Perinatal Outcomes in Two Dissimilar Immigrant Populations in the United States: A Dual Epidemiologic Paradox

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ABSTRACT. ***Objective.*** **Previous studies have addressed perinatal outcomes in Hispanic, black, and white non-Hispanic women and demonstrated that although foreign-born Mexican American women have many demographic and socioeconomic risk factors, their rates of low birth weight (LBW) infants and infant mortality are similar to those of white women. This phenomenon has been termed an epidemiologic paradox. There have been no population-based studies on women of Asian Indian origin, a relatively new, highly educated, and affluent immigrant group that has been reported to have a high rate of LBW infants. The objective of this study was to define the sociodemographic risk profile and perinatal outcomes in women of Asian Indian birth and to compare these outcomes to foreign-born Mexican American and US-born black and white women.**

Methods. **The vital records for self-reported foreign-born Asian Indian (0.8%) and Mexican women (26.7%) and US-born black (31.2%) and white women (31.2%) were extracted from California's 1 622 324 births, 1995–1997. Sociodemographic risk profiles; the percentage of LBW, very low birth weight (VLBW), prematurity, and intrauterine growth retardation (less than third percentile); and percentage of fetal, neonatal, and postneonatal death rates were compared. Logistic models were used to estimate the importance of selected sociodemographic and medical factors to the prediction of LBW infants in each racial/ethnic group.**

Results. **When compared with whites, US-born blacks and foreign-born Mexican mothers were at increased risk for adverse perinatal outcomes on the basis of higher levels of inadequate prenatal care, teen births, Medi-Cal paid delivery, and lower levels of maternal and paternal education. Foreign-born Asian Indian mothers had good prenatal care, were rarely teenagers, had dramatically higher levels of both maternal and paternal education, and had the lowest percentage of deliveries paid for by Medi-Cal. Black infants had the highest rates of prematurity; intrauterine growth retardation; LBW; and fetal, neonatal, and postneonatal mortality. Paradoxically, despite their high-risk profile, Mexicans did not have elevated levels of LBW or neonatal mortality. Conversely, Asian Indian infants, although seemingly of low sociodemographic risk, had high levels of LBW, growth retardation, and fetal mortality. Logistic regression analysis of independent risk factors for giving birth to an LBW infant showed higher maternal education, early access to prenatal care, and having private insurance to be protective in white non-Hispanic and black but not in Asian Indian and Mexican-born women.**

Conclusions. **Despite their high socioeconomic status and early entry into care, foreign-born Asian Indian women have a paradoxically higher incidence of LBW infants and fetal deaths when compared with US-born whites. Factors that protect from giving birth to an LBW infant in white women were not protective among Asian Indian women. Current knowledge regarding factors that confer a perinatal advantage or disadvantage is unable to explain this new epidemiologic paradox. These findings highlight the need for additional research into both epidemiologic and biological risk factors that determine perinatal outcomes.** ***Pediatrics*** **2003;111:e676–e682. URL: http://www.pediatrics.org/cgi/content/full/111/6/e676;** ***perinatal outcomes, epidemiologic paradox, low birth weight, neonatal mortality.***

ABBREVIATIONS. SES, socioeconomic status; LBW, low birth weight; VLBW, very low birth weight; FMR, fetal mortality rate; NMR, neonatal mortality rate; PNMR, postneonatal mortality rate.

The population of the United States is becomingly increasingly diverse with an increase in the number of individuals of Hispanic and Asian origin.[1,2] More recently, the growth of the high-technology industry in the United States has been associated with an increase in the Asian Indian population, a relatively new immigrant group in the United States. In 1989, there were 2344 Californian births to mothers of Asian Indian origin. By 1997, the number had almost doubled to 4459. Of these, only 154 (3.5%) were to Asian Indian women who were born in the United States. Previous studies of immigrants to the United States have demonstrated perinatal outcomes that are much better then one would expect based on their socioeconomic status (SES).[3–7] Also, perinatal outcomes, irrespective of race and ethnicity, have been shown to be better in immigrant groups when compared with that in subsequent generations.[3,4,6] However, a study by Madan et al[8] showed that infants who were born to mothers of Asian Indian origin, although largely of high SES, tended to have a lower mean birth weight and head circumference when compared with their white cohorts.

In an attempt to increase our understanding of risk factors associated with poor perinatal outcomes and develop strategies to reduce disparities, studies have

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focused on racial and ethnic differences in perinatal outcomes particularly among black and Hispanic populations as compared with white non-Hispanics. In general, adverse perinatal outcomes in black women are twice as high as in white, and a racial differential persists even after adjusting for traditional socioeconomic risk factors such as education and income.[9–13] Conversely, Mexican-born Hispanic women, despite being at increased risk by virtue of lower SES status, have been shown to have perinatal outcomes that are comparable to white women. This phenomenon has been termed an "epidemiologic paradox."[4,14–19] Little is known about the perinatal experience of Asian Indian mothers, a high-SES group that may have perinatal outcomes that are less desirable than expected. The purpose of this study was to compare demographic and socioeconomic risk factors and perinatal outcomes of California's foreign-born Asian Indian and Mexican mothers to those found in US-born white non-Hispanic and black women during the period 1995–1997. To the best of our knowledge, this analysis is the only population-based data regarding the birth outcomes of Asian Indian women in the United States.

METHODS

This study is based on data from the California linked infant birth/death certificate files for 1995–1997. Self-reported race and ethnicity were determined from the birth certificate. Data were collected on low birth weight ([LBW]; <2500 g); very low birth weight ([VLBW]; <1500 g); intrauterine growth retardation, defined as a birth weight less than the third percentile using a growth curve generated from infants born to white non-Hispanic parents in 1994; preterm births (<37 completed weeks of gestation); fetal deaths per 1000 births; neonatal deaths (death before 28 days of age per 1000 live births); and postneonatal deaths (28 days to 1 year). Demographic and socioeconomic indicators included maternal age (≤19, 20–34 years, and ≥35 years), maternal and paternal education (≤high school, high school, some college, and completion of college), initiation of prenatal care (first trimester, second trimester, third trimester, and no prenatal care or unknown), and payer for delivery (private insurance, medicaid [Medi-Cal], self-pay, other pay, or unknown). We also assessed the incidence of certain complications of pregnancy (toxemia, hypertension, diabetes, and placental abruption/previa). Differences among the 4 population groups' demographics, pregnancy complications, and perinatal outcomes were compared using the χ^2 test. For identifying risk factors for LBW in singleton live-born infants, separate logistic analyses were run for each of the 4 groups using SAS for Windows, Version 8 (SAS Institute, Cary, NC).

RESULTS

There were a total of 1 622 324 births in California during the study period. Our sample of 12 899 (0.8%) foreign-born Asian Indians, 433 825 (26.7%) foreign-born Mexican Americans, 104 888 (6.5%) US-born blacks, and 506 364 (31.2%) US-born whites accounted for 65.2% of these births. Of the remaining, 408 (0.03%) were born to US-born mothers of Asian Indian origin and 221 132 (13.6%) were born to US-born Mexican American mothers. Of the remaining 342 807 (21.1%), 149 753 (9.2%) were born to Asian, 112 289 (6.9%) were born to non-Mexican Hispanic, and 80 765 (5%) were born to mothers of other race/ethnicities. Because of the small number of births to US-born Indian mothers, our analysis was limited to foreign-born women of Indian origin.

Table 1 shows the parental and perinatal characteristics and complications of pregnancy for the 4 racial/ethnic groups. When compared with US-born white women, both the foreign-born Mexican mothers and the US-born black mothers have a more adverse risk profile in terms of the percentage of teen births, the incidence of no or only third-trimester prenatal care, the percentage of mothers and fathers with less then a high school education, and the percentage of deliveries paid for by Medi-Cal. In sharp contrast, foreign-born Asian Indians are similar to whites in terms of prenatal care (3.4% Indian vs 3.5% whites have either no prenatal care or care initiated

TABLE 1. Selected Characteristics and Pregnancy Complications of Foreign-Born Indian and Mexican Mothers and US-Born Non-Hispanic Black and White Mothers—California Births, 1995–1997

Characteristic (%)	US-Born White (n = 506 365)	Foreign-Born Indian (n = 12 899)	Foreign-Born Mexican (n = 433 825)	US-Born Black (n = 104 888)
Maternal age				
≤19 y	7.9	0.9†	11.1†	19.4†
≥35 y	18.7	10.6†	1.0†	10.8†
Prenatal care initiation				
First trimester	86.2	85.8	72.6†	76.7†
Third trimester/none/unknown	3.5	3.4	7.1†	6.1†
Maternal education				
≤High school	10.1	7.8†	68.9†	20.7†
≥College graduate	31.1	48.6†	2.6†	9.9†
Paternal education				
≤High school	7.2	7.4	61.1†	10.5†
≥College graduate	32.6	59.5†	3.3†	9.2†
Payer for delivery				
MediCal (Medicaid)	23.3	18.1†	72.3†	55.4†
Pregnancy complications				
Hypertension	0.4	0.2	0.2†	0.6*
Preeclampsia or eclampsia	2.9	2.1	1.8	2.7
Diabetes	1.7	1.9†	1.9†	1.4†
Placenta previa or abruption	0.8	0.8	0.5†	0.8

Data source: California Department of Health Services, Birth Cohort File, 1995–1997.
Includes births occurring in California with known birth weight at least 500 g.
* Compared with US-born white mothers, χ^2 test significant at 5% level ($P < .05$).
† Compared with US-born white mothers, χ^2 test significant at 1% level ($P < .01$).

in the third trimester), are rarely teenagers (0.9% Indian vs 7.9% white), have dramatically higher levels of both maternal and paternal education (59.5% of Indian vs 32.6% of white fathers have completed college), and the lowest percentage of deliveries paid for by Medi-Cal (18.1% vs 23.3% in whites).

Table 1 also lists the percentage of complications reported on the birth certificate. With the exception of diabetes, both Indian-born mothers and Mexican-born mothers do not seem to have an adverse complication profile when compared with US-born whites. However, in US-born blacks, the incidence of hypertension is higher and diabetes lower than in US-born whites.

Pregnancy outcomes for the 4 groups are shown in Table 2. White mothers had the best perinatal outcomes, and black mothers had the poorest outcomes. The results in Table 2 also reveal a dual paradox. Asian Indian women, although having a social risk profile that is similar to white women (Table 1), have adverse obstetrical outcomes that more closely approximate black women, the group with the highest sociodemographic risk profile. Conversely, Mexican women, who have a risk profile for adverse perinatal outcomes that resembles black women (Table 1), have obstetrical outcomes that approximate those of white women, the group with the most favorable sociodemographic risk profile. Compared with the group with the best perinatal outcomes (white women), Indian women have a significantly ($P < .01$) higher incidence of prematurity, a lower mean birth weight, and a greater percentage of LBW and VLBW infants. When compared with a US-born white non-Hispanic third-percentile reference standard, 6.8% percent of Asian Indian infants had intrauterine growth retardation, a rate similar ($P = .12$) to the 7.2% seen in black infants. The fetal mortality rate (FMR) in Asian Indian mothers was higher then in whites (6.6 vs 3.9; $P < 0.01$) and similar to that of black mothers (6.6 vs 7.1; $P = .52$). Despite having a more favorable sociodemographic risk profile, Asian Indian mothers had an FMR that was higher than the FMR of Mexican mothers (6.6 vs 4.5; $P < .01$).

The neonatal mortality rate (NMR) was highest for blacks (4.9 per 1000) and similar in infants born to white (2.7), Mexican (2.6), and Asian Indian mothers (2.9). An Indian NMR similar to whites (2.9 vs 2.7; $P = .56$) was somewhat unexpected given their high percentage of LBW (9.1%). Analysis of birth weight-specific mortality provided an explanation for this finding. Compared with whites, Asian Indian infants had a more favorable birth weight-specific neonatal mortality. Although their >2500 g mortality was higher (1.03 vs 0.89 per 1000 >2500 g infants), their 500 to 1499 g and 1500 to 2499 g mortalities were considerably lower (151.1 vs 162 and 5.1 vs 10.3, respectively). On the balance, we estimate that if US-born white non-Hispanic infants had the birth weight-specific mortalities seen in Asian Indian infants, then their NMR would be decreased from 2.7 to 2.2, a savings of 0.5 deaths per 1000 live births (full details at 250-g intervals for 1995–1997 and for 1992–1997 available on request).

Table 2 also shows the postneonatal mortality (PNMR) for the 4 groups. Compared with whites (PNMR = 1.9), Mexican infants had a lower (1.6; $P < .01$) and black infants a higher (4.5; $P < .01$) PNMR. Infants born to Asian Indians had the lowest postneonatal mortality of the 4 groups (1.3). Although this finding is in keeping with their sociodemographic risk profile, because of the small number of Indian births, it did not reach statistical significance.

Birth weight distributions for the 4 racial/ethnic groups are presented in Fig 1A. For more precisely comparing birth weights, analyses were limited to singleton live births. The weight distribution of singletons born to Indian and black mothers were similarly positioned on the birth weight axis with mean birth weights of 3185 and 3180 g, respectively. These distributions were shifted relative to the distribution of white infants toward the lower end of the scale, whereas the distribution of Mexican infants (mean

TABLE 2. Birth Outcomes for Foreign-Born Indian and Mexican Mothers and US-Born Non-Hispanic Black and White Mothers-California Births, 1995–1997

Birth Outcome	US-Born White (n = 506 365)	Foreign-Born Indian (n = 12 899)	Foreign-Born Mexican (n = 433 825)	US-Born Black (n = 104 888)
Birth characteristic				
Mean gestational age* (wk)	38.9	38.6‡	38.8‡	38.3‡
% Prematurity* (<38 wk)	17.3	19.7‡	18.2‡	24.8‡
Mean birth weight (g)	3,422	3,158‡	3,383‡	3,139‡
% LBW (≥2500 g)	5.7	9.1‡	5.2‡	12.5‡
% VLBW (≥1500 g)	1.0	1.4‡	1.0	2.7‡
% Small for gestational age*†	3.0	6.8‡	3.3‡	7.2‡
Mortality rates (per 1000)				
Fetal (per total births)	3.9	6.6‡	4.5‡	7.1‡
Neonatal (per live births)	2.7	2.9	2.6	4.9‡
500–1499	162.0	151.1	151.5	136.0‡
1500–2499	10.3	5.1	13.4‡	7.8
≥2500	0.89	1.03	0.85	1.17
Postneonatal (per 28-d survivors)	1.9	1.3	1.6‡	4.5‡

Data source: California Department of Health Services, Birth Cohort File, 1995–1997.
Includes births occurring in California with known birth weight at least 500 g.
* Does not include infants with gestational age <20 weeks or >45 weeks or missing.
† Defined as ≤ third percentile birth weight, using non-hispanic white mothers as reference.
‡ Compared with US-born white mothers, χ^2 test significant at 1% level ($P < .01$).

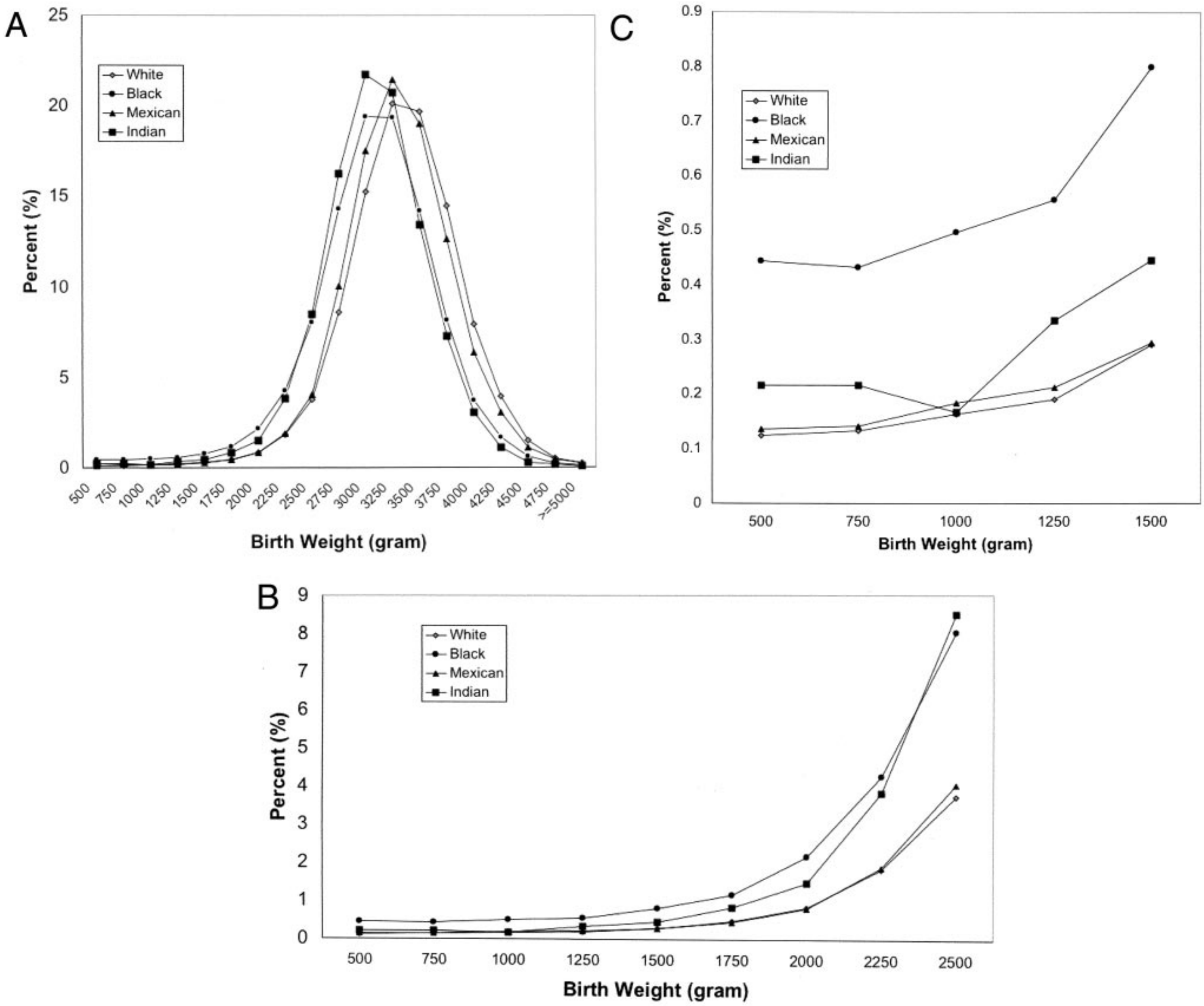

Fig 1. Birth weight distribution for foreign-born Indian and Mexican mothers and US-born non-Hispanic black and white mothers—California live singleton births, 1995–1997 . A, 500 to 3000 g. B, 1500 to 2500 g. C, 500 to 1500 g. Data source: California Department of Health Services, Birth Cohort File, 1995–1997. Includes live singleton births occurring in California with known birth weight at least 500 g.

birth weight: 3406 g) was similar to that of white infants (mean birth weight: 3461 g). Figure 1B shows differences in the tails of the distributions. Below 2500 g, the weight distributions for Mexican and white infants were very much the same, whereas the distributions for black and Indian infants showed higher percentages of LBW and VLBW infants. The distributions of black and Indian infants are very similar between 2500 g and 2250 g and then begin to diverge. Although the percentage of VLBW Indian infants in the tail of the distribution is greater ($P <$ .001) than for Mexicans and whites (0.93% vs 0.67% and 0.61%, respectively), black women had the greatest percentage of VLBW infants (1.93%; Fig 1C).

Table 3 shows the results of the multiple regression analysis of independent risk factors for LBW in singleton live borns for each of the 4 racial/ethnic groups. The groups differed in the extent to which the various risk factors predicted LBW. Female gender, a biological determinant of size at birth, predicted LBW in all 4 groups. Teen pregnancy was associated with a decrease in LBW for blacks and an increase in LBW in the other 3 groups. The odds of LBW in teenage mothers were significantly higher in Indian than in Mexican or white women. Maternal age ≥35 was a risk factor for LBW in all 4 groups. Maternal education was an important predictor of LBW for black and white women but not in Indian or Mexican mothers. The percentage of LBW infants was significantly increased in white and black mothers who did not complete high school and significantly decreased in white and black mothers with greater than a high school education. However, in both the highly educated Indian women and the less formally educated Mexican mothers, there was no relationship between level of schooling and risk for LBW. Lack of paternal completion of high school, another marker for compromised SES,[13] was a risk factor for LBW in Mexican and white infants but not in the black or Indian infants. Although some paternal college education was protective only in US-born blacks and whites, a paternal college degree was protective for all 4 groups.

Beginning prenatal care in the second trimester

TABLE 3. Odds Ratios and 95% Confidence Intervals for LBW for Foreign-Born Indian and Mexican Mothers and US-Born Non-Hispanic Black and White Mothers*—California Live Singleton Births, 1995–1997

Characteristic	US-Born White (n = 488 314)	Foreign-Born Indian (n = 12 542)	Foreign-Born Mexican (n = 424 219)	US-Born Black (n = 100 715)
Infant gender				
Male	1.00	1.00	1.00	1.00
Female	1.16 (1.12–1,19)	1.19 (1.04–1.36)	1.03 (1.00–1.07)	1.22 (1.17–1.27)
Maternal age				
≤19y	1.02 (0.96–1.07)	3.38 (2.06–5.51)	1.43 (1.37–1.50)	0.80 (0.75–0.85)
20–34y	1.00	1.00	1.00	1.00
≥35y	1.37 (1.32–1.42)	1.28 (1.04–1.58)	1.37 (1.31–1.44)	1.56 (1.47–1.67)
Maternal education				
<High school	1.23 (1.17–1.29)	0.95 (0.71–1.28)	0.97 (0.93–1.01)	1.23 (1.16–1.30)
High school	1.00	1.00	1.00	1.00
Some college	0.92 (0.88–0.96)	1.04 (0.84–1.30)	1.06 (0.99–1.14)	0.89 (0.84–0.94)
College	0.80 (0.83–0.92)	1.01 (0.81–1.26)	1.08 (0.97–1.20)	0.84 (0.76–0.92)
Unknown	1.34 (1.15–1.57)	0.84 (0.36–1.94)	0.91 (0.78–1.05)	1.12 (0.94–1.33)
Paternal education				
<High school	1.17 (1.11–1.24)	0.83 (0.61–1.14)	1.05 (1.01–1.10)	1.01 (0.94–1.08)
High school	1.00	1.00	1.00	1.00
Some college	0.92 (0.88–0.96)	0.88 (0.69–1.12)	0.93 (0.86–1.00)	0.92 (0.87–0.98)
College	0.84 (0.80–0.88)	0.75 (0.60–0.94)	0.89 (0.81–0.99)	0.84 (0.76–0.92)
Unknown	1.25 (1.17–1.32)	0.83 (0.46–1.48)	1.25 (1.18–1.33)	1.14 (1.07–1.21)
Prenatal care initiation				
First trimester	1.00	1.00	1.00	1.00
Second trimester	1.12 (1.07–1.17)	0.86 (0.68–1.08)	0.93 (0.90–0.97)	1.11 (1.05–1.18)
Third trimester/none/unkown	1.79 (1.68–1.90)	1.42 (1.02–1.98)	1.16 (1.10–1.23)	1.72 (1.60–1.85)
Payer for delivery				
MediCal (Medicare)	1.31 (1.26–1.36)	0.96 (0.79–1.17)	1.12 (1.08–1.17)	1.29 (1.23–1.36)
Private insurance/HMO	1.00	1.00	1.00	1.00
Self-pay	1.30 (1.19–1.42)	1.33 (0.89–2.01)	1.32 (1.22–1.44)	1.99 (1.71–2.31)
Other payer	1.09 (1.01–1.18)	1.13 (0.48–2.69)	1.31 (1.06–1.62)	0.99 (0.88–1.12)
Unknown	2.39 (1.90–3.00)	0.39 (0.05–2.87)	1.57 (1.25–1.97)	2.51 (1.88–3.36)
Pregnancy complication				
Hypertension	2.63 (2.28–3.03)	2.77 (0.93–8.27)	3.65 (2.96–4.49)	1.86 (1.49–2.31)
Diabetes	0.85 (0.76–0.95)	0.90 (0.64–1.28)	0.89 (0.80–0.99)	0.90 (0.76–1.08)
Preeclampsia/eclampsia	4.90 (4.66–5.16)	7.55 (5.75–9.89)	6.28 (5.91–6.67)	3.80 (3.47–4.15)
Placenta previa/abrupt	9.66 (8.94–10.44)	4.30 (2.62–7.06)	9.63 (8.70–10.65)	7.75 (6.66–9.02)

Data source: California Department of Health Services, Birth Cohort File, 1995–1997.
Includes births occurring in California with known birth weight at least 500 g.
*Logistic regression stratified by maternal race/ethnicity/nationality with 95% confidence intervals shown in parentheses.

was an LBW risk factor for US-born blacks and whites but not for Mexican or Asian Indian mothers. However, no care or only third-trimester prenatal care was a risk factor in all ethnic groups.

Payer for delivery is another reflection of SES. Relative to the rates seen in mothers with private health care insurance, the risk for LBW was increased in US-born white and black mothers and in Mexican-born mothers whose deliveries were paid by Medi-Cal, self-pay, and unknown payer. However, payer for delivery was not a risk factor for LBW in Asian Indian mothers.

Maternal complications of pregnancy also showed some differences across the 4 groups. Hypertension predicted LBW in black, white, and Mexican mothers but not in Asian Indian-born mothers. Diabetes was associated with a decreased risk for LBW but only in Mexican-born and white non-Hispanic mothers. Preeclampsia and placenta previa/abruption were risk factors for LBW in all ethnic groups.

DISCUSSION

Analysis of perinatal outcomes and the risk factors associated with poor outcomes is important for appropriate allocation of health care funds and for directing health education and research toward improving these outcomes. Because currently identified risk factors do not sufficiently explain outcomes in different ethnic populations, an analysis of the differential effect of risk factors that affect perinatal outcome in various ethnic groups will help in the design of future preventive and therapeutic strategies to decrease infant mortality and morbidity.

The results of this study confirmed previous reports of the increased perinatal risk for US-born black women and the relative perinatal advantage for foreign-born Mexican Americans.[4,9,20] The increased risk for black women has been attributed in part to poor demographics and SES as assessed by traditional markers such as maternal education, adequacy of prenatal care, and medical insurance status.[9,11,13,20–38] Epidemiologists continue to be perplexed by what has been termed "an epidemiologic paradox," the relatively good outcome of infants delivered to foreign-born Mexican American women who at least theoretically are at risk for a poor outcome based on a considerable socioeconomic disadvantage. Several reasons, including group differences in prenatal health behaviors, diet, psychosocial factors, social support, a healthy worker effect,[38–45] a lower incidence of preterm births,[19] and the absence of unidentified nontraditional risk factors,[46] have been proposed to explain this phenomenon. The current study describes yet another epidemiologic paradox. Foreign-born Asian Indian women, despite being at considerable socioeconomic advantage than foreign-born Mexican Americans, have a marked perinatal disadvantage with a relatively higher FMR and a higher incidence of prematurity, intrauterine growth retardation, and LBW infants. On the basis of their high percentage of LBW, one would also predict an increased NMR. However, the more favorable birth weight-specific mortality of Asian Indian infants (to be discussed below) compensated for their increased percentage of LBW, resulting in an NMR that was similar to that of the white and Mexican infants. In the postneonatal period, nearly half of the deaths are attributable to potentially preventable causes such as sudden infant death syndrome, infections, and injuries.[47] Factors closely linked to SES, such as lifestyle, health behaviors, and access to primary care, play a major role in the cause of postneonatal death[48] As would be expected on the basis of their sociodemographic risk profile, Indian infants had a low postneonatal mortality. Logistic regression analyses were used to compare the relative importance of factors that predict LBW in the 4 racial/ethnic groups. We found that factors associated with socioeconomic advantage, such as higher maternal or paternal education, early entry into prenatal care, and health insurance, that conferred protection from giving birth to an LBW infant in the white population were not protective in the Asian Indian population. We also found that the incidence of pregnancy-induced hypertension, a condition associated with LBW infants, was not increased in the Asian Indian women. One possibility is that the severity of pregnancy-induced hypertension among Asian Indian women may be much higher than is seen in other populations. However, this is unlikely because we did not observe an increased incidence of eclampsia.

In a smaller study of 1539 infants, Madan et al[8] showed that term Asian Indian infants are on an average 300 g smaller than white infants. Our population-based analysis confirms the LBW in Indian infants and demonstrates that although Asian Indian mothers have a higher incidence of prematurity (19.7% vs 17.3% in white non-Hispanics), the >2-fold increase in growth retardation (6.8% vs 3%) is the major source of their increased LBW.

Some investigators have questioned the validity of using the LBW cut point of <2500 g as a marker for increased mortality risk in multiethnic populations.[49–51] Although the mean birth weight varies in different racial and ethnic groups, infants with the lowest mortality rate are those who are closer to the mean birth weight for their group. The most important determinant in birth weight-specific mortality elevation is the distance (in standard deviation) from their mean birth weight. Because the mean birth weight in black infants is 200 to 250 g less than in white infants, a 1500-g black infant will be closer to the black mean birth weight and will therefore have a lower birth weight-specific mortality than a 1500-g white infant.[52] The same phenomenon has been demonstrated when comparing "small" Pakistani infants with the "larger" Norwegian infants.[53] We found the same pattern of increased LBW survival in Asian Indian infants. The more favorable birth weight-specific mortality of small infants compensated for the high percentage of LBW (9.1%), resulting in an NMR that was similar to white infants (2.9 vs 2.7; $P = .56$). An important issue is why Asian Indian women have so many small infants. Perhaps the answer lies in the observation that Indian women had not only a higher incidence of LBW infants but also a high fetal mortality that was similar to that of US-born black women (6.6 vs 7.1; $P = .52$). We hypothesize that unidentified perinatal risk factors that operate in this population as well as factors related to maternal health compromise fetal growth and well-being, resulting in an increase in both FMR and the incidence of growth retardation.

The observed outcomes in foreign-born Asian Indian and Mexican women cannot be explained by traditional risk factors such as socioeconomic or demographic factors, extent of prenatal care, or the incidence of several important maternal perinatal complications. We did not analyze factors such as maternal diet[45]; maternal height and weight, especially birth weight[54,55]; acculturation and social support[39,56–58]; prenatal attitude to pregnancy; or prenatal stress,[38] all of which have been previously shown to affect birth weight. Even with these limitations, the dual paradox presented in this study highlights the need for continued research directed at understanding the mechanisms by which social factors influence perinatal outcomes. The unexpectedly high fetal mortality and intrauterine growth restriction in Asian Indian mothers, despite a higher SES, stresses the importance of continued research into as-yet-unidentified factors that influence the growth and well-being of the fetus and the newborn.

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