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Racial and Ethnic Differences in Outcomes of Neonates Born at Less Than 30 Weeks' Gestation, 2018-2022

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Abstract

IMPORTANCE Previous research has examined outcomes among very preterm newborns by the birthing parent's race and ethnicity, but knowledge about these trends during the COVID-19 pandemic is limited.

OBJECTIVE To examine trends in outcomes among Black, Hispanic, and Asian preterm newborns compared with White preterm newborns.

DESIGN, SETTING, AND PARTICIPANTS This cohort study (2018-2022) took place at 774 neonatal intensive care units in the Vermont Oxford Network. Participants were newborns born at 22 to 29 weeks' gestation.

EXPOSURE Race and ethnicity.

MAIN OUTCOMES AND MEASURES The primary outcomes were mortality and complications, including respiratory distress syndrome, necrotizing enterocolitis (NEC), early-onset sepsis, late-onset sepsis (LOS), severe intraventricular hemorrhage (sIVH), severe retinopathy of prematurity, chronic lung disease, pneumothorax, and complication-free survival.

RESULTS Among 90 336 newborns (47 215 male [52.3%]; 43 121 female [47.7%]; mean [SD] gestational age, 26.4 [2.1] weeks), 4734 (5.2%) were born to Asian, 20 345 (22.3%) to Hispanic, 31 264 (34.3%) to non-Hispanic Black, and 33 993 (37.3%) to non-Hispanic White birthing individuals. Rates of in-hospital mortality (4831 Black newborns [15.6%]; 3009 Hispanic newborns [14.9%]; and 4886 White newborns [14.4%]), NEC (2374 Black newborns [7.8%]; 1359 Hispanic newborns [6.9%]; and 2137 White newborns [6.5%]), LOS (3846 Black newborns [13.5%]; 2258 Hispanic newborns [12.3%]; and 3575 White newborns [11.5%]), and sIVH (2919 Black newborns [10.3%]; 1673 Hispanic newborns [9.2%]; and 2800 White newborns [9.1%]) were highest among Black and lowest among White newborns. Chronic lung disease and pneumothorax rates were lowest among Black and highest among White newborns. Over the study period, mortality rate differences were slightly higher for Black than White newborns, with no differences by 2022. NEC and LOS rates were consistently higher among Black than White newborns. By 2022, Black newborns had higher rates of NEC (rate difference, 1.3 percentage points; 95% CI, 0.46-2.2 percentage points) and LOS (rate difference, 2.7 percentage points; 95% CI, 1.4-4.0 percentage points). sIVH rates were higher for Black newborns in some years, whereas severe retinopathy of prematurity rates were lower. Hispanic newborns had mortality and complication rates similar to those of White newborns. Black and Hispanic newborns had lower respiratory complication rates and higher complication-free survival than White newborns.

(continued)

Key Points

Question Are racial and ethnic differences in major complications increasing or decreasing among newborns born at 22 to 29 weeks' gestation in the US?

Findings In this cohort study of 90 336 newborns born between 2018 and 2022, mortality rates were similar for Black and White newborns, but by 2022, Black newborns had higher rates of necrotizing enterocolitis (1.3 percentage points higher) and late-onset sepsis (2.7 percentage points higher). Hispanic newborns had mortality and complication rates similar to those of White newborns.

Meaning From 2018 to 2022, mortality rates were similar for Black and White newborns, but Black newborns had higher rates of some complications, suggesting that continued quality improvement and addressing social determinants of health are important for promoting health equity in outcomes for very preterm newborns.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

CONCLUSIONS AND RELEVANCE In this cohort study, there were no differences in mortality rates between Black and White newborns, but Black newborns had higher rates of NEC and LOS. Continued quality improvement and addressing social determinants of health are critical for promoting health equity in hospital outcomes and beyond.

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Introduction

Medical developments in the past several decades have contributed to improved survival and a decrease in severe complications among extremely preterm newborns.[1-5] In a national study[6] conducted between 2006 and 2017, we reported on how such changes in medical developments and improvements in the rates of adverse outcomes among newborns born at 22 to 29 weeks' gestation relate to race and ethnicity. Using data from the Vermont Oxford Network (VON), we showed that compared with White newborns, Black newborns experienced faster declines in mortality, necrotizing enterocolitis (NEC), and late-onset sepsis (LOS).[6] However, by 2017, these complications remained elevated among Black compared with White newborns.[6]

Race, as a social construct, is associated with health outcomes through various social determinants of health (SDOH), including access to care, socioeconomic status, and exposure to systemic biases.[6-9] Thus, it is imperative to continue monitoring trends in care practices and outcomes to ensure that all newborns, regardless of racial and ethnic background, benefit equally from medical advancements. In this study, our objective was to examine more recent data and report on in-hospital care practices and outcome trends by race and ethnicity among newborns born at 22 to 29 weeks' gestation between 2018 and 2022.

Methods

Study Population

We conducted a retrospective cohort study including newborns born between 22 to 29 weeks' gestation at one of the 774 neonatal intensive care units (NICUs) located in the US and participating in the VON Very Low Birth Weight Database between January 1, 2018, and December 31, 2022. VON is a nonprofit, voluntary collaboration of health care professionals dedicated to improving the quality, safety, and value of care for newborns and their families.[10] We restricted our study sample to inborn, singleton newborns without congenital malformations. The University of Vermont Institutional Review Board determined that the use of data from the deidentified VON Research Repository for this study was not human participants research and informed consent was not needed, in accordance with 45 CFR §46. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines.

Study Variables

The birthing parent's self-reported race and ethnicity were collected through personal interview with the birthing parent and, if unavailable, were obtained through birth certificate or medical record review. The VON database categories include Asian, non-Hispanic Black (hereafter, Black), Hispanic, Native American, non-Hispanic White (hereafter, White), and other race, which is selected if none of the previous categories applied to the biological birthing parent. Race and ethnicity of the nonbirthing biological parent were not available; therefore, we ascribed the birthing parent's race and ethnicity to the newborn. Race and ethnicity were examined given the documented racial and ethnic disparities in care processes and outcomes of preterm newborns.[6,7,9]

We examined changes over time in (1) birthing parent's complications, (2) in-hospital care practices for which there are known benefits and/or racial and ethnic disparities,[1,6,7,9,11,12] and (3) in-hospital mortality and complications. The birthing parent's complications included diabetes (gestational diabetes, type 1 diabetes, or type 2 diabetes), hypertension (chronic or pregnancy induced), and chorioamnionitis. Care practices included antenatal corticosteroids (ANS), antenatal magnesium sulfate, delivery room intubation, hypothermia (newborn's body temperature <36.5 °C measured within the first hour of NICU admission),[13] and any human milk provided at discharge. Provision of human milk at discharge included the birthing parent's own milk and/or pasteurized breast donor milk or any human milk with a fortifier or formula within 24 hours of final discharge.[14] Mortality was defined as death before hospital discharge. Respiratory distress syndrome (RDS) was defined as room air partial pressure of oxygen less than 50 mm Hg, room air with central cyanosis, supplemental oxygen to maintain partial pressure of oxygen greater than 50 mm Hg, or supplemental oxygen to maintain a pulse oximeter saturation greater than 85% and chest radiograph findings consistent with RDS within the first 24 hours of life.[13] NEC was diagnosed at surgery or postmortem or required 1 or more clinical signs (eg, bilious gastric aspirate, abdominal distension, or occult blood in stool) and 1 or more radiographic finding (eg, pneumatosis intestinalis, hepatobiliary gas, or pneumoperitoneum).[13] Focal intestinal perforation, separate from NEC, was defined as a single focal perforation with the remainder of the bowel appearing normal, diagnosed at surgery time or postmortem examination.[13] NEC and focal intestinal perforation were combined into 1 outcome labeled NEC. Early-onset sepsis (EOS; up to day 3 of life) was defined as bacterial pathogen recovered from blood or cerebrospinal fluid.[13] LOS (after day 3 of life) was defined as bacterial pathogen or coagulase-negative *Staphylococcus* species recovered from blood or cerebrospinal fluid or fungus recovered from blood culture.[13] Coagulase-negative *Staphylococcus* species infection also required 1 or more signs of generalized infection and treatment with 5 days or more of intravenous antibiotics.[13] Severe intraventricular hemorrhage (sIVH) was defined as grade 3 or 4 using the Papile classification within 28 days of birth.[15] Severe retinopathy of prematurity (sROP) was defined as stages 3 to 5 on the basis of a retinal examination before hospital discharge.[16] Chronic lung disease (CLD) was defined as any supplemental oxygen use at 36 weeks' postmenstrual age or on oxygen at discharge at 34 to 35 weeks if transferred or discharged at less than 36 weeks.[13] We also examined survival to discharge without a major complication defined as 1 or more of the following: early or late bacterial or fungal infection, NEC and/or focal intestinal perforation, CLD, sIVH, cystic periventricular leukomalacia (multiple small periventricular cysts on a cranial ultrasonography, computed tomography, or magnetic resonance imaging), or sROP. Reporting hospitals tracked mortality before hospital discharge and after transfer until ultimate disposition. In-hospital mortality and complications were the primary outcomes, with all other outcomes considered secondary.

Statistical Analysis

We computed summary statistics of birthing parent and neonatal characteristics and selective care practices by the birthing parent's race and ethnicity. We subsequently calculated (1) incidence rates of birthing parent complications and selective care practices by race and ethnicity and birth year along with 95% CIs; (2) incidence rates of newborn mortality and complications by race and ethnicity and birth year along with 95% CIs; and (3) differences between rates (percentage points) for Black, Hispanic, and Asian vs White newborns by birth year, along with 95% CIs.

The analyses comparing White and Asian newborns are provided in the eMethods in Supplement 1. Analyses were performed using R statistical software version 4.4.1 (R Project for Statistical Computing) and SAS software version 9.4 (SAS Institute Inc). In a sensitivity analysis, we assessed the sensitivity of the results when restricting the study sample to centers participating in VON throughout the entire 5-year period.

Results

Study Sample

Of 94 462 singleton newborns born at VON centers, we excluded 29 with unknown sex, 947 missing data on race or ethnicity, 1974 of other races, 62 with missing birth weight, and 407 with implausible birth weight. Implausible birth weights were defined as values outside gestational age–specific cutoffs, determined using a method based on data sparsity.[17,18] This resulted in a sample of 91 064 newborns born at 774 VON centers. Given the limited sample size of Native American newborns (728 newborns), we only report their overall descriptive characteristics and exclude them from further analyses. Thus, the final sample size was 90 336 newborns (47 215 male [52.3%]; 43 121 female [47.7%]; mean [SD] gestational age, 26.4 [2.1] weeks). We had 665 VON centers (87 137 newborns; 96.5% of the original study sample) for our sensitivity analyses after restricting the study sample to centers participating in VON throughout the entire 5-year period.

The **Table** shows birthing parent and newborn characteristics and care practices by birthing parent's race and ethnicity. The study sample distribution consisted of 4734 Asian (5.2%), 31 264 Black (34.3%), 20 345 Hispanic (22.3%), 728 Native American (0.8%), and 33 993 White (37.3%) newborns. Native American birthing individuals had the lowest rate of prenatal care. Asian and Native American individuals had the highest rate of diabetes, whereas Black and Native American individuals had the highest rate of hypertension. Black individuals had the highest rate of chorioamnionitis and the lowest rate of ANS. Exposure to both ANS and antenatal magnesium sulfate was lowest among Hispanic birthing individuals (15 014 individuals [74.0%]). Black newborns had the highest rate of delivery room intubation and the lowest rate of human milk at discharge. Asian newborns had the lowest rates of delivery room intubation, surfactant therapy at any time, conventional ventilation, and postnatal steroids.

Birthing Parent Complications

Diabetes rates increased the most among Hispanic birthing individuals, with a 2.4–percentage point increase between 2018 and 2022 (eFigure 1 in Supplement 1). Chorioamnionitis rates were relatively stable over time among all groups. The rate of birthing parent hypertension showed an increasing trend over time for all groups but was highest for Black birthing individuals and lowest for Hispanic birthing individuals. Between 2018 and 2022, hypertension increased by almost 5 percentage points for all racial and ethnic groups.

Care Practices

Exposure to ANS remained relatively stable over time for all groups with White birthing individuals having approximately 1.7 percentage points higher rate of ANS exposure than Black birthing individuals in 2022 (**Figure 1**). Between 2018 and 2022, exposure to antenatal magnesium sulfate increased among all groups (2.7–percentage point increase among White, 2.4–percentage point increase among Black, and 0.9–percentage point increase among Hispanic birthing individuals) but remained lowest among Hispanic birthing individuals in 2022 (4660 Black individuals [79%], 3317 Hispanic individuals [77%], and 5358 White individuals [81%]). The rates of tracheal intubation and hypothermia in the first hour of NICU admission were higher among Black than White newborns throughout the study period. At the end of the study period, the rate of hypothermia was 6.5 percentage points higher among Black than White newborns. There were no differences between Hispanic and White newborns in the rates of tracheal intubation and hypothermia. Human milk at discharge remained approximately the same at approximately 46% for Hispanic newborns but increased by 3.8 percentage points from 31.5% in 2018 to 35.3% in 2022 among Black newborns, and by 2 percentage points from 48.0% to 50.0% among White newborns (Figure 1). Still, in 2022, the rate of human milk at discharge for Black newborns was 14.7 percentage points lower compared with White newborns (35.3% vs 50.0%).

Mortality and Complications

eTable 1 in Supplement 1 shows the overall rates of outcomes by race and ethnicity. Rates of in-hospital mortality (4831 Black newborns [15.6%]; 3009 Hispanic newborns [14.9%]; and 4886 White newborns [14.4%]), NEC (2374 Black newborns [7.8%]; 1359 Hispanic newborns [6.9%]; and 2137 White newborns [6.5%]), LOS (3846 Black newborns [13.5%]; 2258 Hispanic newborns [12.3%]; and 3575 White newborns [11.5%]), and sIVH (2919 Black newborns [10.3%]; 1673 Hispanic newborns [9.2%]; and 2800 White newborns [9.1%]) were highest among Black and lowest among White newborns. CLD and pneumothorax rates were lowest among Black and highest among White

Table. Birthing Parent and Newborn Characteristics and Care Practices by Race and Ethnicity[a]

Characteristics and care practices	White (n = 33 993)	Black (n = 31 264)	Hispanic (n = 20 345)	Asian (n = 4734)	Native American (n = 728)
Birthing parent, No./total No. (%)					
Prenatal care	32 759/33 916 (96.6)	29 618/31 148 (95.1)	19 366/20 281 (95.5)	4635/4723 (98.1)	661/726 (91.1)
Diabetes[b]	3134/33 823 (9.3)	3184/31 156 (10.2)	2708/20 264 (13.4)	897/4722 (19.0)	120/721 (16.6)
Hypertension[c]	12 733/33 906 (37.6)	12 759/31 176 (40.9)	6349/20 288 (31.3)	1426/4725 (30.2)	291/727 (40.0)
Chorioamnionitis[d]	5889/33 859 (17.4)	6533/31 106 (21.0)	4088/20 291 (20.1)	914/4721 (19.4)	129/724 (17.8)
Antenatal corticosteroids[e]	30 694/33 947 (90.4)	27 504/31 204 (88.1)	17 974/20 308 (88.5)	4215/4732 (89.1)	648/727 (89.1)
Antenatal magnesium sulfate	26 919/33 940 (79.3)	24 306/31 209 (77.9)	15 398/20 323 (75.8)	3690/4730 (78.0)	581/728 (79.8)
Both antenatal corticosteroids and magnesium sulfate	26 278 (77.5)	23 573 (75.6)	15 014 (74.0)	3612 (76.4)	569 (78.3)
Cesarean delivery	24 029/33 990 (70.7)	21 164/31 262 (67.7)	13 457/20 344 (66.2)	3056/4733 (64.6)	498/728 (68.4)
Newborn, No. (%)					
Sex					
Male	17 997 (52.9)	15 718 (50.3)	10 949 (53.8)	2551 (53.9)	371 (51.0)
Female	15 996 (47.1)	15 546 (49.7)	9396 (46.2)	2183 (46.1)	357 (49.0)
Birth weight, mean (SD), g	957 (313)	878 (290)	944 (311)	941 (301)	941 (307)
Gestational age, mean (SD), wk	26.6 (2.0)	26.2 (2.1)	26.3 (2.1)	26.5 (2.0)	26.5 (2.1)
Apgar score at 5 min ≤3	3117 (9.3)	3586 (11.6)	2144 (10.7)	462 (9.9)	84 (11.7)
Postnatal life support[f]	33 382 (98.2)	30 634 (98.0)	19 848 (97.6)	4592 (97.0)	707 (97.1)
Delivery room intubation	17 290 (50.9)	17 943 (57.4)	10 273 (50.5)	2132 (45.1)	389 (53.4)
Surfactant therapy any time	25 299 (74.4)	22 631 (72.4)	14 280 (70.2)	3056 (64.6)	530 (72.8)
Conventional ventilation	22 123 (66.8)	21 070 (69.4)	12 710 (64.6)	2719 (59.6)	471 (67.3)
Postnatal steroids	6433 (19.5)	6071 (20.0)	3357 (17.1)	649 (14.3)	140 (20.0)
Admission temperature, °C[g]					
36.5-37.5	21 663 (67.1)	18 455 (62.6)	13 061 (68.0)	3045 (68.3)	430 (63.3)
<36.5	7485 (23.2)	8586 (29.1)	4289 (22.3)	965 (21.7)	182 (26.8)
>37.5	3116 (9.7)	2423 (8.2)	1849 (9.6)	445 (10.0)	67 (9.9)
Enteral feeding at discharge					
None	5046 (15.3)	4958 (16.4)	3207 (16.3)	712 (15.6)	97 (13.9)
Any human milk	15 822 (47.9)	9997 (33.0)	9059 (46.1)	2686 (59.0)	240 (34.3)
Formula only	12 188 (36.9)	15 352 (50.7)	7380 (37.6)	1153 (25.3)	362 (51.8)

[a] Data are missing for prenatal care (0.30%), diabetes (0.42%), hypertension (0.27%), chorioamnionitis (0.40%), antenatal corticosteroids (0.16%), antenatal magnesium sulfate (0.10%), cesarean delivery (0.01%), Apgar score at 5 minutes (1.2%), delivery room intubation (0.04%), surfactant therapy anytime (0.01%), conventional ventilation (0.01%), postnatal steroids (0.26%), admission temperature (2.7%), and enteral feeding at discharge (3.1%). Postnatal steroids, conventional ventilation, and admission temperature variables were recorded only for newborns admitted to the neonatal intensive care unit.

[b] Birthing parent diabetes is defined as gestational diabetes, type 1 diabetes, or type 2 diabetes.

[c] Birthing parent hypertension is defined as chronic or pregnancy induced, with or without edema and proteinuria, or as birthing parent's blood pressure above 140 systolic or 90 diastolic before or during the present pregnancy.

[d] A diagnosis of chorioamnionitis was recorded as yes if it was in the birthing parent's or newborn's medical record. The diagnosis of chorioamnionitis can be made clinically, from amnionic fluid testing, or histopathologic analysis of the placenta or umbilical cord.

[e] Exposure to antenatal corticosteroids defined as steroids administered intramuscularly or intravenously to the birthing parent during pregnancy at any time before delivery.

[f] Postnatal life support includes any of the following: surfactant therapy at any time, endotracheal tube ventilation, ventilator support at any time (including nasal continuous positive airway pressure, nasal ventilation, face mask ventilation, or mechanical ventilation), epinephrine, or cardiac compressions.

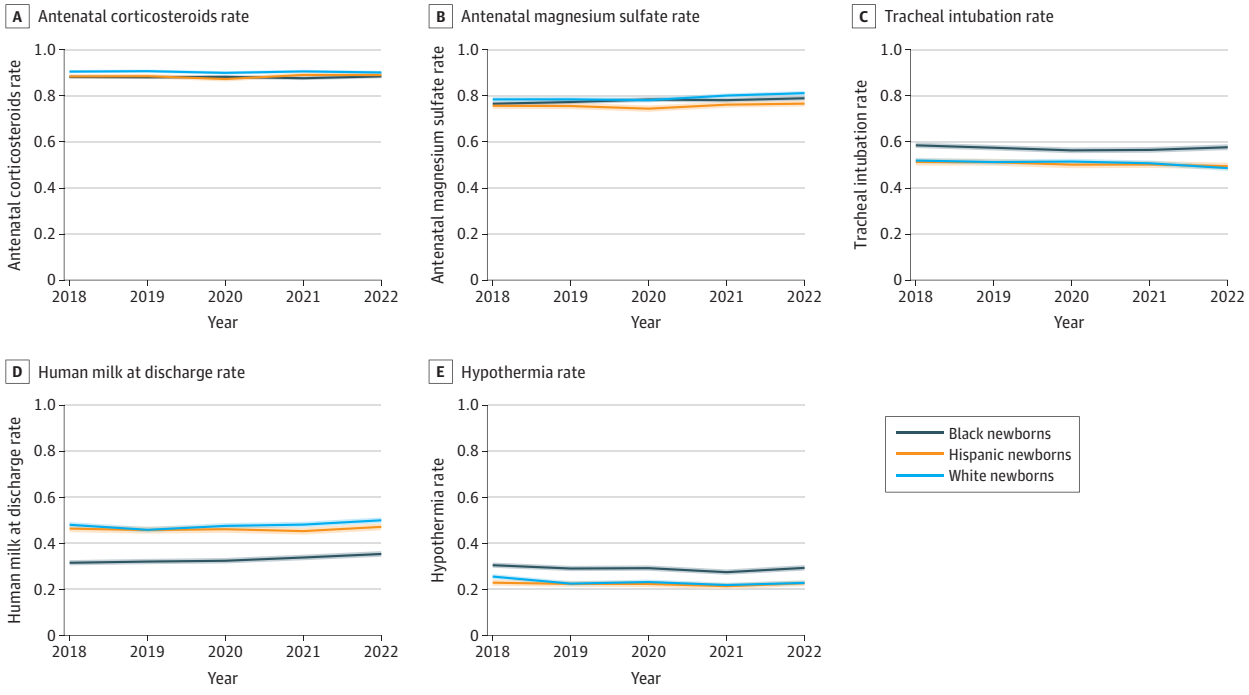
[g] Newborn's body temperature measured by taking a rectal, esophageal, tympanic, or axillary temperature was recorded within the first hour after admission to the neonatal intensive care unit.

newborns. Mortality and complication rates by birth year are shown in eFigures 2 and 3 in Supplement 1, separately for each racial and ethnic group. Between 2018 and 2022, LOS increased among all groups (3.0–percentage point increase among Black, 2.0–percentage point increase among Hispanic, and 1.9–percentage point increase among White newborns). Mortality and complication rate differences between Black and Hispanic vs White newborns during the study period are shown in **Figure 2** and **Figure 3**.

The rate differences for mortality and EOS were occasionally slightly higher for Black than White newborns, with no differences noted at the end of the study period (Figure 2). The rate of NEC was consistently higher among Black than White newborns, except for 1 year, and in 2022 was 1.3 percentage points (95% CI, 0.46-2.2 percentage points) higher. The rate of LOS was consistently higher among Black than White newborns, with a 2.7–percentage point (95% CI, 1.4-4.0 percentage points) difference at the end of the study period. The rate of sIVH was higher among Black newborns in some years, while sROP was lower (Figure 2). The rate of RDS was higher among White newborns, except in 2022 when there were no differences (Figure 3). CLD and pneumothorax rates remained higher among White newborns throughout the study period. Survival without major complications was higher among Black newborns, primarily owing to their lower CLD rates (Figure 3).

When comparing Hispanic and White newborns, there were no differences in the rates of mortality, NEC, LOS, and sIVH throughout the study period and no differences in the rates of EOS and sROP for the majority of the years (Figure 2). The rates for RDS and CLD were lower among Hispanic newborns in each year (Figure 3). Pneumothorax was lower among Hispanic than White newborns in all years except for 2018 when there were no differences between the 2 groups. Survival without major complications was higher among Hispanic newborns in all years. Supplemental results for Asian newborns are listed in eMethods and eFigures 4 to 9 in in Supplement 1. In sensitivity analyses, the results did not change after restricting the analysis to VON centers (665 centers; 87 137 newborns; 96.5% of the original study sample) that were included in all 5 years of the study.

Figure 1. Rates of In-Hospital Care Practices by Birth Year Among Black, Hispanic, and White Newborns



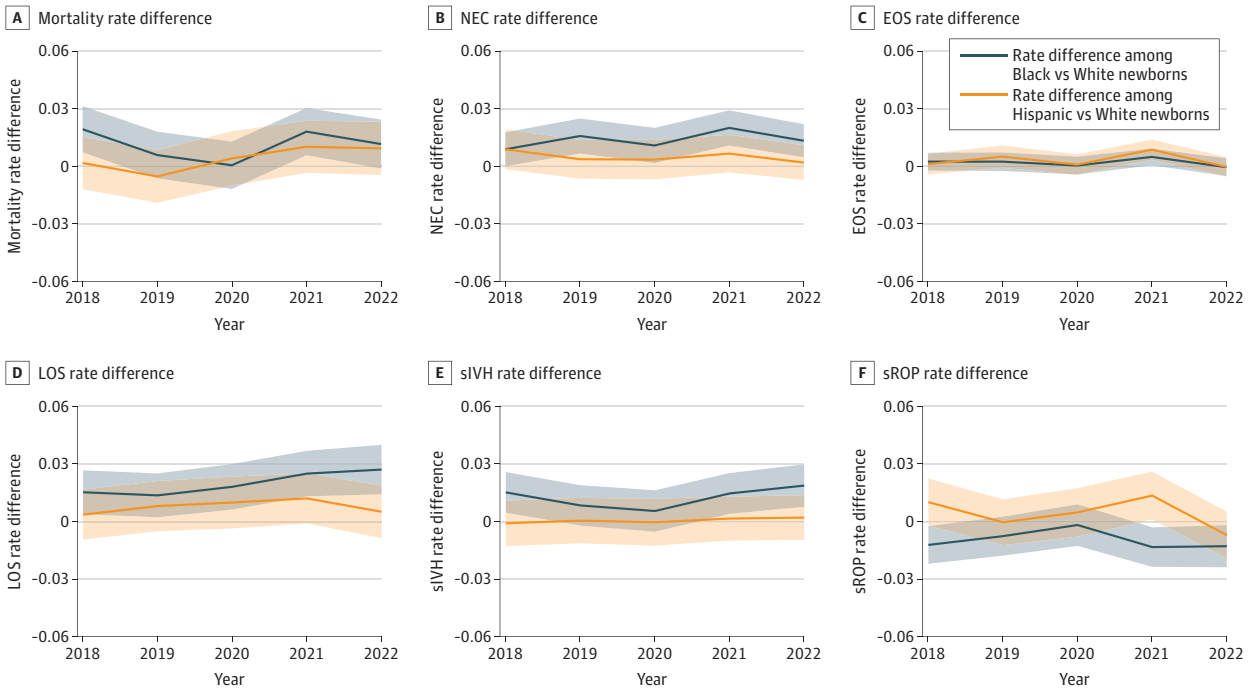
Shading represents 95% CIs.

Discussion

In a cohort study of more than 90 000 newborns born at 22 to 29 weeks' gestation between 2018 and 2022 in the US, we examined in-hospital care practices and outcome trends by race and ethnicity. We reported that by the end of the study period, there were no differences in rates of mortality for Black compared with White newborns, but Black newborns still experienced higher rates of NEC (rate difference, 1.3 percentage points; 95% CI, 0.46-2.2 percentage point) and LOS (rate difference, 2.7 percentage points; 95% CI, 1.4-4.0 percentage points). Hispanic compared with White newborns had similar rates for mortality and in-hospital complications. Both Black and Hispanic newborns experienced lower rates of in-hospital respiratory complications, including CLD, which resulted in the higher rates of survival without major complications among Black and Hispanic compared with White newborns.

We have previously reported on racial and ethnic differences in care practices and outcomes of 22- to 29-week newborns born between 2006 and 2017 and found that compared with White newborns, Black newborns experienced faster declines in mortality, NEC, and LOS.[6] However, by 2017, NEC and LOS remained elevated among Black compared with White newborns.[6] In the current study, we show that by 2022, there were no differences in mortality rates for Black compared with White newborns but the higher rates of NEC and LOS among Black newborns persisted. These findings are in line with a recent study by Horbar et al[1] that examined changes in outcomes between 1997 and 2021 for newborns born 24 to 28 weeks' gestation. That article reported that in-hospital mortality and major complications showed some improvement in earlier years, followed by slower improvement, stagnation, or worsening for certain complications in later years.[1] Specifically, for mortality and LOS, there has been slower improvement between 2012 and 2021 while there have been no changes for NEC between 2015 and 2021.[1] The lack of improvement in these outcomes is mirrored in our study in the persisting disparities between White and Black newborns.

Figure 2. Rate Differences in Mortality and Complications by Birth Year for Black and Hispanic vs White Newborns

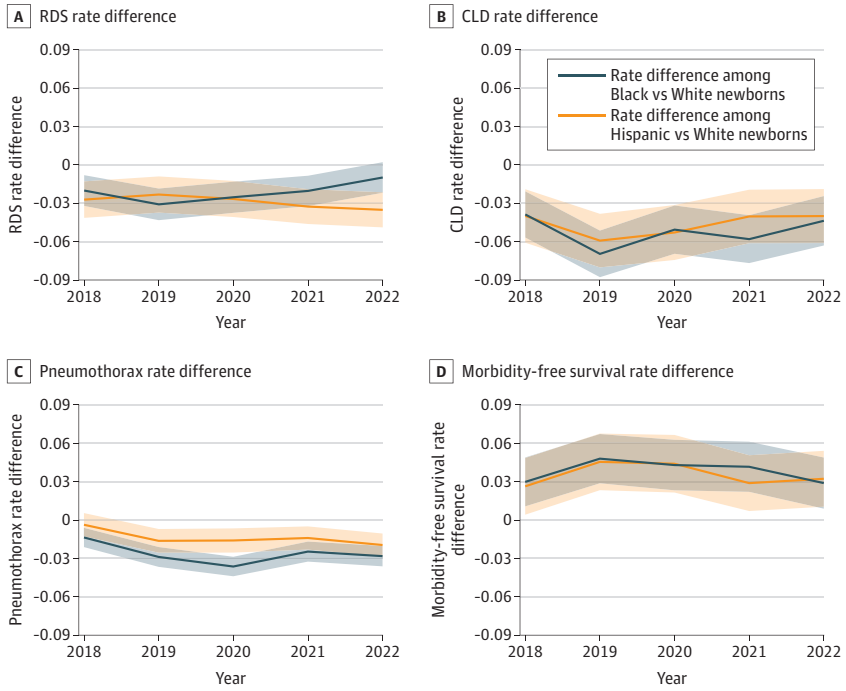


Shading represents 95% CIs. EOS indicates early-onset sepsis; LOS, late-onset sepsis; NEC, necrotizing enterocolitis; sIVH, severe intraventricular hemorrhage; sROP, severe retinopathy of prematurity.

In the study on trends in mortality and complications, Horbar et al[1] propose a 3-part approach to resume the pace of improvement observed in earlier years. This includes research to develop new therapies, quality improvement to maximize the effectiveness of current interventions, and responsibility to follow-through and address the SDOH.[1] All 3 parts are relevant to reducing racial disparities in newborn outcomes. Specifically, quality improvement initiatives that focus on reducing racial disparities in breastfeeding during hospitalization are critical in reducing rates of NEC. This is supported by several studies[19,20] and a recent randomized clinical trial[11] showing that newborns randomized to receive donor milk experienced NEC half as often as those randomized to preterm formula (adjusted between group risk difference, −5%; 95% CI, −9% to −2%). In our study, although human milk at discharge increased by approximately 4 percentage points for Black newborns between 2018 and 2022, the rate of human milk at discharge at the end of the study period was still lower by 14.7 percentage points among Black compared with White newborns (35.3% for Black newborns and 50.0% for White newborns). Similarly, quality improvement efforts have been successful in improving thermoregulation and reducing rates of hypothermia[21-23] and LOS,[24-27] which were 6.5 percentage points and 2.7 percentage points, respectively, higher by the end of the study period among Black compared with White newborns. We are not sure why Black newborns have higher hypothermia rates than White newborns, but the higher rate of delivery room intubation among Black newborns might be a contributing factor and has implications for follow-through. We and others have reported on the higher rate of delivery room intubation among Black newborns,[6,28] but the reasons remain unexplained.

Addressing SDOH is a critical component to promoting health equity. Beyond in-hospital outcomes, newborns born to birthing parents with risk-associated SDOH have higher odds of hospital readmission, neurodevelopmental impairment, and death after discharge.[29] The NICU presents a unique opportunity not only to screen for SDOH[30,31] but also to administer postpartum care[32] with the prospect of improving birthing parent's outcomes. This is particularly salient because birthing parents of preterm newborns are at considerable risk for severe complications and long-term adverse outcomes.[33-37] That the rate of hypertension among birthing parents has increased by

Figure 3. Rate Differences in Respiratory Complications and Complication-Free Survival by Birth Year for Black and Hispanic vs White Newborns



Shading represents 95% CIs. CLD indicates chronic lung disease; RDS, respiratory distress syndrome.

almost 5 percentage points between 2018 and 2022 for each of the racial and ethnic groups in our study further emphasizes the critical need for postpartum care and long-term follow-up for birthing parents of extremely preterm newborns.

Strengths and Limitations

Strengths of our study include a large sample size that is representative of practices and outcomes of the US population of newborns born at 22 to 29 weeks' gestation since VON enrolls approximately 90% of these births. Limitations include a lack of data on provision of human milk during hospitalization and on outcomes beyond hospital discharge, particularly neurodevelopmental outcomes. We did not have more granular data to examine the potential impact of COVID-19 on the racial and ethnic differences in the outcomes that we report. COVID-19 has had a disproportionate impact on minoritized populations in the adult literature[38,39] and has strained health care systems.[40,41] There have been several studies reporting that hospital-acquired infections have significantly increased during the COVID-19 pandemic[42-44] owing to a range of different factors such as overstretched health care workers, increased workload, and redeployment.[43] We are unsure how these factors relate to the care of extremely preterm newborns. However, we did notice a consistent pattern in the increase of LOS among all racial groups. From 2018 to 2022, LOS increased by 3.0 percentage points among Black newborns, 2.0 percentage points among Hispanic newborns, and 1.9 percentage points among White newborns, emphasizing the importance of continued quality improvement to decrease rates of LOS. In addition, we acknowledge that racial disparities in outcomes are also influenced by inequities occurring before birth, which can lead to shorter gestational periods.

Conclusions

Between 2018 and 2022, there were no differences in rates of mortality for Black compared with White newborns, but Black newborns still experienced higher rates of NEC and LOS. Survival without serious complications was higher among Black than White newborns, which was mainly due to the lower rates of CLD among Black newborns. Continued quality improvement approaches and addressing SDOH are critical to promote health equity in hospital outcomes and beyond.

ARTICLE INFORMATION

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Concept and design: Boghossian, Edwards, Horbar.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Boghossian, Geraci.

Critical review of the manuscript for important intellectual content: Geraci, Edwards, Horbar.

Statistical analysis: Boghossian, Geraci.

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SUPPLEMENT 1.

eFigure 1. Maternal diabetes, hypertension, and chorioamnionitis rates by birth year: Black, Hispanic, and White infants.
eTable 1. In-hospital mortality and complications by race and ethnicity
eFigure 2. Mortality and complication rates by birth year: Black, Hispanic, and White infants
eFigure 3. Respiratory complications and complication-free survival rates by birth year: Black, Hispanic, and White infants
eMethods
eFigure 4. Maternal diabetes, hypertension, and chorioamnionitis rates by birth year: Asian and White infants
eFigure 5. Rates of in-hospital care practices by birth year: Asian and White infants
eFigure 6. Mortality and complication rates by birth year: Asian and White infants
eFigure 7. Respiratory complications and complication-free survival rates by birth year: Asian and White infants
eFigure 8. Rate differences in mortality and complications by birth year: Asian versus White infants
eFigure 9. Rate differences in respiratory complications and complication-free survival by birth year: Asian versus White infants
eTable 2. Hospitals in Analysis

SUPPLEMENT 2.

Data Sharing Statement