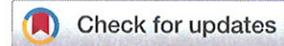# Nurse workforce diversity and reduced risk of severe adverse maternal outcomes

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BACKGROUND: Racial and ethnic diversification of the physician and nurse workforce is recommended as a leverage point to address the impact of structural racism in maternal care, but empirical evidence supporting this recommendation is currently lacking.

OBJECTIVE: This study aimed to assess the association between state-level registered nurse workforce racial and ethnic diversity and severe adverse maternal outcomes during childbirth.

STUDY DESIGN: This population-based cross-sectional study analyzed 2017 US birth certificate data. Severe adverse maternal outcomes included eclampsia, blood transfusion, hysterectomy, or intensive care unit admission. Proportions of minoritized racial and ethnic registered nurses in each state were abstracted from the American Community Survey (5-year estimate, 2013–2017). This proportion was categorized into 3 terciles, with the first tercile corresponding to the lowest proportion and the third tercile corresponding to the highest proportion. Crude and adjusted odds ratios and 95% confidence intervals of severe adverse maternal outcomes associated with terciles of the state proportion of minoritized racial and ethnic nurses were estimated using logistic regression models.

RESULTS: Of the 3,668,813 birth certificates studied, 29,174 recorded severe adverse maternal outcomes (79.5 per 10,000; 95% confidence interval, 78.6–80.4). The mean state proportion of minoritized racial and ethnic nurses was 22.1%, ranging from 3.3% in Maine to 68.2% in Hawaii. For White mothers, the incidence of severe adverse outcomes was 85.3 per 10,000 for those who gave births in states in the first tercile of the proportion of minoritized racial and ethnic nurses and 53.9 per 10,000 for those who gave birth in states in the third tercile (risk difference, −31.4 per 10,000; 95% confidence interval, −34.4 to −28.5).

It corresponds to a 37% decreased risk of severe adverse maternal outcomes associated with giving birth in a state in the third tercile (crude odds ratio, 0.63; 95% confidence interval, 0.60–0.66). A decreased risk of severe adverse maternal outcomes was observed for Black mothers (crude odds ratio, 0.65; 95% confidence interval, 0.61–0.70), Hispanic mothers (crude odds ratio, 0.51; 95% confidence interval, 0.48–0.54), and Asian and Pacific Islander mothers (crude odds ratio, 0.65; 95% confidence interval, 0.58–0.72) but not for Native American mothers (crude odds ratio, 0.89; 95% confidence interval, 0.72–1.09) or mothers with >1 race (crude odds ratio, 1.44; 95% confidence interval, 0.72–1.09). After adjustment for patients and hospital characteristics, giving birth in states in the third tercile was associated with a reduced risk of severe adverse outcomes as follows: 32% for White mothers (adjusted odds ratio, 0.68; 95% confidence interval, 0.59–0.77), 20% for Black mothers (adjusted odds ratio, 0.80; 95% confidence interval, 0.65–0.99), 31% for Hispanic mothers (adjusted odds ratio, 0.69; 95% confidence interval, 0.58–0.82), and 50% for Asian and Pacific Islander mothers (adjusted odds ratio, 0.50; 95% confidence interval, 0.38–0.65). The associations of the proportion of minoritized racial and ethnic nurses with the risk of severe adverse maternal outcomes were not statistically significant for Native American mothers and more than 1 race mothers. Results were similar when blood transfusion was excluded from the outcome measure.

CONCLUSION: A diverse state registered nurse workforce was associated with a reduced risk of severe adverse maternal outcomes during childbirth.

Key words: childbirth, epidemiology, healthcare workforce, maternal morbidity, racial and ethnic diversity, structural racism

Introduction

In 2020, the US federal government recognized addressing racial and ethnic disparities in severe maternal morbidity as a public health priority.[1,2] Compared with non-Hispanic White birthing people, minoritized racial and ethnic groups are up to 3 times as likely to experience life-threatening complications during pregnancy, childbirth, and

EDITOR'S CHOICE

the postpartum period.[3] Among racial and ethnic minoritized people, non-Hispanic Black and Native American people are at particularly high risk of severe adverse maternal outcomes (SAMOs).[4,5] Structural racism contributes to these disparities in SAMO, independent of social determinants of health (eg, poverty or education).[6–9] Structural racism refers to a system where public policies, institutional practices, cultural representations, and other norms work to perpetuate racial group inequities.[10–13]

Racial and ethnic diversification of the physician and nurse workforce has been recommended as a possible remedy for reducing the impact of structural racism

on racial and ethnic disparities in maternal health outcomes.[14,15] A racially diverse workforce improves access to healthcare for minoritized racial and ethnic people, reduces provider implicit bias, and increases the likelihood of racial and ethnic concordance between patients and healthcare workers. However, evidence linking physician or nurse workforce diversity to improved maternal health outcomes is currently lacking. Registered nurses (RNs) are crucial for comprehensive maternal healthcare and are the frontline healthcare providers responsible for identifying warning signs of maternal complications that require urgent bedside evaluation by clinicians and timely intervention.[16] Thus, a racially diverse RN workforce could be

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Why was this study conducted?
Racial and ethnic diversification of the physician and nurse workforce is recommended as a possible remedy for reducing the impact of structural racism on racial and ethnic disparities in maternal health outcomes. However, evidence linking healthcare workforce diversity to improved maternal health outcomes is currently lacking.

Key findings
In this nationwide study in 2017, racial and ethnic diversity in the state nurse workforce was associated with a reduced risk of severe adverse maternal outcomes in White, Black, Hispanic, and Asian and Pacific Islander mothers.

What does this add to what is known?
This finding could guide the development of intervention programs to reduce racial and ethnic disparities in maternal health outcomes by diversifying the healthcare workforce.

associated with a reduced risk of SAMO. Using 2017 US birth certificate data, we aimed to assess the association between state-level proportion of RNs from minoritized racial and ethnic groups and SAMO.

Materials and Methods
The study protocol was deemed exempt by the institutional review board of the authors' institution. This study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.

Data system
Data for this study were abstracted from the 2017 US birth certificates contained in the restricted access Natality File of the National Vital Statistics System (National Center for Health Statistics, Centers for Diseases Control and Prevention). This data system is based on the 2003 revised US Standard Certificate of Live Birth.[17] As of January 2015, it was implemented in the 50 US states and the District of Columbia.

Study sample
The study sample included all births between January 1, 2017, and December 31, 2017. The exclusion criteria were (1) mother not residing in the United States, (2) maternal state of residence not corresponding to state of delivery, (3) birth not occurring in a hospital, (4) missing information on maternal race

and ethnicity, (5) missing information on maternal outcomes, and (6) missing information on county or state identifiers for maternal residence or delivery hospital.

Exposure
The exposure of interest was the proportion of RNs from minoritized racial and ethnic groups in each state. It was calculated as follows: 100 × (total number of RNs−number of non-Hispanic White RNs)/total number of RNs. Total number of RNs and number of non-Hispanic White RNs by state were abstracted from the American Community Survey (5-year estimate, 2013−2017) available in the Area Health Resource File (AHRF).[18] The information on other race and ethnicity RNs (eg, non-Hispanic Black RNs) was missing for many states, precluding the use of a state race-specific proportion (eg, state proportion of non-Hispanic Black RNs).

Outcome
The outcome was SAMO defined as the presence of at least 1 of the 4 following conditions or procedures: eclampsia, blood transfusion, hysterectomy, and intensive care unit (ICU) admission. In a sensitivity analysis, we excluded blood transfusion from the definition of SAMO.

The 4 conditions and procedures are recorded in specific check boxes on the birth certificate. The reported sensitivity

of the individual components in a study conducted in Massachusetts in 2011 to 2013 and using administrative hospital discharge data as the gold standard ranges from 12% for blood transfusion to 51% for hysterectomy.[19]

Birth certificates do not contain codes of the International Classification of Diseases, precluding the assessment of severe maternal morbidity as defined by the US Centers for Disease Control and Prevention.[20]

Maternal, hospital, and state characteristics
Maternal characteristics and comorbidities directly recorded from birth certificate data included age ($\leq$19, 20−29, 30 −39, or $\geq$40 years), race and ethnicity, education level (less than high school, high school with no diploma, high school graduate or General Educational Diploma, or college and higher), health insurance (Medicaid, private, self-pay, or other); body mass index ($\leq$18.4, 18.5 −24.9, 25.0−29.9, 30.0−34.9, or $\geq$35 kg/ m^2), and preexisting or gestational diabetes mellitus or hypertension. Maternal race and ethnicity were categorized into 6 mutually exclusive groups: (1) non-Hispanic White (hereafter referred to as White); (2) non-Hispanic Black (Black); (3) Hispanic; (4) non-Hispanic Asian, Native Hawaiian, and Other Pacific Islander (Asian and Pacific Islander); (5) non-Hispanic American Indian and Alaskan Native (Native American); and (6) more than 1 race.

The following maternal characteristics were estimated at the county of residence level: urban or rural residence, proportion of persons in poverty, and proportion of persons unemployed.

Obstetrical characteristics directly recorded from birth certificate data included previous cesarean delivery, month of gestation prenatal care began (1−3, 4−6, $\geq$7, or no prenatal care), number of prenatal visits, delivery during a weekend, mother transferred in, nulliparous, gestational age at delivery ($\leq$33, 34−38, or $\geq$39 weeks), multiple pregnancy, noncephalic presentation, induction of labor, attendant at birth (doctor of medicine, doctor of osteopathy, midwife, or other), delivery mode

(vaginal spontaneous, vaginal assisted [vacuum or forceps], or cesarean), and birthweight (≤2499, 2500−4000, or ≥4000 g).

Because birth certificate data do not provide a hospital identifier, the following hospital characteristics were estimated at the hospital county level: urban or rural location, number of hospital births, and number of obstetricians and gynecologists (per 1000 hospital births).

The following state characteristics were abstracted from the AHRF or the State Health Facts of the Kaiser Family Foundation[18,21]: proportion of racial and ethnic minority residents, proportion of persons below poverty level, proportion of persons unemployed, number of physicians (per 1000 residents), number of RNs (per 1000 residents), and Medicaid income eligibility threshold.

Statistical analysis

Statistical analysis was performed with R (version 4.0.3; R Foundation for Statistical Computing, Vienna, Austria) and the package "lme4" for mixed-effect modeling.[22] No study a priori power was performed.

Descriptive statistics

The distribution of the state proportion of minoritized racial and ethnic RNs across the 50 states and the District of Columbia was examined visually using a caterpillar plot. Moreover, this proportion was compared between mothers with and without SAMO using the standardized difference (SD), with a value >10% indicative of a significant imbalance.[23]

Crude analysis

The state proportion of RNs from racial and ethnic minorities was categorized into 3 terciles, with the first tercile corresponding to the lowest proportion and the third tercile corresponding to the highest proportion. Terciles were calculated for each of the 6 racial and ethnic maternal groups. For each

FIGURE 1
Flowchart of the study
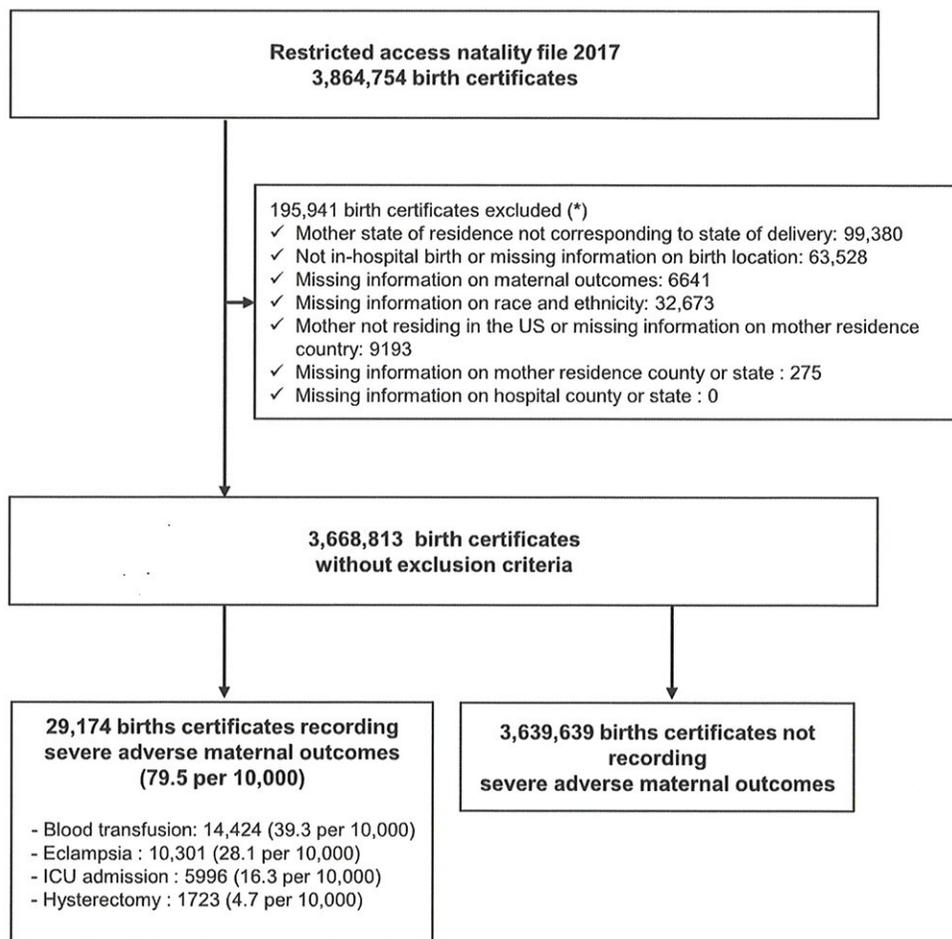
(Asterisk) Reasons for exclusion are not mutually exclusive.

ICU, intensive care unit.

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FIGURE 2
Proportion of minoritized racial and ethnic registered nurses across states

RN, registered nurse.

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maternal racial and ethnic group, the incidence of SAMO was estimated for each tercile of the state proportion of minoritized racial and ethnic RNs. The risk difference was estimated as the difference between the incidence in the third tercile and the incidence in the first tercile (reference). Crude odds ratios (ORs) of SAMO associated with terciles of the state proportion of minoritized RNs were estimated using univariate fixed-effect logistic regression models, with SAMO as the dependent variable and proportion as the independent variable.

Adjusted analysis

For each maternal racial and ethnic group, the adjusted ORs (aORs) of SAMO associated with terciles of the state proportion of minoritized racial and ethnic RNs were estimated using multivariate mixed-effect logistic regression models with the hospital

county nested within the hospital state as the random effect (random intercept and constant slope), and adjusted for patients and hospital characteristics. Mixed-effect models consider the correlation between women within hospitals and hospitals within states.

To identify variables required to adjust the ORs of SAMO, we developed a multivariable prediction model for SAMO using data from all race and ethnicity mothers. Candidate variables included in the model were characteristics with an SD of >10% in the comparison of mothers with and without SAMO presented in Appendix 1. Race and ethnicity were not included as a candidate variable. We used mixed-effect logistic regression modeling with SAMO as the dependent variable, the candidate variables as independent variables, and the hospital county nested within the hospital state as the random effect. Selection was performed using a backward

procedure with a significance threshold of 0.05. We performed a complete case analysis with 200,655 birth certificates (5.5%) excluded for missing values of the candidate variables. The results of the multivariable prediction model are presented in Appendix 2.

In a sensitivity analysis, the state proportion of the racial and ethnic group examined was added to the variables used for adjustment (eg, state proportion of Black residents when analyzing Black mothers).

Results

Of the 3,668,813 birth certificates studied, 29,174 recorded SAMO or 79.5 per 10,000 (95% confidence interval [CI], 78.6–80.4) (Figure 1). The most frequent complication recorded was blood transfusion (39.3 per 10,000), followed by eclampsia (28.1 per 10,000), ICU admission (16.3 per 10,000), and hysterectomy (4.7 per 10,000) (Appendix 3).

Descriptive statistics
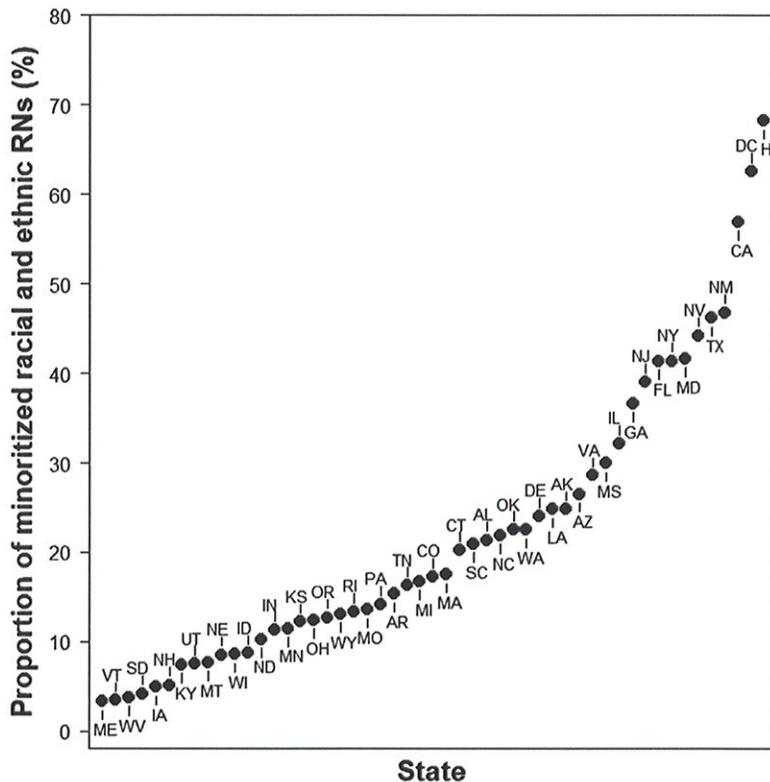
The mean proportion of minoritized racial and ethnic RNs in the 50 US states and the District of Columbia was 22.1%. It ranged from a minimum of 3.3% in the state of Maine to a maximum of 68.2% in the state of Hawaii (Figure 2). Compared with mothers without SAMO, mothers with SAMO gave birth in states with a lower proportion of minoritized racial and ethnic RNs (30.6% vs 27.9%, respectively; SD, 17.2%). A lower state proportion of minoritized racial and ethnic RNs for mothers with SAMO was observed for all racial and ethnic groups, except for mothers with more than 1 race (Appendix 4).

Crude analysis

For White mothers, the incidence of SAMO was 85.3 per 10,000 for those who gave births in states in the first tercile of the proportion of minoritized racial and ethnic RNs and 53.9 per 10,000 for those who gave birth in states in the third tercile (risk difference, −31.4 per 10,000; 95% CI, −34.4 to −28.5) (Table 1). It corresponds to a 37% decreased risk of SAMO associated with giving birth in a state in the

TABLE 1
Incidence of severe adverse maternal outcomes associated with the terciles of the state proportion of minoritized racial and ethnic registered nurses (United States, 2017)

Maternal race and ethnicity	Number of women	Number of SAMO cases	Incidence (per 10,000; 95% CI)	Risk difference (95% CI)[a]	Crude OR (95% CI)[b]	Adjusted OR 1 (95% CI)[c]	Adjusted OR 2 (95% CI)[d]
White							
Tercile 1 (3.3%–14.2%)	632,434	5395	85.3 (83.0–7.6)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (14.3%–32.2%)	653,299	5262	80.5 (78.4–82.7)	−4.8 (−7.9 to −1.6)	0.94 (0.91–0.98)	0.87 (0.78–0.98)	0.78 (0.65–0.92)
Tercile 3 (32.3%–68.3%)	594,021	3199	53.9 (52.0–55.7)	−31.4 (−34.4 to −28.5)	0.63 (0.60–0.66)	0.68 (0.59–0.77)	0.53 (0.39–0.72)
Black							
Tercile 1 (3.3%–21.9%)	208,367	2721	130.6 (125.7–135.5)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (22.0%–41.4%)	203,273	2141	105.3 (100.9–109.8)	−25.3 (−31.9 to −18.7)	0.80 (0.76–0.85)	0.94 (0.79–1.12)	1.05 (0.87–1.26)
Tercile 3 (41.5%–68.3%)	133,295	1142	85.7 (80.7–90.6)	−44.9 (−51.9 to −38.0)	0.65 (0.61–0.70)	0.80 (0.65–0.99)	0.81 (0.65–0.99)
Hispanic							
Tercile 1 (3.3%–36.6%)	283,422	2844	100.3 (96.7–104.0)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (36.7%–46.2%)	185,946	1185	63.7 (60.1–67.3)	−36.6 (−41.8 to −31.5)	0.63 (0.59–0.68)	0.78 (0.64–0.94)	0.71 (0.57–0.88)
Tercile 3 (46.3%–68.3%)	413,657	2112	51.1 (48.9–53.2)	−49.2 (−53.6 to −45.0)	0.51 (0.48–0.54)	0.69 (0.58–0.82)	0.50 (0.34–0.73)
Asian and Pacific Islander							
Tercile 1 (3.3%–28.6%)	85,673	830	96.9 (90.3–103.4)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (28.7%–46.2%)	66,924	393	58.7 (52.9–64.5)	−38.2 (−46.9 to −29.4)	0.60 (0.54–0.68)	0.61 (0.48–0.77)	0.54 (0.43–0.69)
Tercile 3 (46.3%–68.3%)	101,163	636	62.9 (58.0–67.7)	−34.0 (−42.2 to −25.8)	0.65 (0.58–0.72)	0.50 (0.38–0.65)	0.33 (0.24–0.46)
Native American							
Tercile 1 (3.3%–21.9%)	10,468	202	193.0 (166.6–219.3)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (22.0%–26.5%)	7599	118	155.3 (127.5–183.1)	−37.7 (−76.0 to 0.6)	0.80 (0.64–1.01)	0.97 (0.64–1.45)	0.69 (0.43–1.13)
Tercile 3 (26.6%–68.3%)	10,183	175	171.9 (146.6–197.1)	−21.1 (−57.6 to 15.4)	0.89 (0.72–1.09)	0.89 (0.61–1.29)	0.82 (0.56–1.21)
More than 1 race							
Tercile 1 (3.3%–17.3%)	26,476	250	94.4 (82.8–106.1)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (17.4%–41.4%)	26,653	218	81.8 (71.0–92.6)	−12.6 (−28.5 to 3.3)	0.87 (0.72–1.04)	0.84 (0.64–1.10)	0.82 (0.62–1.07)
Tercile 3 (41.5%–68.3%)	25,960	351	135.2 (121.2–149.3)	40.8 (22.5–59.0)	1.44 (1.22–1.69)	0.89 (0.66–1.21)	0.80 (0.58–1.11)

CI, confidence interval; OR, odds ratio; SAMO, severe adverse maternal outcome.

[a] Calculated as the difference between the incidence in the third (or second) tercile and the incidence in the first tercile (reference).

[b] Estimated using univariate fixed-effect logistic regression.

[c] Estimated using multivariate mixed-effect logistic regression with the hospital county nested within the hospital state as the random effect and adjusted for (1) age, (2) body mass index, (3) residence (rural or urban), (4) preexisting diabetes mellitus, (5) gestational diabetes mellitus, (6) preexisting hypertension, (7) gestational hypertension, (8) month prenatal care began, (9) number of prenatal visits, (10) mother transferred in, (11) gestational age at delivery, (12) multiple pregnancy, (13) noncephalic presentation, (14) induction of labor, (15) attendant at birth, (16) delivery mode, (17) birthweight, and (18) hospital location (rural or urban).

[d] With further adjustment for the state proportion of the racial and ethnic group examined (eg, state proportion of Black residents when analyzing Black mothers).

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TABLE 2
Incidence of severe adverse maternal outcomes after exclusion of blood transfusion associated with the terciles of the state proportion of minoritized racial and ethnic registered nurses (United States, 2017)

Maternal race and ethnicity	Number of women	Number of SAMO cases without blood transfusion	Incidence (per 10,000; 95% CI)	Risk difference (95% CI)[a]	Crude OR (95% CI)[b]	Adjusted OR (95% CI)[c]
White						
Tercile 1 (3.3%–14.2%)	632,434	3145	49.7 (48.0–51.5)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (14.3%–32.2%)	653,299	3257	49.9 (48.1–51.6)	0.1 (−2.3 to 2.6)	1.00 (0.95–1.05)	0.90 (0.78–1.04)
Tercile 3 (32.3%–68.3%)	594,021	1582	26.6 (25.3–27.9)	−23.1 (−25.3 to −20.9)	0.53 (0.50–0.57)	0.64 (0.54–0.76)
Black						
Tercile 1 (3.3%–21.9%)	208,367	1807	86.7 (82.7–90.7)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (22.0%–41.4%)	203,273	1256	61.8 (58.4–65.2)	−24.9 (−30.2 to −19.7)	0.71 (0.66–0.76)	0.86 (0.70–1.05)
Tercile 3 (41.5%–68.3%)	133,295	587	44.0 (40.5–47.6)	−42.7 (−48.0 to −37.3)	0.51 (0.46–0.56)	0.60 (0.46–0.79)
Hispanic						
Tercile 1 (3.3%–36.6%)	283,422	1613	56.9 (54.1–59.7)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (36.7%–46.2%)	185,946	663	35.7 (32.9–38.4)	−21.3 (−25.1 to −17.4)	0.63 (0.57–0.68)	0.67 (0.54–0.85)
Tercile 3 (46.3%–68.3%)	413,657	1118	27.0 (25.4–28.6)	−29.9 (−33.1 to −26.7)	0.47 (0.44–0.51)	0.59 (0.48–0.73)
Asian and Pacific Islander						
Tercile 1 (3.3%–28.6%)	85,673	474	55.3 (50.4–60.3)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (28.7%–46.2%)	66,924	181	27.0 (23.1–31.0)	−28.3 (−34.6 to −21.9)	0.49 (0.41–0.58)	0.42 (0.30–0.58)
Tercile 3 (46.3%–68.3%)	101,163	514	50.8 (46.4–55.2)	−4.5 (−11.1 to 2.1)	0.92 (0.81–1.04)	0.52 (0.37–0.72)
Native American						
Tercile 1 (3.3%–21.9%)	10,468	90	86.0 (68.3–103.7)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (22.0%–26.5%)	7599	70	92.1 (70.6–113.6)	6.1 (−21.7 to 34.0)	1.07 (0.78–1.47)	1.11 (0.64–1.92)
Tercile 3 (26.6%–68.3%)	10,183	84	82.5 (64.9–100.1)	−3.5 (−28.4 to 21.4)	0.96 (0.71–1.29)	0.76 (0.45–1.27)
More than 1 race						
Tercile 1 (3.3%–17.3%)	26,476	131	49.5 (41.0–57.9)	0.0 (Reference)	1.00 (Reference)	1.00 (Reference)
Tercile 2 (17.4%–41.4%)	26,653	138	51.8 (43.2–60.4)	2.3 (−9.8 to 14.4)	1.05 (0.82–1.33)	0.96 (0.67–1.37)
Tercile 3 (41.5%–68.3%)	25,960	279	107.5 (94.9–120.0)	58.0 (42.9–73.1)	2.18 (1.77–2.69)	0.93 (0.61–1.40)

CI, confidence interval; OR, odds ratio; SAMO, severe adverse maternal outcome.

[a] Calculated as the difference between the incidence in the third (or second) tercile and the incidence in the first tercile (reference).

[b] Estimated using univariate fixed-effect logistic regression.

[c] Estimated using multivariate mixed-effect logistic regression with the hospital county nested within the hospital state as the random effect and adjusted for (1) age, (2) body mass index, (3) residence (rural or urban), (4) preexisting diabetes mellitus, (5) gestational diabetes mellitus, (6) preexisting hypertension, (7) gestational hypertension, (8) month prenatal care began, (9) number of prenatal visits, (10) mother transferred in, (11) gestational age at delivery, (12) multiple gestation, (13) noncephalic presentation, (14) induction of labor, (15) attendant at birth, (16) delivery mode, (17) birthweight, and (18) hospital location (rural or urban).

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third tercile (crude OR, 0.63; 95% CI, 0.60–0.66). Moreover, a decreased risk of SAMO associated with giving birth in a state in the third tercile was observed for Black mothers (crude OR, 0.65; 95% CI, 0.61–0.70), Hispanic mothers (crude OR, 0.51; 95% CI, 0.48–0.54), and Asian and Pacific Islander mothers (crude OR, 0.65; 95% CI, 0.58–0.72) but not for Native American mothers (crude OR, 0.89; 95% CI, 0.72–1.09) or mothers with more than 1 race (crude OR, 1.44; 95% CI, 0.72–1.09). The results were unchanged when excluding blood transfusion from SAMO (Table 2).

Adjusted analysis

After adjustment and compared with giving birth in states in the first tercile of the proportion of minoritized racial and ethnic RNs (Table 1), giving birth in states in the third tercile was associated with a reduced risk of SAMO as follows: 32% for White mothers (aOR, 0.68; 95% CI, 0.59–0.77), 20% for Black mothers (aOR, 0.80; 95% CI, 0.65–0.99), 31% for Hispanic mothers (aOR, 0.69; 95% CI, 0.58–0.82), and 50% for Asian and Pacific Islander mothers (aOR, 0.50; 95% CI, 0.38–0.65). SAMO risk was not reduced for Native American mothers (aOR, 0.89; 95% CI, 0.61–1.29) or mothers of more than 1 race (aOR, 0.89; 95% CI, 0.66–1.21). The results were robust with further adjustment for the state proportion of the racial and ethnic group examined (Table 1) and when excluding blood transfusion from SAMO (Table 2).

Comment
Principal findings

In this nationwide study of birth certificate data, a racially diverse RN workforce was associated with a significantly reduced risk of SAMO in both non-Hispanic White mothers and minoritized racial and ethnic mothers.

Results in the context of what is known and implications

Our study provided robust evidence to support the recommendation to diversify the healthcare workforce as a remedy for addressing racial and ethnic disparities in maternal health outcomes, as shown in the 2018 Consensus Statement on the Reduction of Peripartum Racial and Ethnic Disparities of the National Partnership for Maternal Safety and in the Surgeon General's recent call to action to improve maternal health.[1,2,15] There are at least 3 pathways linking a racially diverse healthcare workforce to reduced disparities in maternal health outcomes. First, it could improve access to healthcare for underserved patients. For instance, minoritized racial and ethnic physicians are more likely than non-Hispanic White physicians to practice in underserved communities and to treat larger numbers of diverse racial and ethnic patients. Second, it could help reduce provider implicit bias.[14] Implicit bias refers to attitudes or stereotypes toward minoritized racial and ethnic groups that affect healthcare workers' understanding, actions, and decisions in an unconscious manner, ultimately affecting the delivery of care.[24–26] Third, it increases the likelihood of racial and ethnic concordance between patients and healthcare workers. Racial and ethnic concordance has been associated with improvement in patient-physician communication and shared decision-making, greater time spent with physicians, and improved patient satisfaction and experience rating.[27–30] More recently, racial and ethnic concordance between physicians and newborns has been associated with decreased mortality of non-Hispanic Black infants.[31] Although the direction of the effect of the state proportion of RNs from minoritized racial and ethnic groups on SAMO was consistent across the 6 maternal racial and ethnic groups, it was not statistically significant for Native Americans and those of more than 1 race mainly because of the small sample sizes in these 2 groups.

Strengths and limitations

We analyzed a national census of birth data that facilitated meaningful statistical comparisons for relatively rare outcomes across racial and ethnic groups. However, our findings should be interpreted in the context of several limitations. First, our study was observational, and the association between RN workforce diversity and SAMO has not been necessarily causal. Second, we did not analyze physician workforce diversity. Non-Hispanic Black physicians account for only 5% of US physicians, whereas 13% of the US population is non-Hispanic Black, and Hispanic physicians account for 6% of US physicians, whereas Hispanics make up 18% of the US population.[32] We chose to focus instead on RNs because they are the frontline healthcare providers involved in the early recognition of warning signs for maternal complications; delayed recognition of these complications has been repeatedly identified as a major contributor to preventable maternal deaths.[16,33] In addition, diversifying the RN workforce may be a faster process than diversifying the physician workforce because of the shorter duration of their curriculum (up to 4 years vs up to 8 years, respectively). Third, we analyzed the workforce diversity at the state-level but not at the site of delivery level because hospital-level data on racial and ethnic diversity of the healthcare workforce remain unavailable. Fourth, the sensitivity of using birth certificate data to detect SAMO is low.[19] However, the underreporting should be nondifferential across racial and ethnic groups and thus be unlikely to bias the estimated ORs.[34]

Conclusions

A racially and ethnically diverse RN workforce was associated with a reduced risk of SAMO. This finding could guide the development of intervention programs to reduce racial and ethnic disparities in maternal health outcomes by diversifying the healthcare workforce. ∎

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.ajogmf.2022.100689.

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