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# Maternal nativity and risk of adverse perinatal outcomes among Black women residing in California, 2011-2017

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## Abstract

**Objective—**Examine the risk of adverse perinatal outcomes among United States (US)-born and foreign-born Black women in California.

**Study Design—**The study comprised all singleton live births to Black women in California between 2011-2017. We defined maternal nativity as US-born or foreign-born. Using Poisson regression, we computed risk ratios (RR) and 95% confidence intervals (CI) for three adverse perinatal outcomes: preterm birth, small for gestational age deliveries, and infant mortality.

**Results—**Rates of adverse perinatal outcomes were significantly higher among US-born Black women. In adjusted models, US-born Black women experienced an increased risk of preterm birth (RR 1.51, 95%CI 1.39, 1.65) and small for gestational age deliveries (RR 1.52, 95%CI 1.41, 1.64), compared to foreign-born Black women.

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AUTHOR CONTRIBUTIONS

SMS, KAS and BDC conceptualized the study, SMS and RJB performed statistical analyses, and all authors contributed to the manuscript preparation and revisions.

CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

**Conclusions—**Future studies should consider experiences of racism across the life course when exploring heterogeneity in the risk of adverse perinatal outcomes by nativity among Black women in the US.

## INTRODUCTION

In the United States (US), racial inequities in maternal and child health persist; notably, Black women are at higher risk for maternal morbidity and mortality compared to white women.[1] These inequities are present after adjustment for socioeconomic and clinical risk factors, and are most apparent when examining rates of preterm birth (PTB), small for gestational age (SGA) deliveries, and infant mortality (IM). For instance, Black women are more than 1.5-times as likely to deliver an infant SGA, and have a two-fold greater risk of PTB compared with white women.[2,3] Similarly, Black infants experience 2.4 times the risk of IM, compared with white infants.[4] The aforementioned adverse outcomes are associated with healthcare costs upwards of 26 billion dollars annually, and lifelong consequences including chronic lung disease, developmental disabilities, hypertension, and insulin resistance.[5,6] Thus, improving perinatal outcomes for Black women has become a national priority.[1]

Previous studies have highlighted the importance of examining the role of medical and behavioral risk factors such as hypertension, diabetes, excessive alcohol consumption, and illicit drug use during pregnancy in understanding racial inequities in adverse perinatal outcomes.[7] However, examining these factors alone does not account for the inequities seen in adverse perinatal outcomes between Black and white women.[8] In addition, researchers suggest that solely focusing on medical and behavioral risk factors in an attempt to explain the excess rates of adverse perinatal outcomes contributes to "mother blame" narratives and further stigmatizes Black women.[9] Contemporary research points to another factor—racism, a set of institutionalized systems of oppression that ascribe value to people based on race/ethnicity, as a significant contributor to chronic stress, which in turn begins a cascade of biological events leading to the increased risk of adverse perinatal outcomes.[10-16] Dr. Camara Jones developed a framework which further posits that racism manifests across three levels: institutional or structural, personally-mediated or interpersonal, and internalized.[16] Exposure to structural and interpersonal forms of racism across the life course has been linked to adverse perinatal outcomes among Black women, irrespective of nativity status.[13-15]

While rates of adverse perinatal outcomes overall are highest for Black women in the US, significant heterogeneity exists after stratification by maternal nativity.[17] Although the reproductive advantage tends to deteriorate as duration in the United States increases, foreign-born Black women have been found to have a lower risk of PTB and delivering low birthweight infants compared to US-born Black women.[17-20] The majority of past studies pertaining to maternal nativity and adverse perinatal outcomes have been restricted to short or cross-sectional study periods, and most researchers have limited their analyses to Black women living in the Northeast (e.g. New York) and Midwest (e.g. Chicago), where the ethnic background of Black immigrants is different from the West Coast.[21-24] In fact, the Black immigrant population in Northeastern states is predominantly Caribbean-born, whereas migrants of African origin are found in large numbers in Western (e.g. California) and Southern (e.g. Texas) states.[25,26] Given the different composition of Black immigrants, it is possible that the previously studied relationships between maternal nativity and adverse perinatal outcomes are dissimilar in California. Additionally, in light of the ongoing Black maternal health crisis the US, nativity studies are of particular interest, as further research may help to identify additional modifiable pathways through which foreign-born Black women differ from US-born Black women, with the goal of translating these factors into interventions to reduce adverse outcomes. Thus, in an effort to explore the relationship between maternal nativity and adverse perinatal outcomes in the Californian context, we examined the risk of PTB, SGA, and IM among US- and foreign-born Black women from 2011 to 2017.

## MATERIALS AND METHODS

Using a population-based design, we drew our data from all births for the years 2011 through 2017. Birth certificates, maintained by California Vital Statistics, were linked to hospital discharge, emergency department, and ambulatory surgery records maintained by the California Office of Statewide Health Planning and Development.[27] These databases contain detailed information on maternal and infant characteristics, hospital discharge diagnoses, and procedures. Hospital discharge, emergency department, and ambulatory surgery files provided diagnoses and procedure codes based on the 9th and 10th revisions of the International Classification of Diseases, Clinical Modification (ICD-CM) as reported to the California Office of Statewide Health Planning and Development by the hospitals. This data covers approximately 90% of all births in California and has previously been found to be highly reliable.[28,29]

We identified 3 448 707 live births in California between 2011 and 2017 (Figure 1). Among this population, we limited our selection to singleton-births from non-Hispanic Black women (n = 166 942), as multiple-birth has a complex etiology, which would likely confound the relationship between the exposure and outcomes.[30-32] We further restricted the sample to births with a plausible gestational age between 20 and 44 weeks (n= 166 619), and those with linked mother-infant hospital discharge records (n = 151 247). The sample was additionally limited to births with no major physical or chromosomal anomalies identified by ICD-9-CM and ICD-10-CM codes, as these births have a confounded relationship with our outcomes of interest.[33-35] Our final cohort included 146 671 women.

Maternal nativity was defined as a dichotomous exposure where women born in the contiguous 48 states, the District of Columbia, Alaska or Hawaii were considered US-born and women born elsewhere were considered foreign-born.

We chose three adverse perinatal outcomes, PTB, SGA, and IM. PTB was defined as delivery before 37 weeks of completed gestation. Infants were considered SGA if their birthweight was < $10^{th}$ percentile for their gestational age at birth by sex.[36] IM information was obtained from the linked infant death certificates and discharge status on hospital discharge records wherein IM was defined as death within the first year of life.

Several maternal socioeconomic characteristics were included as covariates, such as maternal age at delivery (less than 18 years, 18-34 years, and greater than 34 years), highest level of completed education (less than high school, high school diploma, and some college or higher), and health insurance coverage for delivery (California state Medicaid i.e. Medi-Cal, and all other payment methods). Medi-Cal is California's state-administered healthcare plan which covers medical expenses for individuals and families with low-income or limited resources.[37] Further, participation in the federally funded supplemental nutrition program for Women, Infants, and Children (WIC), as well as pre-pregnancy body mass index (BMI) computed from maternal pre-pregnancy height and weight were included. We categorized BMI as underweight (less than 18.5 kg/m$^2$), normal weight (18.5 to 24.9 kg/m$^2$), overweight (25.0 to 29.9 kg/m$^2$), and obese (30.0 kg/m$^2$ or more). In addition, parity (nulliparous and multiparous), and adequacy of prenatal care (adequate/adequate plus, intermediate, and inadequate) were incorporated in the models.[38]

Clinical risk factors were identified using corresponding diagnostic codes from the ICD-9-CM (for data from 2011 to September 2015) and ICD-10-CM (for data from October 2015 and onwards). Smoking during pregnancy was defined as an indication of smoking in the birth certificate record or the presence of diagnostic code 649.0 anywhere on the maternal admission records. We identified illicit substance or alcohol use during pregnancy with data from the maternal (ICD-CM codes 648.3, 303.0, 304.0, 305.0, 305.2-9, F10-16, F19) and infant discharge abstracts (ICD-CM code 779.5). We used diagnostic codes or indication in the birth certificate record to consider pre-existing or gestational diabetes (ICD codes 648.8, 775.0), and any pre-existing or gestational hypertension (ICD codes 642.3, 642.4, 642.5, 642.6).

We computed the prevalence of PTB, SGA, IM, socioeconomic, and clinical risk factors for the entire sample and for US- and foreign-born women respectively. Pearson's chi-square test was performed to test for differences between US- and foreign-born women across the socioeconomic and clinical risk factors, and *P*-values were reported. Log-linear Poisson regression was used to compute risk ratios (RR) and 95% confidence intervals (CI) for PTB, SGA, and IM using foreign-born women as the referent group. For each outcome, we ran three sequential models. The first model adjusted for maternal age, maternal education, parity and health insurance coverage for delivery. The second model further adjusted for WIC and adequacy of prenatal care. The third model additionally adjusted for BMI, smoking/drug use, pre-existing or gestational diabetes and hypertension. All analyses were performed using SAS statistical software version 9.4 (SAS Institute, Cary, North Carolina, USA), and the syntax is unfortunately unavailable for public disclosure.

Among the women in our sample, 0.1% had missing data, as their place of birth was unknown. Missing data among the covariates was not significantly different by maternal nativity and ranged from 0.1% to 5.1%. There was less than 0.01% missing data for the three outcomes. To test whether associations between maternal nativity and adverse perinatal outcomes differed by socioeconomic status, we stratified the sample by Medi-Cal enrollment (with Medi-Cal used as a proxy for low vs. high socioeconomic status). We then re-fit the three regression models in each sub-sample to investigate the impact of socioeconomic status on outcomes. Methods and protocols for the study were approved by the Committee for the Protection of Human Subjects within the Health and Human Services Agency of the State of California in accordance with the Declaration of Helsinki.

## RESULTS

Among the 146 671 women in the study, 129 775 (88.4%) were US- and 16 896 (11.6%) were foreign-born (Table 1). The bulk (82.2%) of foreign-born women were from Sub-Saharan Africa, with Nigeria, Ethiopia and Somalia emerging as the main countries of origin. Overall, the majority of women (82.4%) were between 18 and 34 years old at time of delivery. This proportion was slightly larger among US-born (84.2%) compared to foreign-born (68.3%, *P*<0.001) women. In fact, foreign-born women were more likely to be 34 years or older at the time of delivery (31.6%) in comparison to US-born women (13.3%).

While a little more than half (51.8%) of all women attained some college or higher education, a significantly smaller proportion of US-born (49.6% of US- compared with 68.5% of foreign-born, *P*<0.001) women attained this level of education. Medi-Cal covered the costs for 57.9% of births to all women and was more frequent among US-born (59.3%) compared with foreign-born (47.0%) women (*P*<0.001). US-born women were also more likely (70.3%) to participate in the WIC program in contrast to 49.2% of foreign-born women (*P*<0.001). Although the overall proportions of women who smoked (8%) and used alcohol/drugs (6%) during pregnancy were minimal, US-born women (8.9% smoked; 0.9% used alcohol/drugs) had significantly higher proportions than foreign-born women (6.7% smoked; 0.8% used alcohol/drugs; *P*<0.001 for both).

In the entire sample, the proportions of PTB and SGA were 9.4%, and 14%, respectively, while the IM rate was 7 per 1 000 live births. However, there were stark differences by maternal nativity. Notably, the proportion of PTB was 6.4% for foreign-born, compared to 9.8% for US-born women (table 2). Likewise, US-born women experienced a higher proportion of SGA (14.6% versus 9.1%, *P*<0.001), and rate of IM (7 per 1000 versus 5 per 1 000 live births, *P*=0.001).

In the first regression model adjusted for maternal age, education, parity and health insurance coverage for delivery, nativity was significantly associated with PTB, with US-born women having an increased risk (RR 1.62; 95%CI 1.52, 1.72) compared to foreign-born women (table 2). After further adjustment for WIC participation and adequacy of prenatal care in model 2, the risk ratio was essentially unchanged (RR 1.60; 95% CI 1.50, 1.71). In model 3 (additionally adjusted for BMI, smoking, alcohol/drug use, pre-existing or gestational diabetes and hypertension), the effect estimate was reduced, (RR 1.51; 95% CI 1.39, 1.65) but remained statistically significant.

In model 1, there was an increased risk (RR 1.57; 95% CI 1.49, 1.65) of SGA for US-born women compared to foreign-born women (table 2). In model 2, the relationship persisted (RR 1.55; 95%CI 1.47, 1.63). Following full adjustment for socioeconomic and clinical risk factors in model 3, the estimate maintained statistical significance (RR 1.52; 95%CI 1.41, 1.64).

US-born women also had a higher risk (RR 1.44; 95%CI 1.15, 1.81) of IM compared to foreign-born women in the first model. The risk was identical (RR 1.44; 95%CI 1.14, 1.81) in model 2. While the risk ratio suggested an increased risk (RR 1.21; 95% CI 0.90, 1.64) of IM among US-born women in model 3, this relationship was not statistically significant.

In sensitivity analyses (results omitted for brevity), we re-fit the models between two sub-samples of women, with and without Medi-Cal coverage for their delivery. The results were considerably similar to those from the adjusted regression models, suggesting that nativity remains an important predictor across low and high socioeconomic status groups.

## DISCUSSION

Our results indicate that among Black women who gave birth in California between 2011 and 2017, US-born women had a higher risk of PTB and SGA compared to foreign-born women. These results were statistically significant after adjustment for known risk factors and remain significant irrespective of health insurance coverage. We also found a higher risk of IM among US-born Black women after partial adjustment in the second model; however, subsequent full adjustment for all socioeconomic and clinical risk factors attenuated the statistical significance of this effect. These results should be interpreted with nuance, as IM was not common in our sample; there were only 83 occurrences among foreign-born women, and 919 among US-born women. Thus, despite the lack of statistical significance, our findings are suggestive of a significant relationship between IM and nativity.

Our findings highlight the excess risk of PTB and SGA among US-born Black women and are comparable with results from previous studies focused on Black women, nativity, and adverse perinatal outcomes. Elo et al. analyzed 2008 birth certificate data in 27 states and found a significantly increased risk of PTB and SGA among US-born compared to foreign-born Black women.[18] New York City based studies carried out with data from 1995 to 2003 also found that foreign-born Black women had statistically significant lower risks of PTB compared with US-born Black women.[17,24,39] Moreover, using a national sample of births from 2003 to 2004, Collins et al. reported 1.8 (95% CI 1.6, 2.1) times the risk of IM among US-born compared to foreign-born Black women.[40] Our results suggested a similar statistically significant increased risk of IM among US-born Black women, after partial adjustment for socioeconomic factors. Given that IM was a relatively rare outcome in our study population, it is possible that our sample was not large enough to detect results as strong as those of Collins et al.

As previous studies have outlined, our findings showing increased risk of adverse perinatal outcomes among US- compared to foreign-born Black women suggest that patterns are not the result of inherent genetic differences between the two groups.[41] Rather, it is hypothesized that differences in cumulative exposure to racism across the life course may contribute to the disparities seen between US- and foreign-born Black women.[18,41] For instance, Dominguez et al. found that US-born pregnant Black women reported a significantly higher prevalence of exposure to personal- and group-based racism compared to foreign-born pregnant Black women.[42] While the exact pathway remains unclear, cumulative exposure to racism is positively associated with increased stress hormones and high allostatic loads among Black women.[43,44] Therefore, the excess cumulative exposure to racism among US-born Black women may lead to increased stress and a higher allostatic load than their foreign-born counterparts, which in turn, likely increases their risk of adverse perinatal outcomes.[45]

Although we assert that differential experiences of racism are an important predictor of the Black foreign-born advantage, the foreign-born health advantage is also attributed to migrant selection. Scholars posit that migrants are not a representative sample of non-migrants left behind in the country of origin. Instead, migrants are a group selected on characteristics that render them healthier and more likely to migrate.[46,47] However, it remains unclear whether migrant selection explains foreign-born advantages, particularly among foreign-born Black populations. Future research should explore the extent to which migrant selection contributes to foreign-born advantages in adverse perinatal outcomes, comparing across racial groups.

As foreign-born Black women become assimilated into American society over time, the protective effect of being foreign-born diminishes; their reported exposure to racism and risk of adverse perinatal outcomes mirror those of US-born Black women.[18,20,41,42] This suggests that the experience of racism in American society is distinct, and the embodiment of this inequity over time increases the risk of adverse perinatal outcomes among Black women.[48] Furthermore, research indicates that the American legacy of chattel slavery and legalized segregation through Jim Crow laws continues to have an enduring impact on the lives of Black women in America and cannot be divorced from their present-day health outcomes.[15,48]

Our study had several strengths including a long and modern study period, as well as a population-based design, which yielded a comprehensive sample of Black women residing in California. Additionally, our sample linked information from birth/death certificates and hospital discharge abstracts, which enabled us to include an array of relevant covariates in regression models. To our knowledge, this is one of the few studies to explore the impact of maternal nativity as it relates to adverse perinatal outcomes, uniquely among Black women in California.

Information pertaining to household income or marital status, which are known risk factors for adverse perinatal outcomes, were unavailable and thus limited our definition of socioeconomic status.[49,50] Nonetheless, our regression models were adjusted for type of health insurance coverage, WIC program participation, and adequacy of prenatal care in an attempt to capture women's economic and social position. Moreover, the results of the sensitivity analyses suggested that our results were robust in low and high socioeconomic groups. We did not have access to the year of immigration for foreign-born women, and thus, could not account for time-varying influence of immigration to the US. Alcohol and illicit substance use were ascertained with ICD codes; as perinatal screening for these behaviors is not state-mandated, we likely underestimated the true prevalence of these behaviors.

In conclusion, we found that after adjustment for socioeconomic and clinical risk factors, US-born Black women in a modern California cohort had an increased risk of PTB and SGA, compared to foreign-born Black women. Moreover, US-born Black women had an increased risk of IM after partial adjustment for socioeconomic factors, compared to foreign-born Black women. However, IM was a rare outcome in our cohort, and therefore replication of our models with a larger sample may yield results similar to previously published literature. The observed inequity gap in adverse perinatal outcomes among Black women in California may be the result of differential exposure to racism in American society. Future studies of maternal nativity should consider including data pertaining to experiences of racial discrimination across the life course with the goal of capturing the ways in which these experiences shape cumulative exposure to stress, as it may further explain the heterogeneity in the risk of adverse perinatal outcomes among Black women in America.

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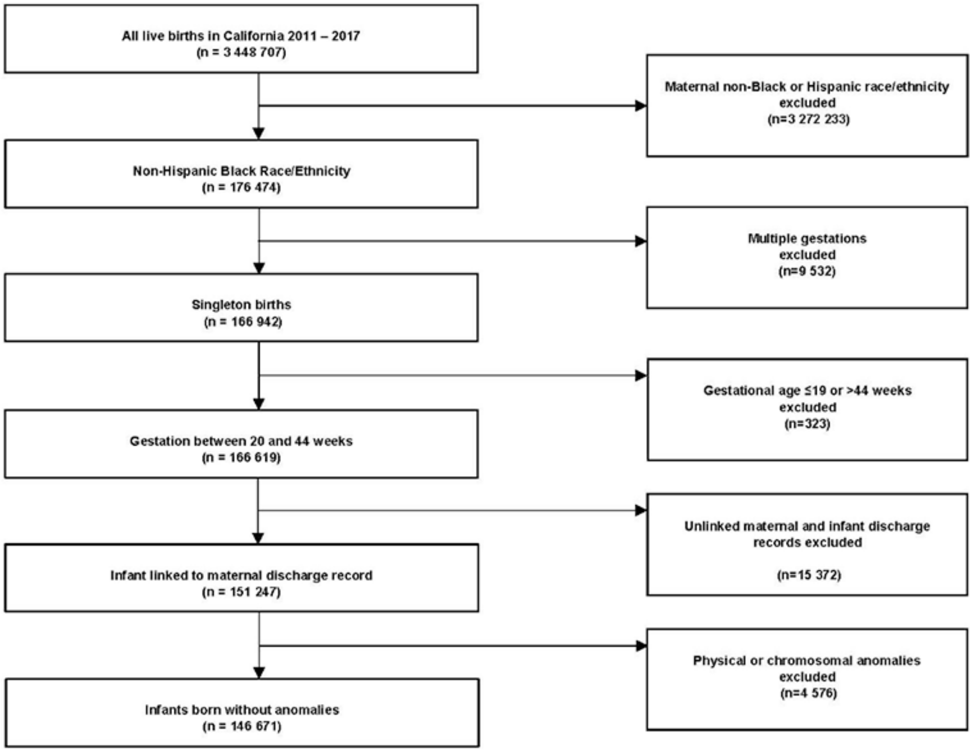


**Figure 1.**
Study sample selection flow chart.

**Table 1.**

Descriptive characteristics of the analytical sample of Black women in California 2011-2017, stratified by maternal nativity.

| | Entire sample (n=146 671) | | US-born (n=129 775) | | Foreign-born (n=16 896) | | *P*-value |
|---|---|---|---|---|---|---|---|
| | n | %[I] | n | %[I] | n | %[I] | |
| Maternal age | | | | | | | < 0.001 |
| < 18 years | 3 333 | 2.3 | 3 308 | 2.5 | 25 | 0.1 | |
| 18-34 years | 120 779 | 82.4 | 109 247 | 84.2 | 11 532 | 68.3 | |
| > 34 years | 22 553 | 15.4 | 17 214 | 13.3 | 5 339 | 31.6 | |
| Maternal education | | | | | | | < 0.001 |
| Less than high school | 19 777 | 13.5 | 18 817 | 14.5 | 960 | 5.7 | |
| High school diploma | 46 900 | 32 | 43 443 | 33.5 | 3 457 | 20.5 | |
| Some college or higher | 75 906 | 51.8 | 64 334 | 49.6 | 11 572 | 68.5 | |
| Insurance coverage for delivery | | | | | | | < 0.001 |
| Not Medi-Cal | 61 757 | 42.1 | 52 803 | 40.7 | 8 954 | 53 | |
| Medi-Cal | 84 914 | 57.9 | 76 972 | 59.3 | 7 942 | 47 | |
| WIC program participant | | | | | | | < 0.001 |
| No | 46 321 | 31.6 | 37 899 | 29.2 | 8 422 | 49.8 | |
| Yes | 99 496 | 67.8 | 91 188 | 70.3 | 8 308 | 49.2 | |
| Pre-pregnancy BMI | | | | | | | < 0.001 |
| Underweight | 5 349 | 3.6 | 4 720 | 3.6 | 629 | 3.7 | |
| Normal weight | 53 374 | 36.4 | 46 064 | 35.5 | 7 310 | 43.3 | |
| Overweight | 37 203 | 25.4 | 32 296 | 24.9 | 4 907 | 29 | |
| Obese | 43 250 | 29.5 | 40 292 | 31.1 | 2 958 | 17.5 | |
| Parity | | | | | | | < 0.001 |
| Nulliparous | 55 502 | 37.8 | 49 553 | 38.2 | 5 949 | 35.2 | |
| Multiparous | 91 013 | 62.1 | 80 094 | 61.7 | 10 919 | 64.6 | |
| Adequacy of prenatal care | | | | | | | < 0.001 |
| Adequate/adequate plus | 94 715 | 64.6 | 83 996 | 64.7 | 10 719 | 63.4 | |
| Intermediate | 23 450 | 16 | 20 510 | 15.8 | 2 940 | 17.4 | |
| Inadequate | 23 059 | 15.7 | 20 476 | 15.8 | 2 583 | 15.3 | |
| Smoking during pregnancy | 11 658 | 8 | 11 506 | 8.9 | 152 | 0.9 | < 0.001 |

| | Entire sample (n=146 671) | | US-born (n=129 775) | | Foreign-born (n=16 896) | | *P*-value |
|---|---|---|---|---|---|---|---|
| | n | %[1] | n | %[1] | n | %[1] | |
| Alcohol or drug use during pregnancy | 8 845 | 6 | 8 717 | 6.7 | 128 | 0.8 | < 0.001 |
| Diabetes (pre-existing or gestational) | 13 663 | 9.3 | 11 630 | 9 | 2 033 | 12 | < 0.001 |
| Hypertension (pre-existing or gestational) | 13 844 | 9.4 | 12 513 | 9.6 | 1 331 | 7.9 | < 0.001 |

[1] Proportions may not add up to 100% due to rounding and omission of missing data.

BMI: Body Mass Index; WIC: Women, Infants and Children supplementation program.

### Table 2.

Risk ratios and 95% confidence intervals from Poisson regressions predicting preterm birth, small for gestational age deliveries, and infant mortality among US-born and foreign-born Black women in California, 2011–2017.

| | n (%) | Model 1[I] RR (95% CI) | Model 2[II] RR (95% CI) | Model 3[III] RR (95% CI) |
|---|---|---|---|---|
| Preterm birth | | | | |
| Foreign-born | 1 081 (6.4) | 1.00 (Reference) | 1.00 (Reference) | 1.00 (Reference) |
| US-born | 12 698 (9.8) | 1.62 (1.52, 1.72) | 1.60 (1.50, 1.71) | 1.51 (1.39, 1.65) |
| Small for gestational age | | | | |
| Foreign-born | 1 532 (9.1) | 1.00 (Reference) | 1.00 (Reference) | 1.00 (Reference) |
| US-born | 18 989 (14.6) | 1.57 (1.49, 1.65) | 1.55 (1.47, 1.63) | 1.52 (1.41, 1.64) |
| Infant mortality | | | | |
| Foreign-born | 83 (0.5) | 1.00 (Reference) | 1.00 (Reference) | 1.00 (Reference) |
| US-born | 919 (0.7) | 1.44 (1.15, 1.81) | 1.44 (1.14, 1.81) | 1.21 (0.90, 1.64) |

[I] Model 1 adjusted for maternal age, maternal education, parity, and health insurance coverage for delivery

[II] Model 2 adjusted for maternal age, maternal education, parity, health insurance coverage for delivery, WIC and adequacy of prenatal care.

[III] Model 3 adjusted for maternal age, maternal education, parity, health insurance coverage for delivery, WIC, adequacy of prenatal care, BMI, smoking/drug use, diabetes and hypertension.

RR: Risk ratio; CI: confidence interval; WIC: Women, Infants and Children supplementation program; BMI: Body Mass Index