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Maternal birthplace is associated with low birth weight within racial/ethnic groups

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Abstract

Introduction—While disparities in low birth weight (LBW) incidence by racial/ethnic group are well known, differences in LBW incidence by maternal birthplace within racial/ethnic groups, and particularly, differences after adjustment for pregnancy complications, are less clear.

Methods—We conducted a population-based study of LBW using 113,760 singleton, live birth records from King County, Washington (2008–2012), a region in the Pacific Northwest with a large immigrant population. Study participants were Asian, non-Hispanic black, Hispanic, Native Hawaiian/Other Pacific Islander (NHOPI), and non-Hispanic white women. Using multivariable logistic regression models, we calculated odds ratios (ORs) and 95% confidence intervals (CIs) to estimate relative risk of LBW (<2,500 g) related to maternal race/ethnicity and birthplace (defined by the Millennium Development Goals Regional Groupings).

Results—Compared with non-Hispanic white women, non-Hispanic black, Asian Indian, Filipino, Japanese, and Vietnamese women had 1.57–2.23-fold higher, statistically significant, risk of having a LBW infant, and NHOPI and Mexican women had 1.30–1.33-fold, statistically significant, higher risk. LBW risk was lower for Asian women from Eastern Asia (OR 0.68, 95% CI 0.55–0.85), non-Hispanic black women from Sub-Saharan Africa (OR 0.58, 95% CI 0.47–0.73), and non-Hispanic white women from other developed countries (OR 0.83, 95% CI 0.69–1.00), as compared with their US-born racial/ethnic counterparts. Results were, in general, similar after adjustment for pregnancy complications.

Conclusions—Compared with most other racial/ethnic groups, non-Hispanic whites had lower risk of LBW. Foreign-born women had lower risk of LBW compared with their US-born counterparts in the majority of racial/ethnic groups. Pregnancy complications had minimal effect on the associations.

Keywords

low birth weight; race; ethnicity; foreign-born; nativity; immigrant

Introduction

Infants with low birth weight (LBW) are at increased risk for perinatal infection, respiratory distress, and death (Conley, Strully, & Bennett, 2003; Stoll et al., 2002). LBW also confers a higher risk for poor health outcomes throughout the lifecourse, including an increased risk

of neurodevelopmental disabilities, high blood pressure, cardiovascular disease and type 2 diabetes (Alexander, Dasinger, & Intapad, 2014; Vohr et al., 2000). Reducing the incidence of LBW is a major public health priority, as evidenced by its inclusion as an objective of Healthy People 2020, a set of national health goals established and monitored by the Centers for Disease Control and Prevention (Department of Health and Human Services).

Disparities in LBW between racial/ethnic groups in the US are well documented in both local (Almeida, Mulready-Ward, Bettegowda, & Ahluwalia, 2014; Chang, Hurwitz, Miyamura, Kaneshiro, & Sentell, 2015; Kieffer, Mor, & Alexander, 1994; Qin & Gould, 2010; Sanchez-Vaznaugh et al., 2016) and national (Acevedo-Garcia, Soobader, & Berkman, 2005, 2007; Le, Kiely, & Schoendorf, 1996; Li, Keith, & Kirby, 2010; Singh & Yu, 1996; Sparks, 2009) studies, even after controlling for socioeconomic status (SES). Previous literature has suggested that variations in size at birth among racial/ethnic groups are in large part due to environmental factors, such as nutrition and the psychosocial stress associated with discrimination and institutional racism, rather than genetic factors (Geronimus, 1996; Papageorgiou et al., 2014; Sparks, 2009). Accumulating, but not conclusive, evidence from local (Howard, Marshall, Kaufman, & Savitz, 2006; Qin & Gould, 2010) and national studies (Acevedo-Garcia et al., 2005, 2007; Le et al., 1996; Li et al., 2010; Singh & Yu, 1996) suggests differential associations between LBW and maternal birthplace within racial/ethnic groups, with studies reporting that foreign-born Hispanics, as well as Asians and non-Hispanic blacks, have a lower risk of LBW compared with their US-born racial/ethnic counterparts. Lower risk of LBW is observed in these immigrant groups despite similar, or lower, SES as compared with US-born members of their same racial/ethnic group. The majority of these studies use data from the 1990's and early 2000's, and an update is needed to determine if these disparities have persisted, given the high rate of immigration in the 2000's.

We are unaware of any previous study assessing these associations in the Pacific Northwest. Although previous studies of the risk of LBW associated with race/ethnicity and maternal birthplace have adjusted for SES factors, the effect on these associations of controlling for pregnancy complications remains in question. Four of the most common pregnancy complications, pregnancy induced hypertension (PIH), gestational diabetes (GDM), preterm birth (PTB), and obesity, have not received sufficient attention for their role in the risk of LBW associated with race/ethnicity and birthplace. Controlling for these complications when assessing the risk of LBW associated with race/ethnicity and maternal birthplace can inform whether addressing pregnancy complications will help to alleviate LBW disparities between these groups.

King County, Washington, which includes the Seattle-Tacoma-Bellevue Metropolitan Area, has a unique racial/ethnic composition as well as a large immigrant population, providing a diverse population in which to study these LBW disparities. Asians comprise 16.4% of King County's population, as compared with 5.4% in the US as a whole (United States Census Bureau, 2015). Twenty-one percent of King County's population is foreign-born, compared with 13% in the US (Public Health - Seattle & King County, 2015). Of note, more than one-fourth of the non-Hispanic black population is foreign-born in King County, compared with less than a tenth in the US (Anderson, 2015; Public Health - Seattle & King County, 2015).

We conducted a population-based study using the unique population of King County to estimate the association of LBW with racial/ethnic group and maternal birthplace.

Methods

We used Washington State birth records to conduct a retrospective cohort study of singleton, live births in King County, Washington from 2008–2012. Of 124,455 eligible live births, we excluded births to women who identified as multiple race (4,092) or American Indian/Alaska Native (872), multiple gestations (4,504), births missing birth weight information (220), and births to women missing race/ethnicity (472) or birthplace information (535). After these exclusions, we identified 113,760 live births for the current analyses. The analyses described in this article were determined to be public health assessment activities by the Washington State Institutional Review Board and thus were exempt from review.

Information for all variables was determined from Washington State birth certificates, which follow the 2003 national revised standards for vital certificates (Washington State Department of Health, 2012). The birth certificates have a section titled, “Mother’s Race,” under which the clinician who attends to the woman’s delivery fills in checkboxes based on the following instructions, “Check one or more races to indicate what the mother considers herself to be.” Checkboxes include white, American Indian/Alaska Native, black, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, other Asian (write-in), Native Hawaiian, Guamanian or Chamorro, Samoan, other Pacific Islander (write-in), and other (write-in). The woman’s Hispanic ethnicity was ascertained using the response to the question, “Mother of Hispanic Origin?” with the checkbox options: “No, not Spanish/Hispanic/Latina,” “Yes, Mexican, Mexican American, Chicana,” “Yes, Puerto Rican,” “Yes, Cuban,” and “Yes, other Spanish/Hispanic/Latina (specify).” We did not include non-Hispanic American Indian/Alaska Natives in the analysis because our principal objective was to investigate the effect of different birthplaces, and the vast majority of non-Hispanic American Indian/Alaska Natives are US-born. Births to women of Hispanic origin were categorized as “Hispanic,” regardless of race; therefore, multiple race Hispanics and Hispanics identifying as American Indian/Alaska Native were included in analyses. Women’s birthplace was determined using the response to the write-in question, “Birthplace (State, Territory or Foreign Country),” and grouped according the United Nation’s Millennium Development Goals Regional Groupings with the US considered separately (Online Resource 1). Per the Millennium Development Goals Regional Groupings, Japan was included among developed countries, Puerto Rico was included in the Caribbean, and Guam and American Samoa were included in Oceania. Our binary outcome variable was LBW (<2500 g).

Sociodemographic and reproductive characteristics included maternal age in years (<20, 20–34, 35), infant sex (male or female), maternal education (no high school diploma/graduate equivalency degree versus high school diploma/graduate equivalency degree or more education), adequacy of prenatal care according to the Adequacy of Prenatal Care Utilization Index (Kotelchuck, 1994) (inadequate versus intermediate, adequate or adequate plus), maternal smoking (none, smoked three months before pregnancy but not during pregnancy, or smoked during pregnancy), and parity (nulliparous versus primiparous or

1.68) and 30% (OR 1.30, 95% CI 1.16–1.45) higher risk of having a LBW infant, respectively.

Considering the effect of birthplace, women from Eastern Asia as a group (China, South Korea, North Korea, Mongolia, Hong Kong, Macao) were 32% less likely to have a LBW infant compared with their US-born Asian counterparts, after adjustment for SES factors (OR 0.68, 95% CI 0.55–0.85; Table 3). Non-Hispanic black women born in Sub-Saharan Africa were 42% less likely to have a LBW infant than US-born non-Hispanic black women (OR 0.58, 95% CI 0.47–0.73). Hispanic women born in Latin America were 16% less likely to have a LBW infant than US-born Hispanic women, but this result did not reach statistical significance (OR 0.84, 95% CI 0.68–1.03). Compared with their US-born counterparts, non-Hispanic white women born in other developed countries had a 17% lower risk of having a LBW infant (OR 0.83, 95% CI 0.69–1.00).

We fit additional models to assess the risk of LBW above and beyond the effect of pregnancy complications (PIH, GDM, PTB, and obesity). Asian Indian, Filipino, Japanese, Vietnamese, and non-Hispanic black women had a 1.64–2.38-fold higher risk of having a LBW infant, as compared with non-Hispanic white women (Table 2). Women born in Eastern Asia had a 22% lower risk of having a LBW infant than US-born Asian women (OR 0.78, 95% CI 0.64–0.96), and women born in Sub-Saharan Africa had a 55% lower risk of LBW than US-born non-Hispanic black women (OR 0.45, 95% CI 0.37–0.56; Table 3). Women born in Southern Asia had a 28% higher risk of LBW as compared with US-born Asians (OR 1.28, 95% CI 1.04–1.58).

Discussion

In this study, we observed disparities in risk of LBW by race/ethnicity, as well as by maternal birthplace within racial/ethnic groups, in King County, Washington. Compared with non-Hispanic white women, most other racial/ethnic groups had higher risk of having a LBW infant. We observed lower risk of having a LBW infant for Asian women from Eastern Asia, non-Hispanic black women from Sub-Saharan Africa, and non-Hispanic white women from developed countries other than the United States, compared with their US-born racial/ethnic counterparts. Results were generally similar after adjustment for pregnancy complications.

Our findings of lower risk in non-Hispanic white women as compared with most other racial/ethnic groups, even after accounting for SES factors, were largely consistent with prior studies in both local and national populations. As compared with non-Hispanic white women, other studies also found a higher risk in Asian Indian, Vietnamese, Filipino, and Japanese populations, but not in Chinese or Korean populations (Le et al., 1996; Li et al., 2010; Schempf, Mendola, Hamilton, Hayes, & Makuc, 2010; Singh & Yu, 1996; Yi, Schiff, & Boutain, 2012). Consistent with our results, other studies observed higher risk of having a LBW infant in non-Hispanic black women (Acevedo-Garcia et al., 2005; Almeida et al., 2014; Singh & Yu, 1996; Sparks, 2009). We observed higher risk in Mexican women, as compared with non-Hispanic white women, after adjusting for SES factors, which is inconsistent with the observations of lower risk or no meaningful difference in risk from

previous studies (Acevedo-Garcia et al., 2007; Sanchez-Vaznaugh et al., 2016; Sparks, 2009). As compared with non-Hispanic whites, previous studies have observed higher risk of LBW in Native Hawaiian and Marshallese populations, but not in Guamanian, Samoan or Micronesian populations (Chang et al., 2015; Kieffer et al., 1994; Le et al., 1996; Schempf et al., 2010). We observed higher risk for NHOPI overall, although we did not have a large enough sample size to assess these detailed groups.

The higher risk of LBW found in these groups as compared with non-Hispanic whites may be due to incomplete adjustment for SES factors that are not captured in detail by the birth certificate, as well as social, cultural, and environmental factors that are not present on the birth certificate. Institutional racism may lead to the observed reproductive health inequities through weathering, in which the stresses of social disadvantage and racial discrimination over the lifecourse contribute to health deterioration (Geronimus, 1996). This “physical consequence of social inequity” may explain the substantial LBW disadvantage in non-Hispanic blacks, as well as other racial/ethnic groups, as compared with non-Hispanic whites (Geronimus, 1996). One particular group this theory may apply to is Filipinos, who report higher levels of discrimination than other Asian groups, which some authors postulate may be associated with their skin color, higher incidence of wage discrimination, and history of colonization (Gee, Spencer, Chen, & Takeuchi, 2007). The higher risk in Asian Indians is somewhat unexpected, given their relatively high SES. A previous population-based study in New Jersey examining the risk of LBW among Asian Indians found that anemia and established and gestational diabetes and hypertension may be particularly important risk factors for LBW in this population (Kurtyka et al., 2014). Our unusual finding of higher risk in Mexican women after adjustment for SES factors may be explained by differences in characteristics of this population in King County as compared with this populations in other regions, such as differences in social support, medical risk factors, and pregnancy complications.

In the model adjusting for pregnancy complications (PIH, GDM, PTB, and obesity), Asian Indian, Filipino, Japanese, Vietnamese, and non-Hispanic black women had a higher risk of having a LBW infant, as compared with non-Hispanic white women. Some studies have controlled for obesity, gestational hypertensive disorders and/or gestational diabetes (Acevedo-Garcia et al., 2005; Almeida et al., 2014; Chang et al., 2015; Sanchez-Vaznaugh et al., 2016; Sparks, 2009), and a few have assessed small for gestational age (as another way to control for PTB) (Elo, Vang, & Culhane, 2014; Li et al., 2010; Stein et al., 2009), but no studies have controlled for these pregnancy complications simultaneously, as our study did. Based on the previously described study in New Jersey, the residual LBW disparity in Asian Indian women after adjustment for PIH, GDM, PTB, and obesity may be associated with anemia, established diabetes, or established hypertension (Kurtyka et al., 2014).

Assessing the effect of birthplace on LBW within racial/ethnic groups, we found a lower risk of having a LBW infant for women born in Eastern Asia (the majority from China) as compared with US-born Asians, after adjustment for SES factors. This was consistent with previous studies that found a lower risk in foreign-born Chinese women, as compared with their US-born counterparts (Le et al., 1996; Li et al., 2010; Qin & Gould, 2010; Singh & Yu, 1996). Our findings confirmed previous observations of lower risk in foreign-born non-

Hispanic blacks (Acevedo-Garcia et al., 2005, 2007; Howard et al., 2006; Singh & Yu, 1996). Although there was a suggestion of lower risk in Hispanic women born in Latin America as compared with US-born Hispanic women in our study, our results did not reach statistical significance, while previous literature observed significantly lower risk in foreign-born Hispanics (Acevedo-Garcia et al., 2005, 2007; Singh & Yu, 1996). In non-Hispanic white women, we observed lower risk of having a LBW infant among foreign-born as compared with US-born women; some previous studies did not find a meaningful difference in risk (Acevedo-Garcia et al., 2007; Almeida et al., 2014; Le et al., 1996; Singh & Yu, 1996), although one study observed a lower risk in foreign-born non-Hispanic white women that was specific to those with low educational status (Acevedo-Garcia et al., 2005).

Migration selectivity, or the tendency for immigrants to be healthier than those who remain in their country of origin and, more importantly for this study, potentially healthier than their racial/ethnic counterparts residing in the US, is one explanation for our findings of lower risk of LBW in foreign-born women from Eastern Asia and Sub-Saharan Africa, as compared with their US-born racial/ethnic counterparts (Frisbie, Cho, & Hummer, 2001). Additionally, unhealthy behaviors that increase risk of LBW, such as alcohol use during pregnancy, may be less common in foreign-born women (Acevedo-Garcia et al., 2005; Sanchez-Vaznaugh et al., 2016). Evidence suggests social support systems available to immigrants may influence these associations (Rumbaut, 1996). Weathering, defined previously, may explain the substantial LBW disadvantage in US-born versus foreign-born non-Hispanic blacks, and other racial/ethnic groups, as the former experiences weathering for much longer, on average, than the latter (Geronimus, 1996). The failure to observe lower risk in immigrants in all racial/ethnic groups may be explained by differing patterns of acculturation, and its effects on health behaviors and psychosocial stressors. Our unusual finding of lower risk in non-Hispanic white women from other developed countries may be due to this population having a larger number of immigrants from Canada, as opposed to Eastern European countries that typically have populations with poorer health status.

After adjustment for pregnancy complications, women born in Eastern Asia and Sub-Saharan Africa had lower risk of LBW than US-born Asian and non-Hispanic black women, respectively, while women born in Southern Asia (the majority in India) had higher risk of LBW than US-born Asians. As previously discussed, we are not aware of any other studies simultaneously controlling for PIH, GDM, PTB, and obesity. The finding of higher risk in women from Southern Asia as compared with US-born Asian women after adjustment for these factors suggests the former group has a LBW disadvantage associated with other pregnancy complications, such as maternal infection, or subclinical conditions during pregnancy.

Our study supports the importance of disaggregation of racial/ethnic groups when conducting public health surveillance and research, including considering specific Asian subgroups and assessing the role of birthplace within all race/ethnicities. By failing to disaggregate, there is a risk of reporting results that are not accurate for any group, and, of particular concern, missing specific groups that are at higher risk for LBW. Policies that encourage culturally appropriate provision of care for specific racial/ethnic groups at higher risk of LBW may help to mitigate disparities.

Our study adds to the literature by presenting risk estimates of LBW by race/ethnicity and maternal birthplace that simultaneously adjust for PIH, GDM, PTB, and obesity, which, to our knowledge, has not been done previously. Additionally, our study provides information from King County, an area in the Pacific Northwest with a large immigrant population. Although national studies are valuable, local information is needed for policy guidance given differing immigration patterns by region of the US. In light of the different distributions and characteristics of racial/ethnic groups around the nation, the similarity of the majority of our findings to previous studies is noteworthy. Additionally, this study provides a valuable update to the literature, most of which is from a decade ago, that is relevant to contemporary rapid socioeconomic changes and reconfiguration of racial/ethnic groups and immigration patterns.

Despite the strengths of this large, population-based study, several limitations deserve mention. We were not powered to assess all associations in NHOPI groups. Additionally we were missing some information that may help to explain observed associations. For instance, we did not have a measure of social support, measures of psychosocial stress or exposure to racism to assess weathering, or a comparison group of births to women who remained in their country of origin to assess selective migration and immigration effects. We were not able to measure or account for longer residency in the US, which tends to be associated with poorer health outcomes for immigrants (Cho, Frisbie, Hummer, & Rogers, 2004). We had detailed race/ethnicity information that would have allowed country-specific comparisons (e.g., risk of having a LBW infant in women born in China versus US-born Chinese women), but we were unable to make these comparisons due to sample size limitations. We investigated collinearity between predictor variables in our models and did not observe evidence of this problem.

In sum, we found that LBW risk is associated with maternal racial/ethnic group and maternal birthplace in the unique population of King County. Our work highlights the importance of disaggregating racial/ethnic groups into specific subgroups and by maternal birthplace in investigations of LBW. We also observed that some racial/ethnic groups remained at higher risk even after controlling for pregnancy complications. Continued research into mechanisms accounting for these differences may help guide interventions and policies that are culturally sensitive and work with diverse communities to reduce LBW disparities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Prior presentation of data

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Significance

LBW, a risk factor for life-long morbidity and mortality, is known to differ by race/ethnicity. Although there is some evidence that foreign-born women have a lower risk of having a LBW infant than their US-born racial/ethnic counterparts, whether this association persists after adjustment for pregnancy complications (pregnancy induced hypertension, gestational diabetes, preterm birth, and obesity) has not been examined. In the diverse population of King County, Washington, we found that non-Hispanic whites had lower risk of LBW than most other racial/ethnic groups, and foreign-born women tended to have lower risk of LBW than their US-born racial/ethnic counterparts. The majority of these associations persisted after controlling for pregnancy complications. This may have important implications for future research and culturally sensitive, targeted public health interventions.

Table 1

Characteristics of singleton, live births in King County, Washington, 2008–2012.

	Asian n=22,333 n (%)	Non-Hispanic black n=9,625 n (%)	Hispanic n=16,999 n (%)	Native Hawaiian/Other Pacific Islander n=1,853 n (%)	Non-Hispanic white n=62,950 n (%)
Population (N=113,760)	1,301 (5.8)	734 (7.6)	771 (4.5)	93 (5.0)	2,339 (3.7)
<i>Sociodemographic and reproductive characteristics</i>					
Maternal age (years)					
<20	276 (1.2)	646 (6.7)	1,727 (10.2)	164 (8.9)	1,490 (2.4)
20–34	16,109 (72.1)	7,275 (75.6)	12,629 (74.3)	1,457 (78.7)	44,546 (70.8)
35	5,945 (26.6)	1,703 (17.7)	2,640 (15.5)	231 (12.5)	16,905 (26.9)
Mother foreign-born					
	18,980 (85.0)	5,262 (54.7)	11,694 (68.8)	1,189 (64.2)	9,469 (15.0)
No high school diploma/GED					
	1,363 (6.1)	2,389 (25.4)	6,571 (39.5)	318 (17.3)	2,616 (4.2)
Inadequate prenatal care*					
	2,543 (18.1)	2,032 (32.3)	3,048 (27.8)	762 (54.2)	6,273 (16.4)
Smoking					
During 3 months before pregnancy**					
	78 (0.4)	61 (0.6)	110 (0.7)	26 (1.4)	623 (1.0)
During pregnancy					
	235 (1.1)	478 (5.0)	342 (2.0)	151 (8.2)	2,922 (4.7)
Nullipara					
	9,385 (42.6)	2,792 (29.5)	5,361 (32.0)	567 (30.8)	24,408 (39.3)
Female infant					
	10,816 (48.4)	4,764 (49.5)	8,270 (48.7)	909 (49.1)	30,699 (48.8)
<i>Medical risk factors</i>					
Pre-pregnancy BMI†					
Underweight	1,359 (6.7)	251 (3.0)	320 (2.1)	21 (1.3)	1,435 (2.5)
Normal weight	13,552 (67.2)	3,160 (38.0)	6,163 (40.8)	341 (20.4)	32,081 (55.5)
Overweight	3,901 (19.3)	2,434 (29.3)	4,703 (31.1)	421 (25.2)	13,977 (24.2)
Obese	1,358 (6.7)	2,465 (29.7)	3,928 (26.0)	891 (53.2)	10,291 (17.8)
Pregnancy-induced hypertension					
	609 (2.7)	451 (4.7)	697 (4.1)	96 (5.2)	2,809 (4.5)
Preterm birth					
Gestational diabetes	2,326 (10.4)	511 (5.3)	1,116 (6.6)	138 (7.5)	2,473 (3.9)
Established hypertension	183 (0.8)	210 (2.2)	143 (0.8)	39 (2.1)	732 (1.2)
Established diabetes‡	125 (0.6)	137 (1.4)	156 (0.9)	46 (2.5)	309 (0.5)

BMI, body mass index; GED, graduate equivalency degree

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Categories may not add to total due to missing data.

* According to the Adequacy of Prenatal Care Utilization Index (Kotelchuck Index)

** No smoking during pregnancy, only during 3 months prior to pregnancy

† Underweight: BMI <18.5 kg/m², normal weight: BMI 18.5–24.9 kg/m², overweight: BMI 25.0–29.9 kg/m², obese: BMI ≥ 30 kg/m²

‡ Type 1 or type 2 diabetes mellitus

Table 2

Risk of low birth weight (<2500 g) by race/ethnicity in singleton, live births in King County, Washington, 2008–2012.

Race/ethnicity	Rate per 100 live births (95% CI)	Model 1 Adjusted OR (95% CI)	Model 2 Adjusted OR (95% CI)	Model 3 Adjusted OR (95% CI)	Count	Total population
Total	4.6 (4.5–4.7)	1.00 (ref)	1.00 (ref)	1.00 (ref)	5,238	113,760
White, non-Hispanic	3.7 (3.6–3.9)				2,339	62,950
Asian	5.8 (5.5–6.2)	1.61 (1.50–1.73) ***	1.73 (1.58–1.89) ***	1.69 (1.55–1.84) ***	1,301	22,333
Asian Indian	6.8 (6.1–7.4)	1.92 (1.72–2.15) ***	2.13 (1.85–2.45) ***	2.38 (2.08–2.72) ***	399	5,910
Chinese	3.7 (3.2–4.3)	1.00 (0.85–1.17)	1.09 (0.89–1.34)	1.16 (0.96–1.40)	170	4,565
Filipino	7.6 (6.7–8.7)	2.14 (1.85–2.47) ***	2.23 (1.87–2.67) ***	1.85 (1.55–2.10) ***	221	2,896
Japanese	5.2 (4.0–6.7)	1.41 (1.08–1.82) *	1.57 (1.14–2.17) **	1.66 (1.22–2.26) **	62	1,183
Korean	3.4 (2.6–4.4)	0.92 (0.71–1.19)	0.95 (0.68–1.31)	1.04 (0.77–1.40)	61	1,777
Vietnamese	5.9 (5.0–6.8)	1.62 (1.37–1.90) ***	1.65 (1.34–2.03) ***	1.64 (1.34–1.99) ***	165	2,808
Black, non-Hispanic	7.6 (7.1–8.2)	2.13 (1.95–2.32) ***	2.09 (1.87–2.35) ***	2.00 (1.79–2.23) ***	734	9,625
Hispanic	4.5 (4.2–4.9)	1.22 (1.12–1.33) ***	1.30 (1.16–1.45) ***	1.05 (0.94–1.16)	771	16,999
Mexican	4.5 (4.1–4.9)	1.21 (1.10–1.33) ***	1.33 (1.18–1.51) ***	1.04 (0.93–1.17)	569	12,677
Puerto Rican	5.1 (3.3–7.5)	1.39 (0.93–2.08)	---	---	25	490
NHOPI	5.0 (4.1–6.1)	1.36 (1.10–1.69) **	1.30 (1.01–1.68) *	0.88 (0.68–1.14)	93	1,853
Samoa	3.6 (2.4–5.1)	0.95 (0.65–1.39)	---	---	28	788

OR, odds ratio; CI, confidence interval; *NHOPI*, Native Hawaiian/Other Pacific Islander

Model 1 is adjusted for infant sex and maternal age; Model 2 is adjusted for infant sex, maternal age, education, smoking, parity, and adequacy of prenatal care; Model 3 is adjusted for infant sex, maternal age, preterm birth, gestational diabetes, pregnancy-induced hypertension, and obesity.

Racial/ethnic subgroups were not presented if they had too few births to perform logistic regression analyses.

Bolded font represents statistically significant results.

* p-value < 0.05,

** p-value < 0.01,

*** p-value < .001

--- Numbers were too small to report reliable estimates using logistic regression.

Table 3

Risk of low birth weight (<2500 g) by maternal birthplace within racial/ethnic groups in singleton, live births in King County, Washington, 2008–2012.

Race/ethnicity and maternal birthplace	Rate per 100 live births (95% CI)	Model 1 Adjusted OR (95% CI)	Model 2 Adjusted OR (95% CI)	Model 3 Adjusted OR (95% CI)	Count	Total population
Asian, non-Hispanic					1,301	22,333
United States	6.7 (5.8–7.6)	1.00 (ref)	1.00 (ref)	1.00 (ref)	224	3,353
Developed countries [†]	5.5 (4.2–7.1)	0.83 (0.61–1.11)	0.78 (0.53–1.15)	1.07 (0.75–1.52)	61	1,110
Eastern Asia	4.5 (4.0–5.0)	0.68 (0.57–0.81) ***	0.68 (0.55–0.85) **	0.78 (0.64–0.96) *	382	8,528
Southern Asia	6.5 (5.9–7.2)	1.04 (0.87–1.24)	1.13 (0.90–1.41)	1.28 (1.04–1.58) *	371	5,705
South-Eastern Asia	6.9 (6.1–7.9)	1.07 (0.88–1.30)	1.10 (0.87–1.40)	0.94 (0.74–1.18)	235	3,393
Black, non-Hispanic					734	9,625
United States	10.7 (9.7–11.7)	1.00 (ref)	1.00 (ref)	1.00 (ref)	466	4,363
Sub-Saharan Africa	5.0 (4.4–5.7)	0.43 (0.37–0.51) ***	0.58 (0.47–0.73) ***	0.45 (0.37–0.56) ***	253	5,045
Hispanic					771	16,999
United States	4.9 (4.3–5.6)	1.00 (ref)	1.00 (ref)	1.00 (ref)	261	5,305
Latin America	4.4 (4.0–4.8)	0.89 (0.76–1.04)	0.84 (0.68–1.03)	0.84 (0.70–1.02)	497	11,331
NHOPI					93	1,853
United States	4.5 (3.0–6.4)	1.00 (ref)	1.00 (ref)	1.00 (ref)	30	664
Oceania	5.3 (4.1–6.8)	1.18 (0.75–1.85)	1.28 (0.75–2.19)	1.01 (0.60–1.71)	61	1,148
White, non-Hispanic					2,339	62,949
United States	3.8 (3.6–3.9)	1.00 (ref)	1.00 (ref)	1.00 (ref)	2,019	53,481
Developed countries [†]	3.2 (2.8–3.7)	0.85 (0.74–0.98) *	0.83 (0.69–1.00) *	0.93 (0.79–1.10)	230	7,127

OR, odds ratio; CI, confidence interval; *NHOPI*, Native Hawaiian/Other Pacific Islander

Model 1 is adjusted for infant sex and maternal age; Model 2 is adjusted for infant sex, maternal age, education, smoking, parity, and adequacy of prenatal care; Model 3 is adjusted for infant sex, maternal age, preterm birth, gestational diabetes, pregnancy-induced hypertension, and obesity.

Regions are defined according to the United Nation's Millennium Development Goals Regional Groupings (Online Resource 1).

Regions were not presented if they had too few births to perform logistic regression analyses.

Bolded font represents statistically significant results.

* p-value < 0.05,

** p-value < 0.01,

Not including the United States

p-value < .001

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