5	30.9	37.4	25.5	23.8	26.6
Maternal age												
20–34 y	84.7	85.0	80.0	88.8	90.0	79.3	82.5	83.6	82.3	90.0	92.0	88.7
≥35 y	15.3	15.0	20.0	11.2	10.0	20.8	17.6	16.4	17.7	10.0	8.0	11.3
Maternal education												
0–11 y	8.4	8.4	8.7	16.9	17.2	14.6	10.9	5.6	11.5	41.8	25.4	52.4
12 y	31.9	32.1	28.0	41.2	41.9	36.0	26.1	31.1	25.4	32.0	38.9	27.5
13–15 y	26.4	26.6	23.2	27.9	28.1	25.9	20.2	24.9	19.5	16.6	24.1	11.7
≥16 y	33.3	32.9	40.1	14.0	12.8	23.6	42.9	38.4	43.6	9.6	11.6	8.4
Behavioral risk factors												
Adequate prenatal care	83.6	83.9	78.4	68.1	68.0	68.4	74.6	76.8	74.3	65.4	70.7	62.0
Married	83.6	83.2	90.5	38.1	35.0	62.3	88.5	74.9	90.4	65.3	63.3	66.6
Current smoking	14.8	15.2	6.7	10.0	11.1	1.5	2.5	9.9	1.4	3.68	7.0	1.6
Current drinking	1.2	1.2	1.1	1.5	1.7	0.4	0.4	1.0	0.3	0.6	1.0	0.3
Medical risk factors												
Chronic hypertension	0.8	0.8	0.5	1.5	1.6	1.4	0.5	0.9	0.4	0.5	0.6	0.4
Anemia	1.7	1.7	1.7	3.3	3.4	2.5	2.1	3.0	1.9	2.6	3.0	2.3
Diabetes	2.8	2.7	2.9	3.0	2.8	4.4	4.9	3.9	5.0	3.3	3.3	3.3
Preclampsia or eclampsia	4.2	4.3	2.7	4.3	4.3	3.7	2.2	3.3	2.0	3.1	3.6	2.8
Placenta previa or abruption	0.9	0.9	0.8	1.0	1.0	1.0	1.0	0.9	1.0	0.7	0.8	0.7

Source: Detail Natality Data, 1998.

TABLE 2. ORs (95% CI) of LBW Live Births Among Mothers ≥20 Years Old by Race/Ethnicity and Nativity

	Model 1	Model 2	Model 3
Non-Hispanic white*	1.00	1.00	0.99 (0.95, 1.03)†
Non-Hispanic black	2.36 (2.32, 2.39)	2.39 (2.35, 2.42)	0.77 (0.74, 0.80)
Non-Hispanic Asian	1.59 (1.54, 1.64)	1.81 (1.75, 1.87)	1.29 (1.18, 1.41)
Hispanic	1.17 (1.15, 1.19)	1.27 (1.24, 1.30)	0.77 (0.75, 0.80)
Foreign	—	0.85 (0.83, 0.87)	—
−2 Log-likelihood (*df*)	978 425.90 (18)	978 167.63 (19)	977 950.04 (22)
Likelihood ratio test		516.54 (1)‡	435.18 (1)‡

Based on logistic regression models that include all the covariates in Table 1; model 3 also includes an interaction between race/ethnicity and nativity; the ORs in model 3 are the odds of LBW among the foreign-born women divided by the odds of LBW among the US-born women within each racial/ethnic group. — indicates that the model does not include the main effect of foreign-born status (model 1) or that the main effect of foreign-born status is not shown (model 3); *df*, degrees of freedom.
* Reference group for models 1 and 2.
† Not significant.
‡ $P < .001$.

gender and birth order. In model 2, we add the mothers' nativity (ie, foreign-born versus US-born status), and in model 3, we include an interaction term between race/ethnicity and foreign-born status.

In Table 3, models 4 and 5 are presented stratified by race/ethnicity, because model 3 in Table 2 showed that the effect of foreign-born status varies by race/ethnicity. Finally, in Table 4, model 6 includes an interaction between foreign-born status and maternal education to examine whether the effect of foreign-born status varies by SES within various racial/ethnic groups.

All models were repeated without controls for behavioral risk factors (results not shown) to examine the effect of excluding the data from California and New York. The associations identified in our first analysis remained. As expected, in the models without controls for smoking and drinking, the effect of foreign-born status was stronger, because these health behaviors partially mediated the protective effect of foreign nativity.

RESULTS

Our analysis comprised 2 436 890 women (68% white, 15% black, 3% Asian, and 14% Hispanic). As shown in Table 1, the LBW rate varies considerably across racial/ethnic groups (from 4.5% among all [ie, US-born and foreign-born] white women to 10.8% among all black women) and also by nativity. Among both US-born and foreign-born women, black women have the highest rate of LBW (11.2% and 7.9%, respectively). As shown in Fig 1, foreign-born women have lower rates of LBW than their US-born counterparts among white, black, and Hispanic women ($P < .01$) but higher rates among Asian women ($P < .01$). The protective effect of immigrant status seems to be particularly strong among black and Hispanic women. Among black women, the LBW rate among the foreign-born is ~30% lower than among the US-born. Among Hispanics, the LBW rate is ~20% lower.

As shown in Fig 2, among white, black and Hispanic women, the protective effect of immigrant status seems stronger among women with low education compared with women with higher education. For instance, among black and Hispanic women, immigrant status reduces the risk of LBW across all education groups, but the effect is stronger among women with low education (43% and 33% reduction among black and Hispanic women, respectively) than among women with high education (18% and 1% reduction among black and Hispanic women, respectively).

For white, black, and Hispanic women, the educational gradient in LBW seems to be different among US-born women than among foreign-born women (Fig 2). Although there is a clear negative education gradient (ie, LBW rates decrease as education level increases) among US-born women in these 3 racial/ethnic groups, the gradient is less pronounced among foreign-born white and black women and nearly flat among foreign-born Hispanic women. There are no clear education gradients among US-born Asian women or foreign-born Asian women.

Risk factors for LBW vary by race/ethnicity and nativity (Table 1). For example, in all racial/ethnic groups, foreign-born women are less likely to be single mothers than their US-born counterparts. This difference is particularly strong among black women (ie, although only 35% of US-born black women are married, 63% of foreign-born black women are married). Regarding education, Hispanic women (both US-born and foreign-born) are more likely to have low education than women in any other racial/ethnic group. Foreign-born Asian and Hispanic women are considerably more likely to have low education (0–11 years) than their US-born counterparts (11.3% vs 4.8% among Asian women and 55.9% vs 23.7% among Hispanic women). Among all racial/ethnic groups, foreign-born women have much lower rates of smoking during pregnancy than their US-born counterparts. Use of adequate prenatal care does not exhibit strong differences between foreign-born and US-born women in any racial/ethnic group. With the exception of diabetes and placenta previa/abruption, medical risk factors tended to be lower among foreign-born than US-born women.

The Effect of Foreign-Born Status

Table 2 shows multivariate logistic analyses using the entire sample ($n = 2\,436\,890$). In model 1, after controlling for demographics, SES, prenatal care, health behaviors during pregnancy, and clinical risk factors, women of racial/ethnic minority groups had significantly higher odds of having an LBW infant than non-Hispanic white women (2.36 for black women, 1.59 for Asian women, and 1.17 for Hispanic women). After controlling for foreign-born nativity

TABLE 3. ORs (95% CI) of LBW Live Births Among Mothers ≥20 Years Old Stratified by Race/Ethnicity: United States 1998

	White		Black		Asian		Hispanic	
	Model 4	Model 5	Model 4	Model 5	Model 4	Model 5	Model 4	Model 5
Foreign	—	0.99 (0.96, 1.03)*	—	0.75 (0.72, 0.78)	—	1.24 (1.13, 1.36)	—	0.81 (0.78, 0.84)
Maternal age								
20–34	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
≥35	1.34 (1.32, 1.37)	1.34 (1.32, 1.37)	1.32 (1.28, 1.36)	1.35 (1.31, 1.39)	1.13 (1.04, 1.21)	1.12 (1.04, 1.21)	1.34 (1.28, 1.41)	1.38 (1.32, 1.45)
Maternal education								
0–11 y	1.62 (1.58, 1.67)	1.62 (1.58, 1.67)	1.29 (1.24, 1.35)	1.29 (1.23, 1.35)	1.18 (1.07, 1.31)	1.16 (1.05, 1.28)	1.07 (1.01, 1.14)†	1.13 (1.07, 1.20)
12 y	1.29 (1.27, 1.32)	1.29 (1.27, 1.32)	1.21 (1.16, 1.26)	1.20 (1.16, 1.25)	1.06 (0.98, 1.14)*	1.06 (0.98, 1.14)*	1.13 (1.06, 1.20)	1.14 (1.07, 1.21)
13–15 y	1.14 (1.11, 1.16)	1.14 (1.11, 1.16)	1.13 (1.08, 1.17)	1.11 (1.07, 1.16)	1.12 (1.03, 1.21)	1.12 (1.04, 1.21)	1.07 (1.01, 1.15)†	1.06 (0.99, 1.13)*
≥16 y	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Married	0.81 (0.80, 0.83)	0.81 (0.80, 0.83)	0.84 (0.82, 0.86)	0.87 (0.84, 0.89)	0.86 (0.79, 0.94)	0.83 (0.76, 0.91)	0.82 (0.79, 0.84)	0.83 (0.80, 0.85)
Adequate prenatal care	0.71 (0.70, 0.73)	0.71 (0.70, 0.73)	0.81 (0.79, 0.83)	0.81 (0.79, 0.82)	0.83 (0.78, 0.89)	0.84 (0.78, 0.89)	0.83 (0.80, 0.86)	0.82 (0.79, 0.85)
First-born	1.46 (1.43, 1.48)	1.46 (1.43, 1.48)	1.21 (1.18, 1.24)	1.22 (1.19, 1.26)	1.46 (1.38, 1.55)	1.45 (1.37, 1.54)	1.32 (1.28, 1.37)	1.34 (1.30, 1.39)
Female	1.21 (1.19, 1.22)	1.21 (1.19, 1.22)	1.25 (1.23, 1.28)	1.25 (1.23, 1.28)	1.13 (1.07, 1.19)	1.13 (1.07, 1.20)	1.15 (1.11, 1.18)	1.15 (1.11, 1.18)
Smoking								
Yes	2.07 (2.03, 2.11)	2.07 (2.03, 2.11)	1.80 (1.74, 1.86)	1.76 (1.70, 1.81)	1.21 (1.02, 1.43)†	1.29 (1.09, 1.54)	2.29 (2.15, 2.43)	2.12 (1.99, 2.26)
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Drinking								
Yes	1.25 (1.18, 1.32)	1.25 (1.18, 1.32)	1.92 (1.80, 2.05)	1.91 (1.79, 2.03)	1.97 (1.38, 2.83)	2.01 (1.41, 2.89)	1.24 (1.06, 1.44)	1.22 (1.04, 1.42)†
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Medical risk factors								
Chronic hypertension	3.42 (3.24, 3.61)	3.42 (3.24, 3.61)	3.00 (2.81, 3.19)	2.97 (2.78, 3.16)	4.94 (3.90, 6.26)	5.05 (3.98, 6.39)	5.68 (5.01, 6.43)	5.59 (4.94, 6.33)
Anemia	0.94 (0.89, 0.99)†	0.94 (0.89, 0.99)†	0.86 (0.81, 0.91)	0.85 (0.80, 0.91)	1.00 (0.82, 1.22)*	1.01 (0.83, 1.23)*	0.84 (0.76, 0.93)	0.83 (0.75, 0.92)
Diabetes	0.99 (0.95, 1.04)*	0.99 (0.95, 1.04)*	0.82 (0.77, 0.87)	0.82 (0.77, 0.88)	1.09 (0.96, 1.24)*	1.09 (0.96, 1.23)*	0.87 (0.80, 0.95)	0.87 (0.80, 0.94)
Preclampsia/eclampsia	3.70 (3.61, 3.79)	3.70 (3.61, 3.79)	3.26 (3.14, 3.39)	3.24 (3.12, 3.37)	4.77 (4.25, 5.34)	4.83 (4.31, 5.42)	4.62 (4.38, 4.87)	4.56 (4.32, 4.81)
Placenta previa/ abruption	9.63 (9.27, 9.99)	9.62 (9.27, 9.99)	7.95 (7.42, 8.52)	7.98 (7.44, 8.55)	6.38 (5.44, 7.48)	6.38 (5.44, 7.47)	8.61 (7.87, 9.41)	8.61 (7.87, 9.42)
−2 log likelihood (*df*)	572 227.66 (15)	572 227.41 (16)	236 683.78 (15)	236 464.59 (16)	37 549.89 (15)	37 529.46 (16)	130 724.04 (15)	130 574.22 (16)
Likelihood ratio test		0.5 (1)*		438.38 (1)		40.86 (1)		299.64 (1)

— indicates that model 4 does not include the main effect of foreign-born status; *df*, degrees of freedom.
* Not significant; † $P < .05$; all other results are significant at $P < .01$.

TABLE 4. ORs (95% CI) of LBW Live Births Among Mothers ≥20 Years Old Stratified by Race/Ethnicity With an Interaction Between Foreign-Born Status and Education: United States 1998

	White		Black		Asian		Hispanic	
	US-Born	Foreign-Born	US-Born	Foreign-Born	US-Born	Foreign-Born	US-Born	Foreign-Born
Model 6								
Effect of foreign-born status by education								
Maternal education								
0–11 y	1.00	0.82 (0.74, 0.92)	1.00	0.64 (0.58, 0.70)	1.00	1.35 (0.94, 1.94)	1.00	0.71 (0.67, 0.75)
12 y	1.00	0.97 (0.91, 1.03)*	1.00	0.75 (0.71, 0.80)	1.00	1.17 (0.99, 1.38)*	1.00	0.83 (0.78, 0.87)
13–15 y	1.00	0.97 (0.90, 1.05)*	1.00	0.78 (0.72, 0.84)	1.00	1.52 (1.26, 1.85)	1.00	0.92 (0.85, 1.00)*
≥16y	1.00	1.09 (1.02, 1.16)*	1.00	0.80 (0.73, 0.87)	1.00	1.12 (0.97, 1.29)*	1.00	0.97 (0.87, 1.08)*
Effect of education by nativity								
Maternal education								
0–11 y	1.65 (1.60, 1.69)	1.25 (1.10, 1.41)	1.32 (1.26, 1.38)	1.05 (0.93, 1.19)*	0.98 (0.67, 1.43)*	1.18 (1.06, 1.31)	1.37 (1.25, 1.50)	1.00 (0.92, 1.08)*
12 y	1.30 (1.28, 1.33)	1.16 (1.06, 1.26)	1.21 (1.16, 1.26)	1.14 (1.04, 1.26)	1.01 (0.82, 1.24)*	1.06 (0.98, 1.14)*	1.24 (1.14, 1.35)	1.06 (0.97, 1.15)*
13–15 y	1.01 (0.99, 1.03)	1.02 (0.93, 1.13)	1.02 (0.98, 1.06)*	1.10 (0.99, 1.22)*	1.12 (0.89, 1.41)*	1.16 (1.07, 1.26)	1.05 (0.96, 1.15)*	1.05 (0.96, 1.15)*
16+ y	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
−2 log likelihood (*df*)	572 207.08 (19)		236 450.95 (19)		37 522.08 (19)		130 527.86 (19)	
Likelihood ratio test		40.66 (3)†		27.28 (3)†		14.76 (3)‡		92.72 (3)†

Likelihood ratio test compares models 2a (Table 3) and 3a for each racial/ethnic group. *df* indicates degrees of freedom.
* Not significant; ‡ $P < .01$; † $P < .001$.

in model 2, the odds ratios (ORs) with respect to white women increased for all racial/ethnic minority groups, especially for Asian and Hispanic women, ie, favorable birth outcomes among foreign-born women contribute to lowering the gap between racial/ethnic minorities and white women. In model 2, the overall OR for foreign-born women vis-à-vis US-born women is 0.85 (95% confidence interval [CI]: 0.83, 0.87), suggesting that, on average, foreign-born women are 15% less likely to have a LBW infant.

The Effect of Foreign-Born Status by Race/Ethnicity

In model 3, we introduced an interaction between race/ethnicity and nativity to examine whether the protective effect of foreign-born status varies by racial/ethnic group. The interaction is significant, and as illustrated by the ORs, the protective effect of foreign nativity represents a reduction in the risk of LBW of ~23% among black (95% CI: 0.74, 0.80) and Hispanic (95% CI: 0.75, 0.80) women, whereas foreign nativity does not have a protective effect among white women (95% CI: 0.95, 1.03) and has an adverse effect among Asian women (95% CI: 1.18, 1.41).

Because model 3 (Table 2) showed a significant differential effect of foreign-born nativity across racial/ethnic groups in Table 3, we present statistical models stratified by race/ethnicity controlling for the same factors as in Table 2. Model 4 shows the effect of demographic and socioeconomic factors, prenatal care, health behaviors during pregnancy, and clinical risk factors for each racial/ethnic group, without including foreign-born status. As shown in Fig 3, although LBW exhibits a strong, monotonic education gradient among (all) white women, such a gradient is less pronounced for black women and weak and nonmonotonic for Asian and Hispanic women.

In model 5 (Table 3), we add the effect of foreign-born nativity. Although foreign-born status is not associated with LBW among white women (95% CI: 0.96, 1.03) and it increases the risk among Asian women by 24% (95% CI: 1.13, 1.36), it reduces the risk by ~25% among black women (95% CI: 0.72, 0.78) and by ~19% among Hispanic women (95% CI: 0.78, 0.84).

The Effect of Foreign-Born Status by Race/Ethnicity and Education

In model 6 (Table 4) we introduce an interaction between foreign-born status and education to examine whether the effect of foreign-born nativity varies by race/ethnicity and SES. The interaction is significant for all groups. As shown in Fig 4, for white, black, and Hispanic women, the effect of foreign-born status is especially protective among women with low (ie, less than high school) education (0–11 years). Although foreign-born white women with 0 to 11 years of education are 18% less likely to have an LBW infant than their US-born counterparts (95% CI: 0.74, 0.92), foreign-born white women with 12 (95% CI: 0.91, 1.03), 13–15 (95% CI: 0.90, 0.1.05), and ≥16 (95% CI: 1.02, 1.16) years of education do not have an advantage over their US-born counterparts. Among black and Hispanic women, there is an inverse so-

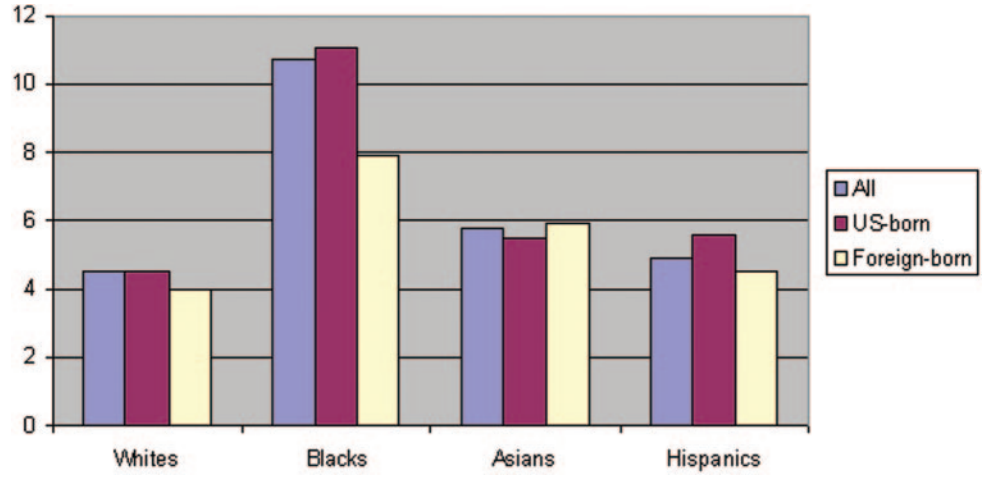

Fig 1. LBW rates among live births to women ≥20 years old by race/ethnicity and nativity: United States, 1998 (Detail Natality Data, 1998; $n = 2\,436\,890$).

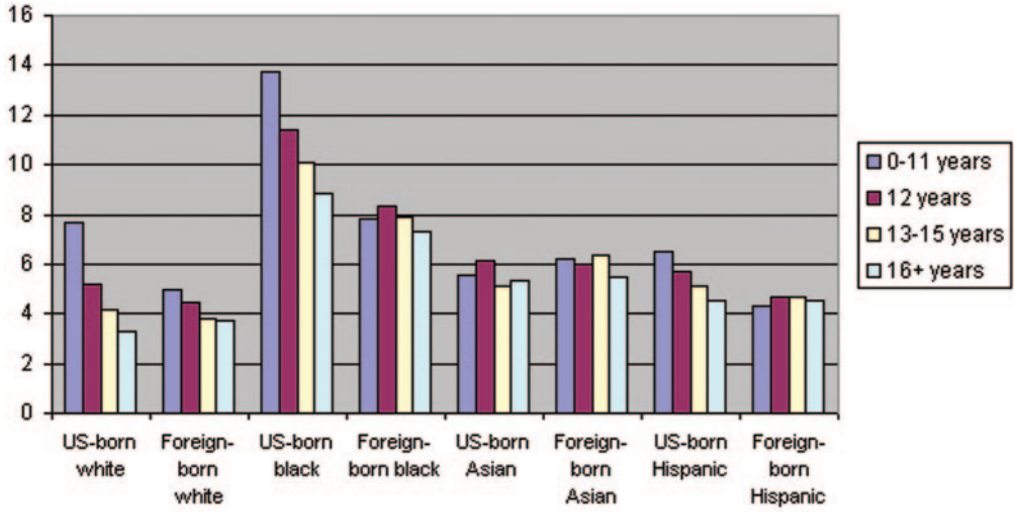

Fig 2. LBW rates among live births to women ≥20 years old by race/ethnicity, nativity, and education: United States, 1998 (Detail Natality Data, 1998; $n = 2\,436\,890$).

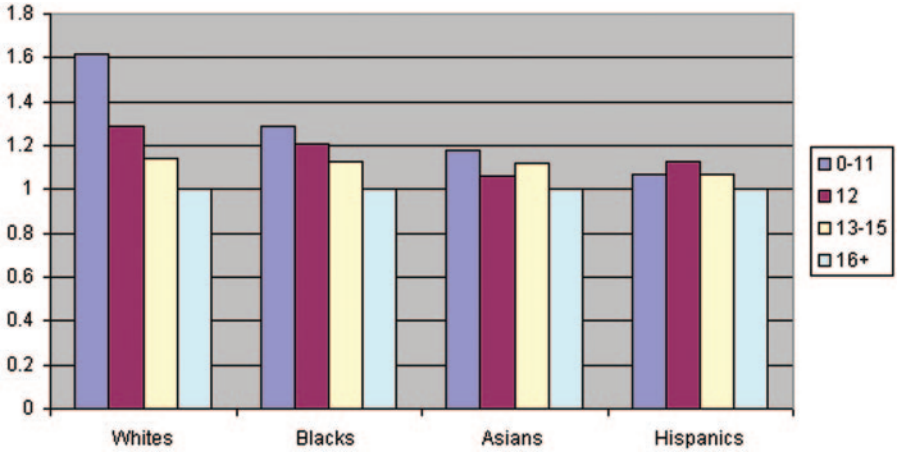

Fig 3. ORs of LBW live births among women ≥20 years old by race/ethnicity and education: United States, 1998 (Detail Natality Data, 1998; $n = 2\,436\,890$). Data are based on results for model 4 (Table 3). Within each racial/ethnic group, women with ≥16 years of education are the reference category (ie, OR = 1). All racial/ethnic categories include both foreign-born and US-born women.

cioeconomic gradient in the protective effect of foreign-born nativity, ie, foreign-born status is associated with a stronger protection against LBW among women with low education, and this protective effect decreases with increasing education (Fig 4). Among black women, the overall pattern is one of diminishing returns of foreign-born status as education increases. Among Hispanic women, foreign-born status is protective against LBW among women in the 2 lowest education groups. Two main differences between black and Hispanic women emerge. First, at every education level, the protective effect of foreign-

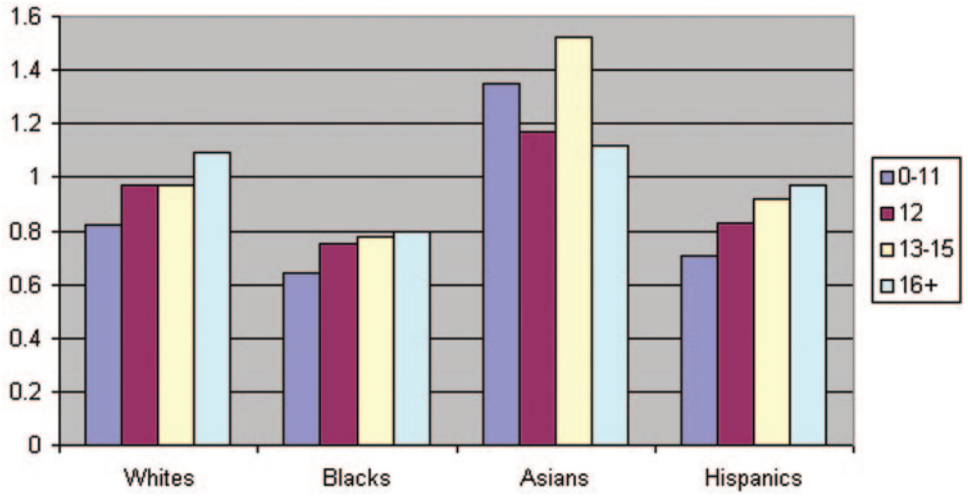

Fig 4. ORs of LBW of foreign-born versus US-born women ≥20 years old by race/ethnicity and education: United States, 1998 (Detail Natality Data, 1998; n = 2 436 890). Data are based on results for model 6 (Table 4). Within each racial/ethnic group and for each education level, bars show the odds of LBW among foreign-born women as a proportion of the odds of LBW among US-born women (reference group).

born status is stronger for black women than for Hispanic women. Second, although for Hispanic women foreign-born status is not protective among those in the 2 highest educational levels, for black women foreign-born status significantly reduces the odds of LBW by ~20% among women those in those educational groups. Among Asian women, the adverse effect of foreign-born status does not follow a clear pattern across various educational groups.

Additionally, the education gradient varies by race/ethnicity and nativity. Figure 5 shows the ORs of LBW of each of the lower education groups (0–11, 12, and 13–15) vis-à-vis the highest education group (≥16 years) for each racial/ethnic group broken down by nativity. There is a pronounced educational gradient in LBW for US-born white, black, and Hispanic women and for foreign-born white women. The educational gradient is flat for foreign-born Hispanic women and indistinct for foreign-born black women and US-born and foreign-born Asian women.

DISCUSSION

We documented differentials in the effect of foreign-born status by race/ethnicity and SES using national data for 1998. Our research has 3 main findings. (1) On average, foreign-born status has a protective effect against LBW. (2) This protective effect varies considerably across racial/ethnic groups. Overall, foreign-born status has a protective effect among black and Hispanic women, has no effect among white women, and has an adverse effect among Asian women. (3) The effect of foreign-born status varies by educational level. Findings 1 and 2 confirm using national data, the results of previous state and local level studies, whereas finding 3 constitutes a new finding. Among white, black, and Hispanic women, being an immigrant (compared

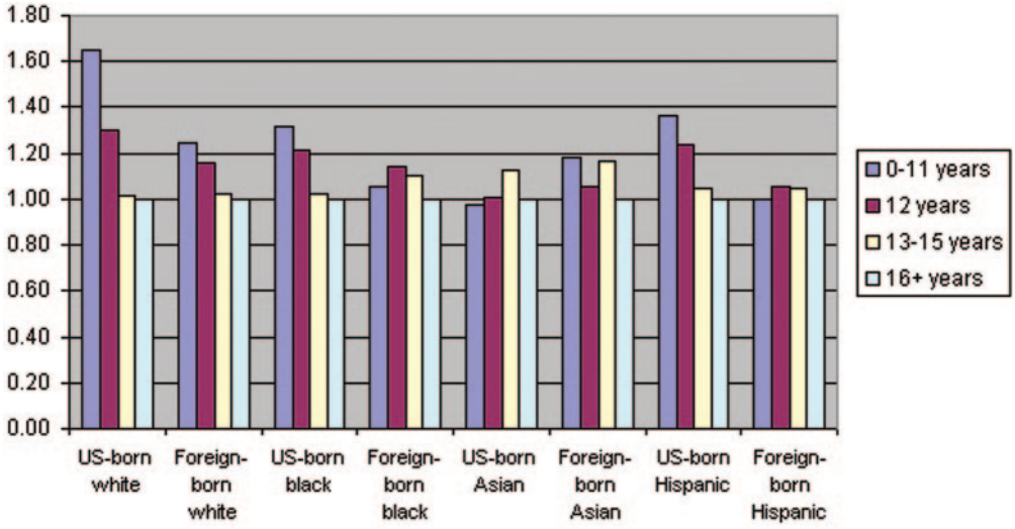

Fig 5. ORs of LBW live births among mothers ≥20 years old by race/ethnicity, nativity, and education: United States, 1998 (Detail Natality Data, 1998; n = 2 436 890). Data are based on results for model 6 (Table 4). Within each racial/ethnic group, women with ≥16 years of education are the reference category (ie, OR=1).

with being US-born) is more protective for women with low education than for women with higher education. In fact, without taking into account the interaction between nativity and education, it may seem that being an immigrant is not protective among white women, because the overall effect of foreign-born status is not significant. However, after taking into account the interaction effect, it seems that foreign nativity is indeed protective among white women with low education.

Foreign-born white, black, and Hispanic women are less likely to have LBW infants than their US-born counterparts. Immigrant women exhibit lower rates of known risk factors for LBW (eg, low education, single motherhood, smoking and drinking during pregnancy) than their US-born counterparts. However, after controlling for demographics, SES, prenatal care, health behaviors, and medical risk factors, our models showed a significant protective effect of foreign-born status. With the present data, we cannot evaluate whether unmeasured risk factors for LBW, cultural factors, or the selection of healthy immigrant women influence this pattern. Prior research has suggested that protective cultural factors and social support among (Latino) immigrants may explain the protective effect of foreign nativity.[12,27,32,33] Another plausible explanation is that foreign-born women may be selected for being healthy.[25,26,29,34] Additional research is needed to examine these possible mechanisms.

Additionally, our results showed a significant independent effect of education. Smoking, drinking, and prenatal care could presumably mediate the effect of education, because more educated women may be more aware of the harmful effects of these behaviors and positive effects of adequate prenatal care. Therefore, unmeasured factors may account for the observed (residual) effect of education. Other research showed that smoking and drinking mediated the effect of education, whereas income had a significant independent effect.[35] It has been suggested that in studies of racial/ethnic disparities in maternal and infant health, the SES measures should be outcome and population specific and chosen on conceptual grounds.[36,37] However, as in the present research, this is often restricted by the limited availability of SES information. We were unable to determine if the effect of education is confounded with the effect of other facets of SES such as income, occupation, and/or health insurance, because education was the only available SES indicator.

For white, black, and Hispanic women, foreign-born status has a protective effect against LBW, particularly among women with low education (Fig 4). Given that 63% of Hispanic women in the sample are foreign-born and that, among those, 56% have less than a high school education (a much larger proportion than in any other racial/ethnic/nativity group), the relatively low rates of LBW in this group are especially significant.

Educational gradients in LBW are less pronounced among foreign-born white, black, and Hispanic women than among their US-born counterparts (Figs 2 and 5). LBW does not exhibit education gradients among Asian women. Some previous studies found that the education gradient varied by nativity/acculturation level. For example, an analysis of the Hispanic Health and Nutrition Examination Survey[12] found that the effect of education on LBW depended on the level of acculturation. Education was unrelated to LBW risk among women with a "Mexican cultural orientation," whereas increased education was associated with reduced LBW risk among those with a "US cultural orientation." Gould et al[7] found that although maternal education was protective against LBW among US-born, non-Hispanic white and black women in California, it was not protective among foreign-born Mexican and Asian Indian women.

The issue of differential SES (eg, educational) gradients by race/ethnicity and nativity remains an important question for future research, ie, why does low education (compared with higher education) increase the risk of LBW more among US-born women than among foreign-born women? Are there cultural factors that protect foreign-born women with low education, and/or does health selection among immigrants play a role?

Possible Mechanisms

This article contributes to the literature on racial/ethnic and socioeconomic disparities in health by showing that the effect of nativity on LBW varies significantly by race/ethnicity and SES. Additional research is needed to examine why foreign-born status confers a protective effect and why education gradients in LBW are less pronounced among the foreign-born than among the US-born. For instance, on average, immigrants may have better health than those in their country of origin who do not migrate and those immigrants who return to their country of origin. Using health data for Mexico and the United States, Soldo et al[34] showed that Mexican immigrants in the United States have a better health profile than their counterparts who returned to Mexico. Ideally, to explore the issue of selection, we would like to compare rates of LBW among foreign-born women from a given country of origin with their US-born ethnic counterparts, as well as with comparable women in their country of origin, including those who have never migrated and return migrants.

If immigrant women are selected for being healthier or having better health behaviors across education levels, such health selection may override the education gradient. If, as suggested by Jasso et al,[29] there is a minimum health level that would make migration worthwhile, this may limit the dispersion in health outcomes among immigrants, thus flattening SES gradients. An alternative hypothesis, which has been proposed primarily in regard to immigrants of Latino descent, is that immigrant women may exhibit cultural factors protective against LBW.[12,27,32,33,38,39] This conjecture is often presented in association with an acculturation hypothesis, ie, that there is an erosion of such protective factors with time spent in the US (within 1 generation) and across generations, which results in a deterioration of health outcomes. In health research, the acculturation

tion hypothesis is frequently tested by examining whether higher levels of "acculturation" (operationalized as nativity status [ie, US-born versus foreign-born], length of stay in the United States [if foreign-born], generation in the United States, and English language ability) are associated with unfavorable health outcomes.[40–42] If present across educational levels, protective cultural factors may attenuate the education gradient. Another possible explanation is that the education gradient in the immigrants' countries of origin may be different (eg, less pronounced) than in the United States. To explore the last hypothesis, it would be necessary to have data that allow a breakdown by national origin as well as data on LBW by education in the immigrants' countries of origin. Increasingly, health researchers realize that a meaningful examination of immigrant health will require health data on the origin and destination countries.[29,34,43]

Limitations

The present research has several limitations arising from omissions in the available data. First, as discussed above, the present data have limited power to examine possible mechanisms that may underlie variations in LBW by race/ethnicity, nativity, and SES. However, uncovering such variations may suggest fruitful hypotheses for future research. For instance, studies may explore why black women, irrespective of education level and nativity status, are more likely to have LBW infants. Comparisons between US-born and foreign-born black women may help address the role of psychosocial stress associated with exposure to discrimination.[3] Similarly, such comparisons may provide additional tests for the "weathering hypothesis."[44–46] For instance, does older maternal age increase the risk of LBW more among US-born black women than among foreign-born black women, given that the former may have longer exposure to factors contributing to weathering such as poverty and discrimination?

Also, why do foreign-born Hispanic women with limited education have low rates of LBW? For example, is the social (eg, neighborhood) environment experienced by this group less disadvantaged than that experienced by their counterparts from other racial/ethnic backgrounds? Recent research has suggested that among Latino women in Los Angeles, California, both individual-level foreign-born status and immigrant enclaves at the neighborhood level have protective effects on LBW.[47] Alternatively, there may be buffers (eg, social support) that protect this group against stressors in their social environment.

Regarding Asian women, what factors may account for the relatively high LBW rate among immigrants vis-à-vis the US-born? For example, this pattern may be driven by certain national-origin subgroups, among which refugees constitute a large proportion of the foreign-born, because unlike voluntary immigrants, refugees may not be selected for positive health and indeed may disproportionately suffer from physical and mental health problems.

Second, although we were able to distinguish foreign-born from US-born mothers within various racial/ethnic groups, we were not able to distinguish second-generation immigrants (ie, those born in the United States of foreign-born parents). We are unable to explore whether the favorable birth-weight outcomes among first-generation immigrants (ie, the protective effect of foreign-born status against LBW) persist among the second generation. From a demographic standpoint, the second generation is becoming increasingly prominent. Births in the United States are surpassing immigration as the main source of growth among immigrants from Latin America, and as a consequence, the second generation will surpass the first generation in size by 2020.[48] Current sociological research also suggests the need for examining the outcomes of the second generation when assessing the adaptation trajectories of various immigrant groups[21–24,28,49–51].

Third, given the national diversity among immigrants, it would be advisable to break down the foreign-born by country of origin. Prior state-level studies have shown that the protective effect of foreign-born status varies across national-origin groups.[5,6] However, we believe that a first, comprehensive, national-level analysis should examine LBW for the 4 major racial/ethnic groups. Then, finer analyses by national origin may examine the extent to which specific subgroups deviate from the average pattern from their racial/ethnic group

CONCLUSIONS

There are statistically significant variations in LBW by race/ethnicity, nativity, and education. Foreign-born status is protective against LBW among black and Hispanic women overall. By educational attainment, foreign-born status is especially protective among white, black, and Hispanic women with less than a high school education. Foreign-born Hispanic women exhibit low rates of LBW across maternal educational levels, and among this group, low education does not seem to increase the risk of having an LBW infant. Although the present data do not allow us to examine the mechanisms underlying the above variations, our analysis suggests hypotheses for future research in relation to the role of health selection, cultural factors, social support, and social (eg, neighborhood) environment.

ACKNOWLEDGMENT

This research was funded by a grant from the Russell Sage Foundation, "Social Inequality and Health," grant 83-01-03 (to Dr Berkman, principal investigator).

REFERENCES

1. US Department of Health and Human Services. *Healthy People 2010*. Vol II. 2nd ed. Washington, DC: US Department of Health and Human Services; 2003
2. Conley D, Strully KW, Bennett NG. *The Starting Gate: Birth Weight and Life Chances*. Berkeley, CA: University of California Press; 2003:258
3. National Institute of Nursing Research, National Institute of Child Health and Human Development, National Institute of Dental and Craniofacial Research. *Reducing Preterm and Low Birth Weight in Minority Families*. Washington, DC: National Institute of Nursing Research, National Institute of Child Health and Human Development, National Institute of Dental and Craniofacial Research; 2003. PA-04-027.

4. Fuentes-Afflick E, Hessol N, Perez-Stable EJ. Maternal birthplace, ethnicity, and low birth weight in California. *Arch Pediatr Adolesc Med.* 1998;152:1105–1112
5. Fuentes-Afflick E, Lurie P. Low birth weight and Latino ethnicity. Examining the epidemiologic paradox. *Arch Pediatr Adolesc Med.* 1997; 151:665–74
6. Fuentes-Afflick E, Hesson N. Impact of Asian ethnicity and national origin on infant birth weight. *Am J Epidemiol.* 1997;145:148–155
7. Gould JB, Madan A, Qin C, Chavez G. Perinatal outcomes in two dissimilar immigrant populations in the United States: a dual epidemiologic paradox. *Pediatrics.* 2003;111(6). Available at: www.pediatrics.org/cgi/content/full/111/6/e676
8. Fuentes-Afflick E, Hesson N. The perinatal advantage of Mexican-origin Latina women. *Ann Epidemiol.* 2000;10:516–523
9. Fuentes-Afflick E, Hessol NA, Perez-Stable EJ. Testing the epidemiologic paradox of low birth weight in Latinos. *Arch Pediatr Adolesc Med.* 1999;153:147–53
10. Collins J, Shay D. Prevalence of low birth weight among Hispanic infants with United States-born and foreign-born mothers: the effect of urban poverty. *Am J Epidemiol.* 1994;139:184–192
11. Cobas JA, Balcazar H, Benin MB, Keith VM, Chong Y. Acculturation and low-birthweight infants among Latino women: a reanalysis of HHANES data with structural equation models. *Am J Public Health.* 1996;86:394–396
12. Scribner R, Dwyer JH. Acculturation and low birthweight among Latinos in the Hispanic HANES. *Am J Public Health.* 1989;79:1263–1267
13. Rumbaut RG, Weeks JR. Unraveling a public health enigma: why do immigrants experience superior perinatal health outcomes? *Res Sociol Health Care.* 1996;13:335–388
14. Williams R, Binkin N, Clingman E. Pregnancy outcomes among Spanish-surname women in California. *Am J Public Health.* 1986;76:387–391
15. Becerra J, Hogue C, Atrash H, Perez N. Infant mortality among Hispanics: a portrait of heterogeneity. *JAMA.* 1991;265:217–221
16. Landale NS, Oropesa R, Gorman BK. Immigration and infant health: birth outcomes of immigrant and native-born women. In: Hernandez DJ, ed. *Children of Immigrants: Health, Adjustment and Public Assistance*. Washington, DC: National Academy Press; 1999:244–285
17. Rumbaut RG, Weeks JR. Infant health among Indochinese refugees: patterns of infant mortality, birthweight and prenatal care in comparative perspective. *Res Sociol Health Care.* 1989;8:137–196
18. Guendelman S, Gould JB, Hudes M, Eskenazi B. Generational differences in perinatal health among the Mexican American population: findings from HHANES 1982–84. *Am J Public Health.* 1990;80:61–65
19. Rumbaut RG, Weeks JR. Children of immigrants: Is "Americanization" hazardous to infant health? In: Fitzgerald H, Lester B, Zuckerman B, eds. *Children of Color: Research, Health, and Policy Issues*. New York, NY: Garland Publishing; 1999
20. Singh G, Yu S. Adverse pregnancy outcomes: differences between US- and foreign-born women in major US racial and ethnic groups. *Am J Public Health.* 1996;86:837–8843
21. Portes A, Rumbaut RG. The new Americans. In: Portes A, Rumbaut RG, eds. *Legacies: The Story of the Immigrant Second Generation*. Berkeley, CA: University of California Press, Russell Sage Foundation; 2001:17–43
22. Portes A, Rumbaut RG. Not everyone is chosen: segmented assimilation and its determinants. In: Portes A, Rumbaut RG, eds. *Legacies: The Story of the Immigrant Second Generation*. Berkeley, CA: University of California Press, Russell Sage Foundation; 2001:44–69
23. Rumbaut RG, Portes A. Introduction-Ethnogenesis: Coming of Age in Immigrant America. In: Rumbaut RG, Portes A, eds. *Ethnicities: Children of Immigrants in America*. Berkeley, CA: University of California Press, Russell Sage Foundation; 2001:1–19
24. Rumbaut RG. The crucible within: ethnic identity, self-esteem and segmented assimilation among children of immigrants. In: Portes A, ed. *The New Second Generation*. New York, NY: Russell Sage Foundation; 1996:8–29
25. Franzini L, Ribble JC, Keddie AM. Understanding the Hispanic paradox. *Ethn Dis.* 2001;11:496–518
26. Palloni A, Morenoff JD. Interpreting the paradoxical in the Hispanic paradox: demographic and epidemiologic approaches. *Ann N Y Acad Sci.* 2001;954:140–174
27. Scribner R. Paradox as paradigm—the health outcomes of Mexican Americans. *Am J Public Health.* 1996;86:303–305
28. Rumbaut RG. Assimilation and its discontents: ironies and paradoxes. In: Hirschman C, Dewind J, Kasinitz P, eds. *The Handbook of International Migration: The American Experience*. New York, NY: Russell Sage Foundation; 1999:172–195
29. Jasso G, Massey DS, Rosenzweig MR, Smith JP. Immigrant health selectivity and acculturation. In: Anderson NB, Bulatao RA, Cohen B; Panel on Race, Ethnicity, and Health in Later Life; National Research Council, eds. *Critical Perspectives on Racial and Ethnic Differences in Health in Late Life.* Washington, DC: National Academies Press; 2004:227–266
30. Ellen IG. Is Segregation bad for your health? The case of low-birth weight. In: Gale WG, Pack JR, eds. *Papers on Urban Affairs*. Washington, DC: Brookings Institution Press; 2000:203–238
31. National Center for Health Statistics. *Data File Documentations, Natality, 1998* [machine-readable data file and documentation]. Hyattsville, MD: National Center for Health Statistics; 2000
32. Weigers M, Sherraden M. A critical examination of acculturation: the impact of health behaviors, social support, and economic resources on birth weight among women of Mexican descent. *Int Migr Rev.* 2001;35: 804–839
33. Sherraden M, Barrera RE. Family support and birth outcomes among second-generation Mexican immigrants. *Soc Serv Rev.* 1997;71:607–633
34. Soldo B, Wong R, Palloni A. Migrant health selection: evidence from Mexico and the US. Paper presented at: Population Association of America Annual Meeting; May 9–11, 2002; Atlanta, GA
35. Finch BK. Socioeconomic gradients and low birth-weight: empirical and policy considerations. *Health Serv Res.* 2003;38:1819–1841
36. Braveman P, Cubbin C, March K, Egerter S, Chavez G. Measuring socioeconomic status/position in studies of racial/ethnic disparities: maternal and infant health. *Public Health Rep.* 2001;116:449–463
37. Parker JD, Schoendorf JK, Kiely JL. Association between measures of socioeconomic status and low birth weight, small for gestational age, and premature delivery in the United States. *Ann Epidemiol.* 1994;4: 271–278
38. Hayes-Bautista DE, Beazconde-Garbanati L, Schink WO, Hayes-Bautista M. Latino health in California, 1985–1990: implications for family practice. *Fam Med.* 1994;9:556–562
39. Hayes-Bautista DE. The Latino health research agenda for the twenty-first century. In: Suarez-Orozco MM, Paez M, eds. *Latinos Remaking America*. Berkeley, CA: University of California Press, David Rockefeller Center for Latin American Studies; 2002:215–235
40. Acevedo-Garcia D. Acculturation. In: Anderson NB, ed. *Encyclopedia of Health and Behavior*. Thousand Oaks, CA: Sage Publications; 2004:1–6
41. Hunt LM. The concept of acculturation in health research: assumptions about rationality and progress. East Lansing, MI: Julian Samora Research Institute, Michigan State University; 1999
42. Hunt LM, Schneider S, Corner B. Should "acculturation" be a variable in health research? A critical review of research on US Hispanics. *Soc Sci Med.* 2004;59:973–986
43. Frank R, Hummer RA. The other side of the paradox: the risk of low birth weight among infants of migrant households within Mexico. *Int Migr Rev.* 2002;36:746–765
44. Geronimus AT. Black/white differences in the relationship of maternal age to birthweight: a population-based test of the weathering hypothesis. *Soc Sci Med.* 1996;42:589–597
45. Geronimus AT. The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethn Disease.* 1992;2:207–221
46. Rich-Edwards JW, Buka SL, Brennan RT, Earls F. Diverging associations of maternal age with low birthweight for black and white mothers. *Int J Epidemiol.* 2003;32:83–90
47. Finch BK. Assimilation and its discontents: the case of low birth-weight in Los Angeles. Paper presented at: Population Association of America Annual Meeting; April 1–3, 2004; Boston, MA
48. Suro R, Passel JS. *The Rise of the Second Generation: Changing Patterns in Hispanic Population Growth*. Washington, DC: Pew Hispanic Center; 2003
49. Portes A. Children of immigrants. Segmented assimilation and its determinants. *The Economic Sociology of Immigration: Essays on Networks, Ethnicity and Entrepreneurship*. New York, NY: Russell Sage Foundation; 1995:248–279
50. Portes A. *The New Second Generation*. New York, NY: Russell Sage Foundation; 1996:x, 246
51. Portes A, Rumbaut RG. Conclusion: the forging of a new America: lessons for theory and policy. In: Rumbaut RG, Portes A, eds. *Ethnicities: Children of Immigrants in America*. Berkeley, CA: University of California Press, Russell Sage Foundation; 2001:301–317