

Adverse Birth Outcomes Among Korean Women Compared to White Women in the United States

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Published online: 24 April 2011
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Abstract To evaluate the risk of adverse birth outcomes among US- and foreign-born Korean women compared to US-born white women, we used the 2004 US natality file to assess the risk of low birth weight (LBW), preterm delivery (PTD), and cesarean delivery (CD) among US-born ($N = 943$) and foreign-born Koreans ($N = 11,974$) compared to white women ($N = 25,834$). Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were calculated using regression models to assess the risk of these outcomes. US-born (aOR = 0.66, 95% CI 0.43–1.02) and foreign-born Korean women (aOR 0.86, 95% CI 0.70–1.06) exhibited a lowered risk of LBW than white women, although not statistically significant. The risks of PTD and CD among Korean women were similar to white women, regardless of Korean women's nativity status. Future research should focus on identifying the cultural factors and practices associated with decreased risk of LBW among Korean women.

Electronic supplementary material The online version of this article (doi:10.1007/s10995-011-0802-0) contains supplementary material, which is available to authorized users.

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Keywords Perinatal outcomes · Birth outcomes · Korean · Asian · Maternal nativity · US-born · Foreign-born · Low birth weight · Preterm delivery · Cesarean delivery · Retrospective design · US natality file

Introduction

Korean-Americans are a growing population in the United States (US), with over 1 million Koreans residing in the US in 2000 (0.4% of US population) compared to 69,130 in 1970 (0.03% of US population) [1]. Prior studies have noted that as Asian immigrants become more acculturated into the US culture, they adopt high risk behaviors, such as smoking and substance abuse [2, 3] and change dietary habits resulting in chronic diseases [4] and obesity [5].

Despite these findings, Korean women and their birth outcomes have not been studied extensively and the findings from the few studies that exist are inconclusive [6]. A study of Korean women in Hawaii noted that maternal nativity, whether the woman was US- or foreign-born, was not associated with more favorable pregnancy outcomes compared to whites with regard to PTD and LBW, [6] while other studies of Asian women which included Korean women found a perinatal outcome advantage associated with being foreign-born [7–9]. CD rates are increasing [10] and sometimes performed when medical indicators are not present and clear benefits over risks are not anticipated [11]. The rate of primary CD among Asian/Pacific Islander women increased by 70.2% between 1991 and 2008 [12]. CD among Korean women was examined along with other Asian subgroups, and found that Koreans (not disaggregated by nativity) were at a slightly increased CD risk compared to Chinese (aOR = 1.14, 95% CI 1.05–1.23) in 2003 [9]. Despite these findings, little is known regarding

the trends and CD risks among Korean-American women, especially by nativity status.

Studying the distribution of birth outcomes is important because these outcomes differ by nativity status among Hispanic and African-American women [13–16] and it is unknown if birth outcomes differ by nativity status among Korean-American women. This study examined whether a relationship exists between maternal nativity of Korean-American women and adverse birth outcomes including LBW, PTD, and CD using the 2004 US national natality file.

Methods

Study Population and Data Source

We performed a retrospective cohort study to assess pregnancy outcomes between US- and foreign-born Korean women compared to white women using the 2004 US national natality file. The nationality and US- or foreign-born status were obtained by self-report and documented on the birth certificate. The study subjects were Korean and white women who gave birth in the US in 2004. The women who reported multiple races or ethnicities were excluded. The exposure of interest was the nativity status of Korean women (US- or foreign-born). As a reference group, white women were randomly selected at a ratio of 2:1, with two white women selected for every Korean woman, US-born and foreign-born combined. Korean ethnicity was reported on the birth certificate in 21 states (CA, FL, HI, ID, IL, KY, MN, MO, NH, NJ, NY, OH, OK, PA, SC, TN, TX, UT, VA, WA, WV). Therefore, the study subjects were selected from these states and were restricted to singleton births.

Outcomes

The outcomes evaluated were LBW, PTD, and CD. Infant birth weight was recorded in grams on the birth certificate. For the analysis, LBW was defined as an infant weight less than 2,500 g. PTD was defined as gestational age less than 37 weeks. Method of delivery was categorized as cesarean delivery and non-cesarean delivery (vaginal/spontaneous, vaginal/forceps, vaginal/vacuum, vaginal after cesarean) as coded on the birth certificate.

Analysis

Descriptive analysis compared the demographic and pregnancy-related characteristics among the three groups—US-born and foreign-born Korean women and white women. The demographic variables evaluated were

maternal age, education, marital status, and father's race. The age variable was categorized as 12–17, 18–24, 25–34, and 35–50 years of age based on the evidence that teens younger than 17 years and women older than 35 years are at greatest risk of poor birth outcomes [17]. Educational attainment was categorized by the highest level of education achieved as noted on the birth certificate: less than high school, completed high school (or general equivalency diploma [GED]), some college, 4-year college degree, and greater than college. Marital status was categorized as married or not married. The paternal race categories were white, black, Korean, Japanese, Chinese, and other. The category “other” for the paternal race included American Indian/Alaskan Native, Hawaiian, Filipino, Asian Indian, Samoan, Vietnamese, Guamanian, and other Asian-Pacific Islander.

Pregnancy-related factors included parity, gravidity, number of prenatal care visits, Kotelchuck's adequacy of prenatal care utilization index, weight gain during pregnancy, tobacco use, alcohol use, maternal medical complications, abnormal conditions of the newborn, and congenital anomalies of the newborn. Parity and gravidity were categorized as 1, 2, or 3 or more. The number of prenatal care visits during pregnancy was categorized as no care, 1–9 visits, 10–12 visits, 13–18 visits, or 19–49 visits. The Kotelchuck's adequacy of prenatal care utilization index categories were: inadequate, intermediate, adequate, and adequate plus [18]. The amount of weight gain during pregnancy was recorded in pounds and categorized using the American College of Obstetricians and Gynecologists (ACOG) recommendations for normal weight women [19]. The categories were no weight gain, 1–24 lb, 25–35 lb, 36–69 lb, or equal to or greater than 70 lb. While weight gain during pregnancy was considered a potential confounder, pre-pregnancy weight or body mass index was not available on the birth certificate. Tobacco and alcohol use were categorized as yes or no. The variables “maternal medical complications,” “abnormal conditions of the newborn,” and “congenital anomalies of the newborn” were categorized as binary outcomes and were coded “yes” if any of the relevant conditions were recorded on the birth certificate (supplemental file).

Logistic regression was used to estimate the odds ratio (OR) and 95% confidence interval (CI) for the relationship between US- and foreign-born status of Korean women and the risk of the adverse birth outcomes of LBW and PTD compared to white women. Because CD was not a rare outcome in our sample (greater than 10% of the subjects delivered by cesarean) and logistic regression OR would overestimate the relative risk, Poisson regression was used to estimate the risk for CD outcome. Separate models were built for each outcome. The interaction between ethnicity (white or Korean) and nativity (US- or foreign-born) was

evaluated in each of the models. No interaction was found for any of the models.

Maternal age and parity were adjusted for a priori based on findings from previous studies. To evaluate for further confounding, exploratory analysis was done to assess the factors that were associated with the exposure and each outcome. The variables were adjusted for in the final model if the crude odds ratio changed by equal to or greater than 10%. LBW and CD were adjusted for age, parity, and father's race. PTD was adjusted for age, parity, education, and father's race. The variables tobacco use and alcohol use were considered as potential confounders but because of significant amounts of missing data (62.8%, 59.5%, and 58.4% among whites, US-born Koreans, and foreign-born Koreans, respectively, for both tobacco and alcohol variables), they could not be used for adjustment without introducing a significant amount of bias in the modeling. Interaction between parity and nativity and between education and nativity were evaluated for each of the models (LBW, PTD, CD). No statistically significant interactions were found. All analyses were performed using Stata version 10 (College Station, TX).

Results

The demographic characteristics and pregnancy-related factors of US-born ($N = 943$) and foreign-born ($N = 11,974$) Korean women were statistically significantly different for all maternal characteristics examined (Table 1). Foreign-born Korean mothers were more likely to be older, married, have attained more education, and have a Korean partner compared to US-born Korean mothers. When compared with white women, US-born Korean women were more likely to be older, married, have attained higher education, and less likely to have a white partner.

The US-born Koreans were more likely to be primiparous than whites or foreign-born Koreans. Foreign-born Koreans were least likely to have had prenatal care at the adequate plus level than US-born Koreans and whites. A smaller percentage of foreign-born Korean women (26.3%) gained 36 or more pounds during pregnancy compared to white women (34.4%). Among US-born and foreign-born Korean women, 1.5% and 0.8% reported use of tobacco during pregnancy, respectively, compared to 3.7% of white women, although data on tobacco use were missing for most subjects. Alcohol use during pregnancy was similar among the three groups. Foreign-born Koreans experienced the lowest percentages of maternal medical complications, abnormal conditions of the newborn, and congenital anomalies of the newborn compared to US-born Korean and white women.

Foreign-born Korean women had the smallest percentage of women delivering a LBW infant at 3.5%, followed by US-born Korean women at 3.8% and white women at 5.0%. Although not statistically significant, both US-born Korean women (aOR = 0.66, 95% CI 0.43–1.02) and foreign-born Korean women (aOR = 0.86, 95% CI 0.70–1.06) appeared to have decreased risk of LBW compared to white women.

While 6.1% of foreign-born Korean women delivered preterm, 7.6% of US-born Koreans and 9.2% of whites delivered preterm. The risk of delivering a preterm infant was not statistically significant among the groups, after adjusting for confounders.

The percentage of CD did not differ among the groups, with CD accounting for 27.0% for both US-born and foreign-born Koreans and 28.0% among whites. The CD risk did not differ among both foreign-born (aOR = 1.00, 95% CI 0.95–1.07) and US-born (aOR = 0.90, 95% CI 0.80–1.02) Korean women, after adjusting for confounders (Table 2).

Discussion

Both US-born and foreign-born Koreans had the suggestion of a reduced risk of delivering a LBW infant compared to white women in the US. The risks of PTD and CD among Korean women were similar to white women, regardless of Korean women's nativity status. Adverse outcomes among Korean women did not differ by nativity status.

Previous studies indicated that Korean women have lower rates and are at lower risk of delivering LBW infants when compared to other Asian subgroups and white women. Wong and colleagues found that 9.69% of infants born to Asian Indian women and 5.02% of infants born to Korean women were LBW [9]. In another study, the percentage of Korean women delivering a LBW infant was 4.1% compared to 4.5% among white women and 8.2% among Indian women, who exhibited the highest percentage among the groups examined [20]. With Chinese women being the reference group, Korean women's risk of delivering a LBW infant was one of the lowest with an aOR of 0.88 (95% CI 0.75–1.03) while Asian Indian women's risk was greatest with an aOR of 1.80 (95% CI 1.64–1.96) [9]. Our findings are consistent with previous studies that showed decreased rates and risk of LBW among Korean women compared to other ethnic groups [9, 20, 21].

For LBW, the explanation for the decreased risk among Korean women is not clear. It can be speculated that dietary and cultural factors related to Korean women's practices contribute to Korean women being at lower risk of LBW. Examining the factors and practices related to the

Table 1 Demographic characteristics and pregnancy-related factors of white women, US-born Korean women and foreign-born Korean women who delivered a singleton live birth in 2004 in the United States

	White ^a N = 25,834		US-born Korean ^a N = 943		Foreign-born Korean ^a N = 11,974	
	N	%	N	%	N	%
Demographic maternal characteristics						
Age (years)						
12–17	804	3.1	22	2.3	15	0.1
18–24	7,579	29.3	155	16.4	578	4.8
25–34	13,055	50.5	617	65.4	8,891	74.3
35–50	4,396	17.0	149	15.8	2,490	20.8
Education						
<HS	2,692	11.4	27	3.5	151	1.4
HS	6,684	28.4	97	12.4	1,207	11.5
Some college	6,001	25.5	122	15.6	2,011	19.2
4 year degree	4,834	20.5	253	32.3	4,486	42.7
>college	3,363	14.3	284	36.3	2,644	25.2
Marital status						
Married	18,157	70.3	796	84.4	11,213	93.6
Father's race						
White	21,903	95.5	376	48.0	2,294	20.4
Black	735	3.2	26	3.3	135	1.2
Korean	17	0.1	311	39.7	8,442	75.0
Japanese	35	0.2	13	1.7	96	0.9
Chinese	46	0.2	41	5.2	247	2.2
Other	191	0.8	17	2.2	39	0.4
Pregnancy-related factors						
Parity						
1	10,850	42.2	549	58.3	6,087	51.1
2	8,324	32.4	276	29.3	4,189	35.2
≥3	6,530	25.4	116	12.3	1,632	13.7
Gravidity						
1	8,875	34.6	454	48.3	5,040	42.4
2	7,416	28.9	260	27.7	3,969	33.4
≥3	9,382	36.5	226	24.0	2,889	24.3
Prenatal care (# of visits)						
no care	168	0.7	7	0.8	54	0.5
1–9	5,050	20.3	185	20.7	2,563	22.4
10–12	10,629	42.7	401	44.8	4,894	42.7
13–18	8,183	32.9	277	31.0	3,658	31.9
19–49	852	3.4	25	2.8	293	2.6
Adequacy of prenatal care utilization index (Kotelchuck)						
inadequate	1,639	8.5	48	6.9	815	8.6
intermediate	2,829	14.6	123	17.6	1,640	17.4
adequate	8,796	45.4	324	46.3	4,366	46.3
adequate+	6,121	31.6	205	29.3	2,620	27.8
Weight gain (pounds)						
no gain	246	1.7	7	1.3	76	1.2
1–24	3,894	26.6	123	22.3	1,866	28.2
25–35	5,464	37.3	244	44.2	2,931	44.3

Table 1 continued

	White ^a N = 25,834		US-born Korean ^a N = 943		Foreign-born Korean ^a N = 11,974	
	N	%	N	%	N	%
36–69	4,834	33.0	175	31.7	1,722	26.0
≥70	198	1.4	3	0.5	20	0.3
Tobacco use ^b						
Yes	960	3.7	14	1.5	98	0.8
States known to collect data	960	9.8	14	3.4	98	2.0
Alcohol use ^b						
Yes	59	0.2	1	0.1	16	0.1
States known to collect data	59	0.6	1	0.3	16	0.3
Medical complications						
Yes	1,886	9.3	52	7.0	583	5.9
Abnormal conditions of the newborn						
Yes	953	4.8	43	5.9	370	3.8
Congenital anomalies of the newborn						
Yes	227	1.1	7	1.0	66	0.7

^a Some column numbers may not add to totals due to missing data

^b For tobacco and alcohol variables, data were missing for 62.8% among whites, 59.5% among US-born Koreans, and 58.4% among foreign-born Koreans

Table 2 Outcomes of low birth weight, preterm delivery, and cesarean delivery of white women, US-born Korean women and foreign-born Korean women who delivered a singleton live birth in 2004 in the United States

Outcome	White N = 25,834		US-born Korean N = 943				Foreign-born Korean N = 11,974			
	N	%	N	%	Crude OR (95% CI)	Adjusted OR (95% CI)	N	%	Crude OR (95% CI)	Adjusted OR (95% CI)
LBW	1,291	5.0	36	3.8	0.65 (0.43–0.97)	0.66 (0.43–1.02) ^a	419	3.5	0.72 (0.64–0.81)	0.86 (0.70–1.06) ^a
PTD	2,320	9.2	70	7.6	0.68 (0.50–0.94)	0.88 (0.63–1.22) ^b	713	6.1	0.61 (0.55–0.67)	0.87 (0.74–1.03) ^b
CD	7,210	28.0	252	26.9	0.89 (0.79–1.01)	0.90 (0.80–1.02) ^c	3,215	27.0	0.95 (0.92–0.99)	1.00 (0.95–1.07) ^c

^a LBW adjusted for maternal age, parity, and father's race

^b PTD adjusted for maternal age, parity, education, and father's race

^c CD adjusted for maternal age, parity, and father's race

reduced risk of LBW among Koreans is a future research need.

Lower rates of PTD were observed in previous studies among Korean women compared to white women and other Asian subgroups [20]. Among different Asian subgroups, Hawaiians exhibited the highest percentage of PTD (14.33%) and Koreans the lowest (7.44%) [9]. Compared to Chinese women, Korean women had a similar risk of PTD with an aOR of 1.07 (95% CI 0.95–1.19) [9]. A descriptive analysis showed that Korean women had the lowest percentage of women delivering preterm (6.7%) among the Asian subgroups examined, while the highest percentage was observed among Cambodian women (16.2%) [20]. In contrast to these prior studies, we found no association with Korean ethnicity and risk of PTD. However, this may be due to lack of statistical power and future

studies may explore this outcome combining multiple years of data for a larger sample size.

Despite increasing CD rates in the US, [10, 11] little is known about the CD rates of Korean women in the US compared to white women. In comparison to the primary CD rate for white women, the CD rate was 19% (95% CI 16–23%) higher for Asian/Pacific Islander women [12]. Korean women exhibited a slightly increased risk of CD compared to Chinese women (aOR = 1.14, 95% CI 1.05–1.23) [9]. Given that both Korean groups (US- and foreign-born) had lower percentages of maternal medical complications (5.9% among foreign-born Koreans and 7.0% among US-born Koreans compared to 9.3% among white women), medical indications may not explain the high percentages of Korean women having CD and the similar risks observed. The minimal data on Korean

women and CD, especially when not explained by medical or obstetrical indications [10] merits further research.

Limitations

Our study had several limitations. The literature indicates that some birth certificate data are valid and reliable while others are not [22–25]. Birth weight, gestational age, and methods of delivery—the outcomes of interest for this study—are valid and reliably measured on the birth certificate [24, 26]. The limitation in using birth certificate data specific to our study stems from the fact that states do not collect the same information on the birth certificate. This resulted in our study being restricted to the 21 states that separated Korean ethnicity from Asian race and our results may not be generalizable to the US population. Some variables, such as tobacco and alcohol use during pregnancy, are not collected in all states and resulted in a significant amount of missing data. Therefore, we did not adjust our multivariate models for tobacco and alcohol use and this may have resulted in residual confounding for risk of LBW and PTD [27, 28]. Lastly, some information obtained on the birth certificate is self-reported. As with any self-reported data, recall and response biases and misclassification are possible.

Conclusion

LBW, PTD, and CD outcomes did not differ by nativity status among Korean-American women. Korean women, regardless of nativity status, exhibited a lowered risk of LBW than white women, although not statistically significant. PTD and CD risks among Koreans were similar to whites, regardless of Korean women's nativity status. Our findings add to the limited existing data on adverse pregnancy outcomes among Korean women in the US and highlight the need for further research to identify the factors associated with the decreased risk of LBW among Korean women. Identification of protective factors that decrease the risk of adverse birth outcomes may be useful in developing prevention strategies for other perinatal populations and will help inform public health policies related to maternal and child health.

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