**Racial and Ethnic Disparities in Obstetric Outcomes and Process Measures in the Northwest Region of the United States**

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**Abstract**

*Objective*: To investigate racial and ethnic disparities in obstetric outcome and process measures in the Northwest Region of the United States.

*Methods*: The study population included patients with singleton, livebirths (23+0 - 42+6 weeks’ gestation) between January 1, 2017 and June 30, 2019 at 17 hospitals in Washington State. The exposure was self-reported race/ ethnicity. Outcome measures included cesarean delivery in the nulliparous term singleton vertex (NTSV) population, 3rd/ 4th degree laceration, severe maternal morbidity (SMM), and 30-day maternal readmission after delivery. Process measures included absent or minimal prenatal care, Maternal and Fetal Medicine specialist care for high-risk pregnancies, episiotomy, epidural administration, and antenatal steroid administration for preterm birth (23+0-36+6 weeks’ gestation). Poisson regression models were used to calculate adjusted risk ratios (aRRs) and 95% confidence intervals.

*Results*: The study included 58,439 patients with a mean age of 30.1 years (standard deviation = 5.5 years). Compared with Non-Hispanic (NH) White patients, NH Black patients had the greatest increased risk of NTSV cesarean delivery and 30-day maternal readmission (aRR 1.43, 95% CI 1.28, 1.61; aRR 1.90, 95% CI 1.49, 2.41, respectively). NH Asian patients had increased risk of NTSV cesarean delivery, 3rd/4th degree laceration, and episiotomy (aRR 1.25, 95% CI 1.16, 1.33; aRR 2.32, 95% CI 1.95, 2.55; aRR 1.38, 95% CI 1.18, 1.60, respectively). Hispanic/ Latinx, NH Indigenous, and NH Multiple Race patients had increased risk of SMM (aRR 1.48, 95% CI 1.20, 1.86; aRR 2.11, 95% CI 1.23, 3.54; aRR 1.76, 95% CI 1.01, 3.24, respectively). Hispanic/ Latinx patients with preterm birth were less likely to receive antenatal steroids (RR 0.74, 95% CI 0.63, 0.86).

*Conclusions*: Non-White patients, compared with White patients, in the Northwest, United States are at greater risk of adverse obstetric outcomes. Further, process measures in obstetrics care differ by race/ ethnicity in this region.

**Introduction**

Racial and ethnic disparities in adverse obstetric outcomes represent a significant public health problem in the United States1–3. Non-Hispanic (NH) Black and Indigenous persons had a 3.3 and 2.5 times greater risk, respectively, of pregnancy-related mortality, and 2.1 and 1.7 times greater risk, respectively, of severe maternal morbidity (SMM), compared to NH White persons3,4. Research has also demonstrated racial/ ethnic disparities in obstetric process measures, which are treatments and interventions that aim to reduce likelihood of adverse outcomes or prevent worsening of conditions5,6. Since more than 65% of maternal deaths are preventable7, better understanding of racial/ethnic disparities in obstetric process measures, particularly those that are immediately actionable, has the potential to promote equity in obstetric outcomes.

The risk of adverse obstetric outcomes and sub-optimal process measures may vary by geographical location8–10. Racial/ ethnic disparities in obstetric outcomes, which may also vary by geographic region, as well as differences in racial/ethnic compositions of populations may partially explain these regional differences. Therefore, accurate accounts of region-specific racial/ ethnic disparities in obstetric outcomes and process measures are needed. To address paucity of large-sample, contemporary studies addressing this issue, we examined racial/ethnic disparities in obstetric outcomes and process measures in Washington State using data from a perinatal quality improvement collaborative.

**Methods**

Study Setting: This retrospective cohort study used clinical data on births (23+0-42+6 weeks’ gestation) delivered between January 1, 2017 and June 30, 2019 at 17 hospitals participating in the Obstetrical Care Outcomes Assessment Program (OB COAP), an ongoing perinatal quality improvement collaborative in the Northwest Region of the United States. OB COAP collects medical record data for patients giving birth at 20 weeks’ gestation or greater. Participating sites include hospitals in urban, suburban, and rural settings with neonatal levels of care I-IV. The OB COAP dataset covers approximately a third of births in Washington State.

Study Population: Eligibility was restricted to singleton, livebirths. Analyses of 3rd/4th degree laceration and episiotomy were restricted to vaginal deliveries at term (n = 38,731). Analysis involving cesarean delivery was restricted to nulliparous, singleton, term, vertex (NTSV) deliveries (n = 20,856). Analysis involving antenatal steroid use was restricted to preterm (23+0-36+6 weeks’ gestation) births (n = 3,571). Analysis involving Maternal-Fetal Medicine (MFM) specialist care was restricted to high-risk births (n = 9,342), defined as having at least one of the following characteristics: maternal age of 40 years or greater, BMI at admission for delivery >= 40 kg/m2, illicit substance use during pregnancy, pre-pregnancy diabetes, pre-pregnancy hypertension, history of preterm birth, and/or placenta accrete or percreta indication for cesarean delivery. OB COAP research has been determined as exempt from Institutional Review Board review by the Western Institutional Review Board11.

Data Collection: Data collection was initiated at admission for labor and concludes with possible documentation of readmission within 30 days of discharge. Clinical patient data were acquired through direct uploading from electronic health records where possible and through hand abstraction by trained data abstractors. Data underwent real-time data quality and validation checks, both at the hospital and aggregate level— minimizing the risk of misclassification due to data entry errors.

Exposure and Outcome: The exposure of interest was self-reported race/ ethnicity. Self-reported race/ ethnicity was classified into the following: NH White/Caucasian, NH Black/African American, NH Asian, NH Indigenous/First Persons, NH Hawaiian/ Pacific Islander, NH Multiple Race, NH Other, and Hispanic/Latinx. Any patient who identified as Hispanic/Latinx ethnicity, regardless of their racial identification, were only included in the Hispanic/Latinx category.

Outcome measures included cesarean delivery following nulliparous term singleton vertex (NTSV) pregnancy, 3rd/4th degree laceration, composite severe maternal morbidity (SMM), and maternal readmission to the same hospital within 30 days of delivery (all-cause). The SMM metric was defined as one or more of the following during admission for labor and delivery: blood transfusion, hysterectomy, disseminated intravascular coagulation, eclampsia, thromboembolism, or amniotic fluid embolism. Process measuresincluded absent or minimal prenatal care, maternal fetal medicine (MFM) specialist care for higher-risk births, episiotomy, epidural administration, and antenatal steroids for preterm birth (23+0-36+6 weeks’ gestation).

Covariates: Covariates of interest for adjustment in our models included age, BMI at admission for delivery, parity (nulliparous or multiparous), neonatal level of care (I, II, or III-IV), prenatal illicit substance use, prenatal smoking, pre-pregnancy diabetes, gestational diabetes, history of cesarean birth, and private health insurance status. Inclusion of these covariates in the models were needed to clarify the relationships between race/ethnicity and the adverse obstetric outcomes and process measures that we examined. More specifically, we wanted to examine the role of race/ethnicity on the outcomes, beyond the effect mediated by the other well described risk factors (e.g. BMI) that have been related to race/ethnicity. Age was included as a continuous variable. Substance abuse and prenatal smoking were included as binary variables indicating if the patient self-reported substance use (illegal drugs or misuse of prescribed medications) or smoked a product with nicotine during pregnancy. Private health insurance status was included as a binary variable indicating if the patient has commercial health insurance or not. BMI at delivery was categorized into four groups (underweight, regular, overweight, obese) and was included in the models using grouped linear adjustment.

Statistical Analysis: Study population characteristics were described using mean (standard deviations) for continuous variables and number (percentage) for categorical variables. Poisson regression models with robust standard errors and clustering by hospital were used to model the relationships between race/ethnicity and each obstetric outcome and process measure. Adjusted risk ratios (aRR) with corresponding 95% confidence intervals were calculated for the obstetric outcome and process measures. No adjustments for covariates were made in modeling the relationship between race/ethnicity and antenatal steroid administration due to the additional exclusion criteria applied to the assessment of each process measure and small sample size.

A p-value of less than 0.05 indicated a statistically significant association. All analyses were completed in R (Version 1.2.1335).

**Results**

. Intra-partum transfers from other hospitals (4.7%), planned community-based births (6.2%), patients with missing race/ethnicity (2.7%), and patients with missing covariate information (4.5%) were excluded from the study sample. Implausible values for age (<12 years or >55 years old) and body mass index (BMI <15kg/m2 or > 70kg/m2) were considered as missing data, and excluded. The final study population included 58,439 births. The majority of study participants were NH White (52.2%), followed by NH Asian (18.1%) and Hispanic/Latinx (17.7%) (Table 1). The mean age of participants was 30.1 years (standard deviation = 5.5 years) and the majority of patients had private health insurance (60%). Several covariates of interest differed significantly by race/ ethnicity (Table 1). For instance, obesity at admission (BMI ≥ 30kg/m2) was most common among NH Hawaiian/ Pacific Islander (82%) and least common among NH Asian patients (33%).

NH Black patients had a 41% increased risk of NTSV cesarean delivery (aRR 1.41, 95% CI 1.23, 1.61) and a 90% increased risk of 30-day maternal readmission (aRR 1.90, 95% CI 1.49, 2.41) compared to NH White patients (Table 2). NH Asian patients were at a significantly elevated risk of NTSV cesarean delivery (aRR 1.31, 95% CI 1.21, 1.41) and 3rd/4th degree laceration (aRR 2.32, 95% CI 1.95, 2.55) compared to NH White patients. NH Indigenous/ First Persons, Hispanic/Latinx, and NH Multiple Race patients had increased risk of SMM compared to NH White patients (aRR 2.11, 95% CI 1.23, 3.54; aRR 1.48, 95% CI 1.20, 1.86; aRR 1.76, 95% CI 1.01, 3.24, respectively). NH patients who self-classified their race/ ethnicity as “Other” were at a significantly greater risk of 3rd/ 4th degree laceration (aRR 1.72, 95% CI 1.21, 2.46).

 NH Black, Hawaiian/ Pacific Islander, and Indigenous/ First Nations patients had increased risk of absent or minimal prenatal care compared with NH White patients (aRR 1.63, 95% CI 1.41, 1.88; aRR 2.66, 95% CI 2.16, 3.26; aRR 2.38, 95% CI 1.89, 2.99, respectively) (Table 3). NH Asian patients were more likely to receive an episiotomy (aRR 1.38, 95% CI 1.18, 1.60) or an epidural (aRR 1.17, 95% CI 1.02, 1.34), compared with NH White patients. All racial/ ethnic groups had a similar risk of MFM specialist care for a high-risk birth as NH White patients. Hispanic/ Latinx patients with preterm birth were less likely to receive antenatal steroids (RR 0.74, 95% CI 0.63, 0.86) compared with NH White patients.

**Discussion**

Study findings suggest that racial/ethnic disparities in obstetric outcome and process measures were present among patients giving birth in the Northwest region of the United States. While our findings were similar to several previous reports5,12–16, they differed from others14,17,18. Similar to previous national and regional reports, our findings suggest that non-White racial/ethnic groups, except for NH Asian, Hispanic/Latinx, and Multiple Race patients, were substantially more likely to have had absent or minimal prenatal care compared with NH White patients13,19,20. Literature suggests that increasing timely utilization of prenatal care is a multi-faceted issue, but delaying prenatal care is likely related to logistical factors (access to transportation, insurance status, etc.) and perceptions of racial discrimination in prenatal and medical care21,22. A study among Black patients giving birth in Baltimore demonstrated a strong relationship between delayed use of prenatal care and experiences of group racism (racism impacting family, friends, neighborhood, and the broader African American community)23. Further, NH Black and Hispanic/Latinx respondents had three times the odds of perceived race-based, language, or cultural discrimination21,24. These results suggest the need for additional research exploring how perceptions of discrimination in the healthcare system play roles in use of prenatal care among racially/ethnically diverse populations.

Our findings demonstrate a significant increase risk in NTSV cesarean delivery among NH Black and NH Asian patients. A 2014 study of 427,393 NTSV births in Massachusetts did not find statistically significant disparities between Asian/ Pacific Islander and NH White patients in risk of NTSV cesarean delivery (aOR 1.01, 95% CI 0.98, 1.04)14. When the analysis was stratified based on Asian ethnicity, a significantly increased risk among Asian Indian (aOR 1.61, 95% CI 1.52, 1.70), Vietnamese (aOR 1.12, 95% CI 1.03, 1.21), and Filipino (aOR 1.56, 95% CI 1.39, 1.77) patients compared to NH White patients was demonstrated. Differences in distribution of Asian ethnicity between this population and our study population (Table 4) may account for the difference in results. Our conclusion of an increased risk for severe perineal laceration in Asian patients is consistent with previous studies, however differences in estimates between our study and other reports could be related to not evaluating NH Asian subgroups16,25. More research is needed on NH Asian-NH White 3rd/4th degree laceration and NTSV cesarean delivery disparities within NH Asian subgroups and on efforts to reduce severe perineal lacerations.

Our motivation for assessing disparities in epidural administration stemmed from evidence demonstrating racial bias in provider perception of patient pain26. Previous research has suggested that Black and Hispanic patients are less likely than NH White patients to receive either an epidural or postpartum pain medications.18 Our study only found a disparity in epidural administration between NH Asian and NH White patients, with NH Asian patients being more likely to receive an epidural (Table 3). Regional disparities may be driving the differences in results between our study and previous reports.

Several limitations of our study deserve mention. The small sample sizes within certain racial or ethnic patient groups (e.g. NH Indigenous/ First Nation patients), particularly after restrictions in the different analyses, may have limited our study power. This highlights the need for continued, expanded, and culturally-sensitive data collection within diverse minority communities.

Another limitation is the insufficient data on Asian subgroup specification in the OB COAP dataset. For 69.3% of patients who indicated Asian as their race, further information regarding Asian subgroup was not available in the medical record (Table 4). Given previous reports suggesting variation in adverse obstetric outcomes among Asian subgroups27, our findings related to NH Asian patients should be cautiously generalized.

Despite efforts to reduce racial/ ethnic disparities in the United States, adverse obstetric outcomes have remained substantially more common among non-White persons1,28. Evidence suggests interventions and efforts aimed at reducing these disparities will require a community-driven, multidisciplinary approach28,29. Future research should assess process and treatment measures prospectively in order to better clarify the relationship between race/ ethnicity and several process measures of interest.

While the conclusions in the current study were generally aligned with most previous research reports, several of the estimates differed from estimates reported by studies conducted in other regions, suggesting there may be differences in magnitude of racial and ethnic disparities in obstetric outcomes across regions. The current study provides a recent and comprehensive assessment of racial/ethnic disparities in obstetrics outcomes and process measures in the Northwest, United States. This knowledge can inform the design and implementation of region-specific intervention strategies to improve obstetric outcomes.

**Table 1: Study Population Characteristics by Self-Reported Race/ Ethnicity**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | **NH White** | **NH Asian** | **NH Black/ African American** | **NH Hawaiian/ Pacific Islander** | **Hispanic/ Latinx** | **NH Indigenous/ First Persons** | **NH Multiple Race** | **NH Other** | **P-value\*** |
|  |
| *N* | 30528 | 10634 | 3298 | 991 | 10034 | 756 | 708 | 1490 |   |  |
| *Age* |  |  |  |  |  |  |  |  |   |  |
| *<20 years* | 2.0% | 0.4% | 4.7% | 3.8% | 7.9% | 7.1% | 6.8% | 4.5% | <0.05 |  |
| *20-34 years* | 75% | 72% | 73% | 82% | 75% | 80% | 79% | 79% | <0.05 |  |
| *35+ years* | 23% | 28% | 22% | 15% | 17% | 13% | 14% | 14% | <0.05 |  |
| *Obesity at Admission (BMI ≥30kg/m2)* | 56% | 33% | 60% | 82% | 67% | 71% | 63% | 58% | <0.05 |  |
| *Nulliparous* | 41% | 48% | 34% | 30% | 31% | 34% | 45% | 39% | <0.05 |  |
| *Level of Care (mean)* | 2.6 (0.6) | 2.9 (0.3) | 2.8 (0.4) | 2.7 (0.5) | 2.5 (0.7) | 2.7 (0.6) | 2.8 (0.4) | 2.8 (0.5) | <0.05 |  |
| *Substance Abuse during Pregnancy* | 2.1% | 0.13% | 3.2% | 0.1% | 1.1% | 12% | 4.3% | 2% | <0.05 |  |
| *Smoking during Pregnancy* | 6.8% | 0.47% | 6.1% | 7.6% | 1.7% | 13% | 9.1% | 4.8% | <0.05 |  |
| *Pre-Pregnancy Diabetes* | 1.3% | 1.8% | 1.7% | 3.4% | 2.1% | 3.5% | 1.3% | 1.9% | <0.05 |  |
| *Gestational Diabetes* | 7.9% | 18% | 9.4% | 13% | 11% | 7.3% | 7.8% | 8.9% | <0.05 |  |
| *History of Cesarean Section* | 17% | 18% | 22% | 22% | 18% | 14% | 16% | 17% | <0.05 |  |
| *Private Health Insurance* | 69% | 84% | 33% | 39% | 26% | 29% | 52% | 42% | <0.05 |  |

NH: Non-Hispanic/Latinx

\* Chi-squared test of significance

◊ Hospitals categorized into four levels of neonatal care specified by the American Academy of Pediatrics, with level I being the most basic level of care30

**Table 2: Associations of Race/Ethnicity with Obstetric Outcome Measures**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | NTSV Cesarean Delivery\* | 3rd/4th Degree Laceration ◊ | 30-Day Maternal Readmission° | Severe Maternal Morbidity ° |
|  | *N* | *aRR (95% CI)* | *N* | *aRR (95% CI)* | *N* | *aRR (95% CI)* | *N* | *aRR (95% CI)* |
| NH White | 11102 | 1.0 (ref) | 20404 | 1.0 (ref) | 30528 | 1.0 (ref) | 30528 | 1.0 (ref) |
| NH Asian | 4605 | **1.25 (1.16, 1.33)** | 6650 | **2.32 (1.95, 2.55)** | 10634 | 0.91 (0.74, 1.10) | 10634 | 1.06 (0.88, 1.36) |
| NH Black/ African American | 1031 | **1.43 (1.28, 1.61)** | 2009 | 1.24 (0.90, 1.72) | 3298 | **1.90 (1.49, 2.41)** | 3298 | 1.21 (0.90, 1.79) |
| NH Hawaiian/ Pacific Islander | 265 | 1.06 (0.82, 1.36) | 639 | 0.45 (0.17, 1.21) | 991 | 0.96 (0.55, 1.68) | 991 | 0.78 (0.38, 1.71) |
| Hispanic/Latinx | 2815 | 1.02 (0.93, 1.12) | 7043 | 0.90 (0.71, 1.12) | 10034 | 0.99 (0.79, 1.22) | 10034 | **1.48 (1.20, 1.86)** |
| NH Indigenous/ First Persons | 231 | 1.11 (0.85, 1.45) | 499 | 1.07 (0.53, 2.16) | 756 | 1.43 (0.83, 2.44) | 756 | **2.11 (1.23, 3.54)** |
| NH Multiple Race | 293 | 1.02 (0.79, 1.30) | 472 | 0.72 (0.34, 1.52) | 708 | 1.18 (0.65, 2.16) | 708 | **1.76 (1.01, 3.24)** |
| NH Other | 514 | 0.99 (0.82, 1.19) | 1015 | **1.72 (1.21, 2.46)** | 1490 | 0.80 (0.49, 1.33) | 1490 | 0.78 (0.43, 1.45) |

NH: Non-Hispanic/Latinx.

NTSV: Nulliparous, term, singleton, vertex births.

\*Adjusted for age, BMI, neonatal level of care, pre-pregnancy diabetes, gestational diabetes, commercial health insurance, and maternal smoking and clustered by hospital.

◊ Adjusted for age, BMI, neonatal level of care, pre-pregnancy diabetes, commercial health insurance, maternal smoking, and clustered by hospital.

° Adjusted for age, BMI at admission for delivery, neonatal level of care, pre-pregnancy diabetes, gestational diabetes, commercial health insurance, and maternal smoking

**Table 3: Associations of Race/Ethnicity with Obstetric Process Measures**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | Absent or Minimal Prenatal Care◊ | MFM Specialist Care for High-Risk Birth◊ | Episiotomy◊ | Epidural Administration◊ | Antenatal Steroids for Preterm Birth |
|   | *N* | *aRR* | *N* | *aRR* | *N* | *aRR* | *N* | *aRR* | *N* | *RR* |
| NH White | 30528 | 1.0 (ref) | 11073 | 1.0 (ref) | 20404 | 1.0 (ref) | 30528 | 1.0 (ref) | 1820 | 1.0 (ref) |
| NH Asian | 10634 | 0.84 (0.71, 1.00) | 3341 | 0.93 (0.77, 1.12) | 6650 | **1.38 (1.18, 1.60)** | 10634 | **1.17 (1.02, 1.34)** | 553 | 1.10 (0.95, 1.27) |
| NH Black/ African American | 3298 | **1.63 (1.41, 1.88)** | 1327 | 0.96 (0.79, 1.18) | 2009 | 0.93 (0.67, 1.29) | 3298 | 1.08 (0.86, 1.37) | 211 | 1.12 (0.90, 1.37) |
| NH Hawaiian/ Pacific Islander | 991 | **2.66 (2.16, 3.26)** | 473 | 0.72 (0.39, 1.34) | 639 | 0.85 (0.47, 1.55) | 991 | 0.81 (0.42, 1.57) | 68 | - |
| Hispanic/ Latinx | 10034 | 0.95 (0.84, 1.09) | 3366 | 1.02 (0.83, 1.25) | 7043 | **0.70 (0.56, 0.87)** | 10034 | 1.14 (0.95, 1.35) | 618 | **0.74 (0.63, 0.86)** |
| NH Indigenous/ First Persons | 756 | **2.38 (1.89, 2.99)** | 348 | 0.96 (0.52, 1.76) | 499 | 0.61 (0.29, 1.29) | 756 | 1.24 (0.73, 2.11) | 87 | - |
| NH Multiple Race | 708 | 1.39 (0.98, 1.94) | 233 | 0.88 (0.48, 1.62) | 472 | 0.78 (0.39, 1.59) | 708 | 0.90 (0.40, 2.02) | 38 | - |
| NH Other | 1490 | **1.30 (1.04, 1.62)** | 453 | 1.13 (0.70, 1.83) | 1015 | 1.30 (0.88, 1.92) | 1490 | 1.47 (0.98, 2.21) | 88 | - |

Dash indicates insufficient power (power < 0.75) to detect difference in proportions.

MFM: Maternal and Fetal Medicine

NH: Non-Hispanic/ Latinx

◊ Adjusted for age, BMI at admission for delivery, hospital level, and private health insurance

**Table 4: Asian Subgroups**

|  |  |  |
| --- | --- | --- |
| Subgroup | N | Percent |
| Southeast (Cambodian, Laotian, Malaysian, Filipino, Thai, Vietnamese) | 515 | 4.8% |
| Far East (Chinese, Japanese, Korean) | 876 | 8.2% |
| Indian (Indian Subcontinent-Indian, Pakistan, Nepal, Bhutan, Bangladesh, Sri Lanka, Maldives) | 1886 | 17.7% |
| Unspecified | 5404 | 50.7% |
| Missing | 1977 | 18.6% |

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