

Racial disparity in previable birth

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BACKGROUND: Extremely preterm birth of a live newborn before the limit of viability is rare but contributes uniformly to the infant mortality rate because essentially all cases result in neonatal death.

OBJECTIVE: The objective of the study was to quantify racial differences in previable birth and their contribution to infant mortality and to estimate the relative influence of factors associated with live birth occurring before the threshold of viability.

STUDY DESIGN: This was a population-based retrospective cohort of all live births in Ohio over a 7 year period, 2006–2012. Demographic, pregnancy, and delivery characteristics of previable live births at 16 0/7 to 22 6/7 weeks of gestation were compared with a referent group of live births at 37 0/7 to 42 6/7 weeks. Rates of birth at each week of gestation were compared between black and white mothers, and relative risk ratios were calculated. Logistic regression estimated the relative risk of factors associated with previable birth, with adjustment for concomitant risk factors.

RESULTS: Of 1,034,552 live births in Ohio during the study period, 2607 (0.25% of all live births) occurred during the previable period of 16–22 weeks. There is a significant racial disparity in the rate and relative risk of previable birth, with a 3- to 6-fold relative risk increase in black mothers at each week of previable gestational age. The incidence of previable birth for white mothers was 1.8 per 1000 and for black mothers, 6.9 per 1000. Factors most strongly associated with previable birth,

presented as adjusted relative risk ratio (95% confidence interval [CI]), were maternal characteristics of black race adjusted relative risk 2.9 (95% CI, 2.6–3.2), age \geq 35 years 1.3 (95% CI, 1.1–1.6), and unmarried 2.1 (95% CI, 1.8–2.3); fetal characteristics including congenital anomaly, 5.4 (95% CI, 3.4–8.1) and genetic disorder, 5.1 (95% CI, 2.5–10.1); and pregnancy characteristics including prior preterm birth 4.4 (95% CI, 3.7–5.2) and multifetal gestation, twin, 16.9 (95% CI, 14.4–19.8) or triplet, 65.4 (95% CI, 32.9–130.2). The majority, 80%, of previable births (16–22 weeks) were spontaneous in nature, compared with 73% in early preterm births (23–33 weeks), 72% in late preterm births (34–36 weeks), and 65% of term births (37–42 weeks) ($P < .001$). Previable births constituted approximately 28% of total infant mortalities in white newborns and 45% of infant mortalities in black infants in Ohio during the study period.

CONCLUSION: There is a significant racial disparity in previable preterm births, with black mothers incurring a 3- to 6-fold increased relative risk compared with white mothers, most of which are spontaneous in nature. This may explain much of the racial disparity in infant mortality because all live-born previable preterm births result in death. Focused efforts on the prevention of spontaneous previable preterm birth may help to reduce the racial disparity in infant mortality.

Key words: prematurity, preterm birth, previable birth, racial disparity

Extremely preterm birth of a live newborn before the limit of viability (less than 23 weeks of gestation) is rare but contributes uniformly to the infant mortality rate (IMR) because essentially all cases result in neonatal death.^{1–3} Variations exist in gestational age ranges in which the delivery of a previable pregnancy may be considered a birth vs a miscarriage. However, because the passage of the Born-Alive Infants Protection Act of 2002, in the United States, any delivery of a living fetus is reported as a live birth, regardless of gestational age, even if born at < 20 weeks of gestation.^{4–6} The US IMR is then calculated as a rate per 1000 live-born infants who die prior to 12 months of age divided by the number

of live births during the same time period.

In this study, we aim to gain a better understanding of the frequency of previable preterm births, defined as live births at 16–22 weeks of gestation as recorded in the US birth certificate.^{5,7} We chose 16 weeks as the lower limit of the previable birth period rather than 20 weeks, as has been recommended recently by experts in the field of preterm birth,^{8,9} considering the pathological etiologies of extremely preterm births at 16–20 weeks are similar epidemiologically compared with early preterm births that occur after 20 weeks.^{10–12} Furthermore, these early deliveries of live-born babies also contribute to the IMR. We extend the gestational age range to 22 weeks in this study because essentially all live births prior to 23 completed weeks result in infant death and likewise contribute to the IMR.⁵

Our study examines a population-based statewide cohort of live birth records to assess factors associated with previable preterm birth to better

understand their underlying etiology and quantify how they may contribute to the high IMR in our state.¹³

Materials and Methods

We performed a population-based cohort study of all live births in Ohio over a 7 year period, 2006–2012, utilizing US live birth records from Ohio birth certificate data. The protocol for this study was approved, and a deidentified data set was provided by the Ohio Department of Health. This study was exempt from review by the Institutional Review Board at the University of Cincinnati (Cincinnati, OH).

The primary outcome for this study was previable preterm birth, defined as live birth at 16 0/7 to 22 6/7 weeks of gestational age in the US birth certificate.^{7,14} The frequency of maternal demographic, pregnancy, and delivery characteristics of previable births were compared with later preterm births (23 0/7 to 36 6/7 weeks) and also to a referent group of term births (37 0/7 to 42 0/7 weeks). Live births with a recorded

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TABLE 1
Maternal characteristics of previable compared with term births, Ohio live births 2006–2012

Characteristics	Previable, 16–22 wks (n = 2222)	Term, 37–42 wks (n = 842,488)	P value
Race/ethnicity			
White (non-Hispanic)	54.3%	79.6%	<.001
Rate incidence	0.18% 1.8 per 1000		
Black (non-Hispanic)	41.4%	15.8%	<.001
Rate incidence	0.69% 6.9 per 1000		
Hispanic	4.3%	4.6%	.50
Rate incidence	0.25% 2.5 per 1000		
Maternal age, y			
<20	15.4%	9.8%	<.001
20–34	72.5%	78.4%	<.001
≥ 35	12.1%	11.8%	.63
Unmarried	65.9%	41.2%	<.001
Medicaid	52.3%	37.7%	<.001
Less than high school educational attainment	23.7%	16.1%	<.001
BMI			
Underweight	4.7%	4.4%	.48
Normal weight	41.4%	48.8%	<.001
Overweight	23.3%	23.9%	0.55
Obese	30.6%	23.0%	<0.001
Primiparous	47.1%	40.2%	<0.001
Tobacco use	28.1%	23.8%	<0.001
Prior preterm birth	11.0%	2.7%	<0.001
Interpregnancy interval <12 mo	25.4%	19.6%	<0.001

Percentages represent the fraction within each column with the specified characteristic. Maternal characteristics were counted only once for each multifetal delivery.

BMI, body mass index.

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gestational age at delivery of < 16 and ≥ 43 weeks were not included in analyses.

Gestational age was defined by the best obstetric estimate variable in the birth record, which takes into account a combination of last menstrual period and clinical and ultrasound parameters, as is commonly accepted in clinical practice for gestational age estimation. The exposure variable for this study, maternal race, was self-reported, which has been shown to be highly accurate

when compared with ancestral genetic markers in a US population.¹⁵

The racial groups compared in these analyses were non-Hispanic black and non-Hispanic white. Because of the small number of births to Hispanic mothers in Ohio during the study period (< 5%), they were not included in the primary outcome comparisons. Fetal growth restriction was defined as birth-weight less than the 10th percentile for gestational age.¹⁶ Body mass index was

calculated using prepregnancy weight and height, as recorded in the medical record and categorized by the World Health Organization.¹⁷ Other characteristics included in analyses were obtained from the birth certificate, with data obtained as outlined in the National Vital Statistics System Guide for Completing the Facility Worksheets for the Certificate of Live Birth in the United States.¹⁴ All birth records included in this analysis utilized the most recent, 2003 version, of the US birth certificate.⁷

For maternal characteristic comparisons, only 1 birth record for each multifetal gestation was included. For birth outcomes such as pregnancy complications and delivery characteristics, each birth of a multifetal gestation was included. Births were considered indicated if complicated by preeclampsia or fetal growth restriction, delivered by cesarean without preceding labor, or delivery followed a labor induction. Those with preterm premature rupture of membranes, received tocolysis, or not classified as indicated were considered spontaneous for the purposes of this study.

Differences in baseline maternal demographic, behavioral, socioeconomic, pregnancy, and delivery characteristics among previable (16–22 weeks) and term live births (37–42 weeks) were compared. Statistical comparisons were displayed as P values, relative risk ratios with 95% confidence intervals (CIs).

The frequency of live birth at each week of gestational age was calculated and then stratified by maternal black and white race. Relative risk ratios for births to black compared with white mothers were calculated for each week of gestation. A multivariate logistic regression was then used to estimate the relative risk of various characteristics on the outcome of previable birth, compared with the term birth referent category, after accounting for coexisting risk factors. The final regression model was constructed choosing baseline factors with significant differences noted in univariate comparisons as well as factors with biologic plausibility.

Significant differences were defined as comparisons with a probability value of

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