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RESEARCH ARTICLE

Black–White Disparities in Preterm Birth: Geographic, Social, and Health Determinants

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Introduction: Reducing racial/ethnic disparities in preterm birth is a priority for U.S. public health programs. The study objective was to quantify the relative contribution of geographic, sociodemographic, and health determinants to the black, non-Hispanic and white, non-Hispanic preterm birth disparity.

Methods: Cross-sectional 2016 U.S. birth certificate data (analyzed in 2018–2019) were used. Black–white differences in covariate distributions and preterm birth and very preterm birth rates were examined. Decomposition methods for nonlinear outcomes based on logistic regression were used to quantify the extent to which black–white differences in covariates contributed to preterm birth and very preterm birth disparities.

Results: Covariate differences between black and white women were found within each category of geographic, sociodemographic, and health characteristics. However, not all covariates contributed substantially to the disparity. Close to 38% of the preterm birth and 31% of the very preterm birth disparity could be explained by black–white covariate differences. The largest contributors to the disparity included maternal education (preterm birth, 11.3%; very preterm birth, 9.0%), marital status/paternity acknowledgment (preterm birth, 13.8%; very preterm birth, 14.7%), source of payment for delivery (preterm birth, 6.2%; very preterm birth, 3.2%), and hypertension in pregnancy (preterm birth, 9.9%; very preterm birth, 8.3%). Interpregnancy interval contributed a more sizable contribution to the disparity (preterm birth, 6.2%, very preterm birth, 6.0%) in sensitivity analyses restricted to all nonfirstborn births.

Conclusions: These findings demonstrate that the known portion of the disparity in preterm birth is driven by sociodemographic and preconception/prenatal health factors. Public health programs to enhance social support and preconception care, specifically focused on hypertension, may provide an efficient approach for reducing the racial gap in preterm birth.

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INTRODUCTION

Preterm birth (PTB) and very PTB (VPTB), defined as a birth before 37 and 32 weeks of gestation, respectively, are associated with both short- and long-term morbidity and mortality.[1–5] Although the rate of PTB in the U.S. has declined from its peak in 2007,[6] rates have increased since 2014 and significant racial/ethnic disparities persist.[6,7] Accordingly, the reduction of racial/ethnic disparities in PTB is a key priority for U.S. public health programs.

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Both distal and proximal determinants, including social, environmental, health, and clinical care factors, influence PTB and attendant disparities.[8–15] A theoretical framework for understanding the relationship between these factors across the life course has been proposed by Misra et al.,[16] which posits that distal social and physical factors influence more proximal behavioral and biomedical processes to shape birth outcomes and disparities. However, decisions about where to focus efforts remain a challenge for resource-constrained programs. Few available studies have quantified the relative components of racial/ethnic disparities to help guide policies and programs and promote health equity.

To inform preventive action, multivariable decomposition methods can be used to determine the extent to which black–white differences in the distribution of covariates (e.g., access to prenatal care) contribute to an overall disparity.[17] In other words, they quantify the magnitude by which the black–white disparity in PTB could be reduced by addressing modifiable determinants.

To date, only three studies have applied this approach to examine racial disparities in PTB in the U.S. Using national data from 1991 and 2001, Llihla and Long[18] found that 21.1%–27.5% of the black–white PTB gap was explained by observable characteristics, predominantly sociodemographic factors, but detailed variable contributions were not specified. More recently, a 40-state analysis restricted to the U.S.-born population reported 27% of the disparity was explained by covariates on the birth certificate, but lacked geographic contributors.[19] Finally, a California-based study attributed 38% of the black–white PTB disparity to maternal, neighborhood socioeconomic, and environmental factors but did not include proximate healthcare or health status information.[20]

Building upon and combining the strengths of these previous studies, the authors investigate the detailed contribution of geographic, sociodemographic, and health indicators to black–white differences in PTB and VPTB using national birth data for all 50 states and the District of Columbia. This study uses more timely data to extend these prior studies by examining newly available variables, such as interpregnancy interval, and validated measures of residential segregation. Additionally, this study examines VPTB, which has more pronounced racial disparities, greater long-term consequences, and explains most of the black–white gap in infant mortality.[1,7]

METHODS

Study Population

Data from the 2016 national birth certificate data file with geographic detail released by the Centers for Disease Control and Prevention's National Center for Health Statistics were used.[21] The data represent 100% of all the registered live births in the U.S. and the first year that all the items on the revised birth certificate are available nationally.[22] The sample was restricted to all resident singleton births among black, non-Hispanic and white, non-Hispanic women (n=2,516,132) with complete information on gestational age (n=2,514,303). The final analytic sample (analyzed in 2018) for all the regression and decomposition analyses was limited to births with complete information for all the covariates (n=2,268,217).

Measures

This study defined PTB and VPTB as a birth occurring before 37 or 32 completed weeks of gestation, respectively, compared with their complement using the birth certificate item "obstetric estimate of gestational age." This measure includes live births at any gestational age and is reported with a high degree of accuracy on the birth certificate.[21–23] Race and ethnicity categories were defined consistent with the 1997 Office of Management and Budget standards.[24]

Covariates were selected to examine the contribution of conceptually relevant categories guided by a multiple determinants framework for perinatal health.[16] These covariates represent or are proxy measures for distal and proximal determinants specified within this framework. Neighborhood and sociodemographic characteristics were considered distal, whereas maternal health factors were considered proximal determinants. The quality of these data items has been shown to be generally well reported for sociodemographic characteristics but of mixed quality for health items.[22]

Geographic factors included state, county population size, and racialized economic segregation in the mother's county of residence. The Index of Concentration at the Extremes (ICE) was used to assess residential segregation by both race/ethnicity and income. ICE values range from −1 to 1 and indicate the extent to which the area population is concentrated at the extremes of black deprivation (−1) or white privilege (1) as described by Krieger and colleagues.[25] This information was obtained from the 2016 U.S. Census Bureau's American Community Survey 5-year estimates.

Maternal sociodemographic characteristics included age (5-year categories), education, nativity, marital status, parity and interpregnancy interval (IPI), paternity acknowledged at the hospital, and source of payment for delivery. The last three measures represent new or revised information collected on the revised birth certificate.[22] Marital status and paternity acknowledgment (married, unmarried with paternity acknowledged, and unmarried with no paternity acknowledged) were combined into one categorical variable. IPI, defined as the time between a live birth and the start of a subsequent pregnancy ending in a live birth, was derived by subtracting the obstetric estimate of gestational age (in months) from the interval of the last live birth variable.[26,27] Categories were defined according to recent recommendations with 18–23 months as a reference category.[28]

Measures of maternal health and behaviors included information on the timing of prenatal care initiation, prepregnancy BMI, preconception (3 months before pregnancy) and prenatal smoking, diabetes in pregnancy (gestational or chronic), hypertension in pregnancy (gestational or chronic), and whether any infection (gonorrhea, chlamydia, syphilis, and hepatitis B or C) was reported during pregnancy. Prenatal care initiation was derived from information on the "date of first prenatal care visit" and

obstetric estimate of gestational age. The BMI was derived from information collected on height and pregnancy weight. These health variables represent new or more substantive modifications from previous versions of the birth certificate.

Statistical Analysis

Covariate distributions and the percentage of PTB and VPTB across covariates were examined separately for black and white women. Differences in the distribution of covariates by race and PTB were compared using chi-squared tests or *t*-tests. Logistic regression was used to estimate unadjusted ORs and AORs. All covariates were categorical with the exception of the county ICE measure, which exhibited a linear relationship with PTB. Because maternal health factors (proximal) may be influenced by sociodemographic or geographic factors (distal), two separate models were fit to assess the influence of proximal determinants on each outcome. Model 1 adjusted for geographic and sociodemographic characteristics; Model 2 added maternal health characteristics to Model 1. To isolate the contribution of interpregnancy interval, independent of parity, a subsample of nonfirstborn births was analyzed. All logistic regression models informed the decomposition analyses.

The authors applied decomposition methods to examine the extent to which black–white differences in geographic, sociodemographic, and health determinants explain the racial difference in PTB and VPTB. An extension of the linear Oaxaca–Blinder method for nonlinear binary outcome models was applied.[29,30] Pooled coefficients from the logistic regression models were used to estimate the percentage of the disparity that is "explained" by differences in the distribution of covariates between black and white women and the percentage that remained "unexplained" (i.e., owing to within group processes or unmeasured variables). Individual covariate contributions are additive and represent components of the overall explained percentage. Because a change to equalize the distribution of one component of a categorical variable (e.g., gestational hypertension) would necessitate distributional shifts in other categories (e.g., chronic hypertension), the method can only estimate the contribution of categorical variable overall (e.g., any hypertension during pregnancy). However, individual contributions may be inferred from black–white covariate differences and regression models.

A positive covariate contribution represents a factor that, if changed, would result in a reduction in the disparity; a negative contribution, if changed, would result in a widening of the disparity. Appendix Text 1 (available online) and Appendix Table 1 (available online) provide a detailed description of this approach. Stata, version 14.2 was used to perform all the analyses.

RESULTS

Several geographic, sociodemographic, and health determinants differed between black, non-Hispanic and white, non-Hispanic women (Table 1). Compared with white women, black women were more likely to live in the South, in counties with larger population size, and have more disadvantaged ICE values. Births occurred more frequently among black women who were younger in age, less educated, foreign born, unmarried, had a delivery paid for by Medicaid, and were nonfirstborn with both short (<12 months) and long (≥60 months) IPI compared with white women. Delayed prenatal care, obesity, chronic or gestational diabetes and hypertension, and infection during pregnancy were more frequently reported for black compared with white women.

Although the magnitude of PTB and VPTB was higher among black compared with white women, the relationships between PTB and covariates were generally similar (Appendix Table 2, available online), with the exception of infection during pregnancy having no or minimal differences in PTB or VPTB within each racial group.

The odds of PTB and VPTB in black compared with white women were 1.46 and 2.38, respectively, after adjustment for all the covariates in Model 2 (Table 2). The ORs changed minimally when comparing Models 1 with 2. In Model 2, covariates associated with higher odds of PTB or VPTB were similar and included older age, lower education, U.S.-born maternal nativity, being unmarried, having the delivery paid for by Medicaid, having a first birth or a short (<12 months) or long IPI (>24 months), having initiated prenatal care in the third trimester or not at all, underweight prepregnancy BMI, smoking during pregnancy, chronic diabetes, and chronic or gestational hypertension.

Decomposition analyses showed that Model 2 explained close to 38% and 31% of the disparity in PTB and VPTB, respectively (Table 3). Minimal differences in the explained proportion of the model were found when comparing Model 2 with Model 1 with only geographic and sociodemographic characteristics (PTB, 36.6%; VPTB, 27.6%).

Based on the full model (Model 2), sociodemographic characteristics were the major positive contributors (Total contribution for PTB, 25.1%; VPTB, 19.9%) to each disparity (Figure 1, Table 3). Maternal education (PTB, 11.3%; VPTB, 9.0%), marital status and paternity acknowledgment (PTB, 13.8%; VPTB, 14.7%), and, to a lesser degree, source of the payment for delivery (PTB, 6.2%; VPTB, 3.2%) were the largest contributors to excess PTB and VPTB among black women. The major health contributor was hypertension during pregnancy (PTB, 9.9%; VPTB, 8.3%). The main geographic contributor was variation in the state of residence for PTB (6.2%), but this contributed less to disparities in VPTB (1.9%).

The contribution of sociodemographic characteristics remained significant after the inclusion of maternal health factors in Model 2, but was slightly reduced

Table 1. Demographic and Health Characteristics of Singleton Births Stratified by Black, Non-Hispanic and White, Non-Hispanic Women

	Overall	
Characteristics	**Black, NH**	**White, NH**
Total (N)	535,252	1,979,051
Outcome		
Gestational age, mean (SD)	38.2	38.7
Preterm birth (<37 weeks) (%)	11.6	7.1
Very preterm birth (<32 weeks) (%)	2.6	0.9
Geographic factors		
Region		
Northeast	14.2	16.8
Midwest	19.8	27.6
South	58.5	36.4
West	7.5	19.1
County population size		
<100,000	13.9	28.5
100,000–250,000	13.6	19.3
250,001–500,000	15.3	15.9
500,001–1,000,000	27.0	18.6
>1,000,000	30.2	17.7
Index of concentration at the extremes (income + race), quintiles		
(1) (Range: −0.501 to 0.018)	41.8	14.1
(2) (Range: 0.018–0.064)	20.9	19.8
(3) (Range: 0.064–0.096)	14.4	21.8
(4) (Range: 0.096–0.155)	12.1	21.9
(5) (Range: 0.155–0.410)	10.9	22.4
Index of concentration at the extremes (income + race), mean	0.027	0.096
Maternal sociodemographic characteristics		
Maternal age (years, %)		
<20	7.9	3.9
20–24	27.8	18.0
25–29	29.3	30.2
30–34	21.2	31.1
35–39	11.0	14.1
≥40	2.8	2.7
Maternal education (%)		
Less than high school	14.7	7.4
High school	34.3	21.2
Some college	26.6	20.6
Bachelor's degree or higher	24.4	50.7
Maternal nativity (%)		
U.S.-born	83.4	93.4
Born elsewhere	16.6	6.6
Marital status (%)		
Married	30.3	71.4
Unmarried and Paternity acknowledged	40.7	21.7
Unmarried and No paternity acknowledged	29.1	6.9
Source of payment for delivery (%)		
Private	27.6	63.0
Medicaid	65.7	30.6
Self-pay	3.2	2.9
Other	3.5	3.5

(*continued on next page*)

Table 1. Demographic and Health Characteristics of Singleton Births Stratified by Black, Non-Hispanic and White, Non-Hispanic Women (*continued*)

	Overall	
Characteristics	**Black, NH**	**White, NH**
Parity and IPI in months (%)		
First birth	38.4	41.6
Second birth or higher	61.7	58.4
<6	4.3	2.4
6 to 11	7.2	6.6
12 to 17	6.8	9.6
18 to 23	5.6	8.3
24 to 59	20.8	21.5
≥60	16.9	10.1
Maternal health and health behaviors		
Prenatal care initiation (%)		
First trimester	66.4	82.2
Second trimester	23.5	13.4
Third trimester/None	10.0	4.4
Prepregnancy BMI (%)		
Underweight	3.2	3.5
Normal	33.9	48.0
Overweight	26.9	24.6
Obese	36.0	23.9
Smoking history (%)		
Nonsmoker	92.0	86.3
Smoking before pregnancy only	2.0	3.1
Smoking during pregnancy only	0.2	0.2
Smoking before/During pregnancy	5.8	10.4
Diabetes (%)		
None	94.0	94.1
Chronic (prepregnancy)	1.2	0.7
Gestational diabetes	4.8	5.2
Hypertension (%)		
None	89.1	92.1
Chronic (prepregnancy)	3.5	1.6
Gestational hypertension	7.4	6.3
Infection during pregnancy (%)[a]		
Yes	5.4	1.9
No	94.6	98.1

Note: Missing values were <6% for black, NH and white, NH for each of the following variables, respectively: education (0.9%, 0.5%), nativity (0.4%, 0.1%), marital status and paternity (0.4%, 0.1%), source of payment (0.6%, 0.6%), parity and IPI (5.4%, 3.5%), prenatal care initiation (4.8%, 2.3%), prepregnancy BMI (3.8%, 2.1%), smoking history (0.7%, 0.5%), diabetes (0.1%, 0.1%), hypertension (0.1%, 0.1%), infection during pregnancy (0.3%, 0.2%). All covariate distributions were statistically significantly different ($p<0.001$) by race based on chi-squared tests or *t*-tests.
[a]Any infection present and/or treated during pregnancy from the following: gonorrhea, syphilis, chlamydia, hepatitis B, or hepatitis C.
IPI, interpregnancy interval; NH, non-Hispanic.

compared with Model 1 (Table 3). After the restriction to second or higher order births, a higher proportion of the overall disparity (PTB, 44.9%; VPTB, 40.6%) was explained by all variables in the model (Appendix Table 3, available online). The contribution of IPI, independent of parity, comprised a larger proportion of the disparity (PTB, 6.2%; VPTB, 5.8%).

DISCUSSION

Geographic, sociodemographic, and maternal health variables accounted for 38% and 31% of excess PTB and VPTB among black, non-Hispanic women in the U.S., respectively, based on birth certificate data. Although differences between black and white women were found

Table 2. ORs Between Geographic, Sociodemographic, and Health Characteristics and Preterm Birth Outcomes Among Singleton Births

Characteristics	Preterm (<37 weeks)			Very preterm (<32 weeks)		
	Unadjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[a] OR (95% CI)	Unadjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[a] OR (95% CI)
Racial categories						
White, non-Hispanic	1.00	1.00	1.00	1.00	1.00	1.00
Black, non-Hispanic	1.72 (1.71, 1.74)	1.45 (1.43, 1.47)	1.46 (1.44, 1.48)	2.98 (2.91, 3.06)	2.40 (2.33, 2.47)	2.36 (2.28, 2.44)
Geographic factors[b]						
County population size						
<100,000	1.03 (1.01, 1.04)	1.07 (1.05, 1.09)	1.02 (1.00, 1.04)	1.03 (0.99, 1.07)	1.10 (1.05, 1.15)	1.02 (0.97, 1.07)
100,000–250,000	1.04 (1.02, 1.06)	1.06 (1.04, 1.08)	1.02 (1.00, 1.04)	0.98 (0.94, 1.02)	1.10 (1.05, 1.15)	1.07 (1.02, 1.12)
250,001–500,000	1.07 (1.04, 1.09)	1.04 (1.02, 1.06)	1.01 (0.99, 1.03)	0.99 (0.95, 1.03)	1.06 (1.02, 1.11)	1.05 (1.00, 1.10)
500,001–1,000,000	1.10 (1.08, 1.12)	1.02 (1.00, 1.03)	1.00 (0.98, 1.02)	0.94 (0.91, 0.98)	1.05 (1.01, 1.10)	1.05 (1.00, 1.10)
>1,000,000	1.00	1.00	1.00	1.00	1.00	1.00
Index of concentration at the extremes (income + race/ethnicity)[c]	0.21 (0.20, 0.22)	0.84 (0.79, 0.89)	0.89 (0.83, 0.94)	0.08 (0.07, 0.09)	0.70 (0.60, 0.81)	0.69 (0.59, 0.81)
Maternal sociodemographics						
Age (years, %)						
<20	1.33 (1.30, 1.36)	0.80 (0.77, 0.81)	0.89 (0.87, 0.91)	1.68 (1.60, 1.77)	0.74 (0.70, 0.78)	0.86 (0.81, 0.91)
20–24	1.14 (1.12, 1.15)	0.88 (0.87, 0.90)	0.93 (0.91, 0.94)	1.24 (1.19, 1.28)	0.83 (0.80, 0.85)	0.88 (0.84, 0.91)
25–29	1.00	1.00	1.00	1.00	1.00	1.00
30–34	0.98 (0.96, 0.99)	1.16 (1.15, 1.18)	1.11 (1.10, 1.13)	0.96 (0.93, 0.99)	1.25 (1.21, 1.29)	1.19 (1.15, 1.24)
35–39	1.17 (1.15, 1.19)	1.43 (1.41, 1.46)	1.31 (1.29,1.34)	1.18 (1.13, 1.23)	1.58 (1.52, 1.64)	1.46 (1.40, 1.52)
≥40	1.56 (1.52, 1.61)	1.86 (1.81, 1.91)	1.63 (1.58, 1.68)	1.54 (1.44, 1.65)	1.93 (1.80, 2.06)	1.70 (1.58, 1.83)
Education (%)						
Less than high school	1.70 (1.67, 1.73)	1.49 (1.46, 1.52)	1.35 (1.32, 1.37)	2.05 (1.97, 2.14)	1.59 (1.52, 1.67)	1.42 (1.35, 1.49)
High school	1.49 (1.47, 1.51)	1.33 (1.31, 1.35)	1.24 (1.22, 1.26)	1.81 (1.76, 1.87)	1.47 (1.42, 1.53)	1.36 (1.31, 1.41)
Some college	1.35 (1.33, 1.36)	1.22 (1.21, 1.24)	1.17 (1.15, 1.19)	1.65 (1.51, 1.61)	1.32 (1.27, 1.36)	1.23 (1.19, 1.28)
Bachelor's degree or higher	1.00	1.00	1.00	1.00	1.00	1.00
Nativity (%)						
U.S.-born	1.00	1.00	1.00	1.00	1.00	1.00
Born elsewhere	0.81 (0.79, 0.82)	0.77 (0.75, 0.78)	0.81 (0.80, 0.83)	0.94 (0.90, 0.98)	0.78 (0.74, 0.81)	0.87 (0.83, 0.92)
Marital status (%)						
Married	1.00	1.00	1.00	1.00	1.00	1.00
Unmarried and Paternity acknowledged	1.39 (1.37, 1.40)	1.11 (1.09, 1.12)	1.07 (1.06, 1.09)	1.80 (1.75, 1.85)	1.21 (1.17, 1.25)	1.18 (1.14, 1.22)
Unmarried and No paternity acknowledged	1.88 (1.85, 1.90)	1.36 (1.34, 1.38)	1.26 (1.24, 1.29)	2.73 (2.64, 2.82)	1.52 (1.46, 1.58)	1.42 (1.36, 1.48)
Source of payment for delivery (%)						
Private	1.00	1.00	1.00	1.00	1.00	1.00
Medicaid	1.48 (1.46, 1.49)	1.13 (1.11, 1.14)	1.09 (1.08, 1.11)	1.77 (1.72, 1.81)	1.11 (1.07, 1.14)	1.08 (1.04, 1.11)

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Table 2. ORs Between Geographic, Sociodemographic, and Health Characteristics and Preterm Birth Outcomes Among Singleton Births (*continued*)

Characteristics	Preterm (<37 weeks)			Very preterm (<32 weeks)		
	Unadjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[a] OR (95% CI)	Unadjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[a] OR (95% CI)
Self-pay	0.95 (0.92, 0.98)	0.89 (0.86, 0.91)	0.90 (0.87, 0.94)	1.34 (1.24, 1.44)	1.19 (1.11, 1.27)	1.19 (1.10, 1.29)
Other	1.13 (1.10, 1.16)	1.05 (1.02, 1.08)	1.03 (1.00, 1.06)	1.27 (1.18, 1.36)	1.09 (1.02, 1.16)	1.07 (0.99, 1.14)
Parity and interpregnancy interval in months (%)						
First birth	1.42 (1.39, 1.45)	1.46 (1.43, 1.49)	1.32 (1.29, 1.35)	2.19 (2.06, 2.33)	2.21 (2.08, 2.34)	2.03 (1.90, 2.16)
Second birth or higher						
<6	2.07 (2.00, 2.14)	1.70 (1.65, 1.76)	1.70 (1.64, 1.75)	2.56 (2.36, 2.80)	1.86 (1.71, 2.01)	1.83 (1.68, 2.00)
6 to 11	1.30 (1.27, 1.34)	1.21 (1.18, 1.24)	1.21 (1.18, 1.25)	1.42 (1.31, 1.53)	1.23 (1.14, 1.33)	1.24 (1.15, 1.35)
12 to 17	1.05 (1.02, 1.08)	1.04 (1.01, 1.07)	1.05 (1.02, 1.08)	1.07 (0.98, 1.15)	1.05 (0.97, 1.13)	1.07 (0.98, 1.15)
18 to 23	1.00	1.00	1.00	1.00	1.00	1.00
24 to 59	1.22 (1.19, 1.25)	1.12 (1.09, 1.14)	1.11 (1.08, 1.14)	1.34 (1.25, 1.43)	1.16 (1.09, 1.23)	1.16 (1.08, 1.24)
≥60	1.78 (1.74, 1.83)	1.36 (1.32, 1.39)	1.28 (1.25, 1.32)	2.39 (2.23, 2.55)	1.54 (1.45, 1.64)	1.47 (1.38, 1.58)
Maternal health and health behaviors						
Prenatal care initiation (%)						
First trimester	1.00	–	1.00	1.00	–	1.00
Second trimester	1.02 (1.01, 1.04)	–	0.87 (0.85, 0.88)	1.06 (1.02, 1.10)	–	0.82 (0.79, 0.85)
Third trimester/None	1.46 (1.43, 1.49)	–	1.20 (1.17, 1.22)	1.62 (1.54, 1.69)	–	1.14 (1.09, 1.20)
Prepregnancy BMI (%)						
Underweight	1.55 (1.51, 1.59)	–	1.45 (1.42, 1.49)	1.62 (1.52, 1.73)	–	1.45 (1.36, 1.54)
Normal	1.00	–	1.00	1.00	–	1.00
Overweight	1.06 (1.05, 1.08)	–	0.93 (0.92, 0.94)	1.18 (1.14, 1.22)		1.02 (0.98, 1.05)
Obese	1.35 (1.33, 1.36)	–	0.94 (0.93, 0.95)	1.67 (1.62, 1.72)		1.14 (1.10, 1.17)
Smoking history (%)						
Nonsmoker	1.00	–	1.00	1.00	–	1.00
Smoking before pregnancy only	1.03 (1.00, 1.06)	–	0.94 (0.91, 0.97)	0.96 (0.89, 1.04)	–	0.89 (0.83, 0.96)
Smoking during and/or before pregnancy	1.56 (1.53, 1.58)	–	1.35 (1.33, 1.37)	1.46 (1.41, 1.52)	–	1.37 (1.32, 1.43)
Diabetes (%)						
None	1.00	–	1.00	1.00	–	1.00
Chronic (prepregnancy)	4.61 (4.46, 4.77)	–	3.14 (3.03, 3.25)	3.40 (3.14, 3.68)	–	1.78 (1.64, 1.94)
Gestational diabetes	1.55 (1.53, 1.48)	–	1.35 (1.32, 1.37)	0.91 (0.86, 0.96)	–	0.74 (0.69, 0.78)
Hypertension (%)						
None	1.00	–	1.00	1.00	–	1.00
Chronic (prepregnancy)	3.55 (3.46, 3.63)	–	2.72 (2.65, 2.79)	4.27 (4.06, 4.49)	–	2.93 (2.78, 3.09)

(*continued on next page*)

Table 2. ORs Between Geographic, Sociodemographic, and Health Characteristics and Preterm Birth Outcomes Among Singleton Births (*continued*)

Characteristics	Preterm (<37 weeks)			Very preterm (<32 weeks)		
	Unadjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[a] OR (95% CI)	Unadjusted OR (95% CI)	Model 1[a] OR (95% CI)	Model 2[a] OR (95% CI)
Gestational hypertension	3.27 (3.23, 3.32)	–	3.09 (3.05, 3.14)	3.11 (3.01, 3.21)	–	2.70 (2.61, 2.80)
Infection during pregnancy (%)[d]						
Yes	1.51 (1.47, 1.55)	–	1.11 (1.08, 1.14)	1.62 (1.52, 1.72)	–	1.03 (0.97, 1.10)
No	1.00	–	1.00	1.00	–	1.00

[a]Adjusted for all variables presented in the column and state fixed effects. State fixed effects are not shown.
[b]OR estimates for each individual state are not shown.
[c]County-level estimates. Formula: ([n of "white, non-Hispanic" high-income persons] − [n of "black alone" low-income persons])/n of persons with race/ethnicity and household income data. Measures obtained from the 2016 American Community Survey 5-year estimates.
[d]Any infection present and/or treated during pregnancy of the following: gonorrhea, syphilis, chlamydia, hepatitis B, or hepatitis C.

Table 3. Decomposition of Black–White Non-Hispanic Disparities in Preterm Birth Among Singleton Births

Measure	Preterm (<37 weeks)		Very preterm (<32 weeks)	
	Model 1[a]	Model 2[a]	Model 1[a]	Model 2[a]
Black–white difference in the percentage preterm or very preterm birth (disparity)				
Absolute difference	4.35	4.35	1.56	1.56
Explained difference	1.62	1.65	0.44	0.49
Percentage of the disparity jointly explained by variables in the model				
Explained, %	37.2	37.9	28.2	31.4
Unexplained, %	62.8	62.1	71.8	68.6
Independent contribution of each variable to the disparity (% contribution)[b]				
Geographic factors				
State fixed-effects	0.24 (5.4)	0.25 (5.7)	0.02 (1.3)	0.03 (1.9)
County population size	−0.10 (−2.3)	−0.03 (−0.7)	−0.02 (−1.3)	−0.01 (−0.6)[ns]
Index of concentration at the extremes (income + race/ethnicity)[c]	0.13 (3.0)	0.08 (1.8)	0.07 (4.5)	0.06 (3.8)
Maternal sociodemographic characteristics				
Age	−0.47 (−10.8)	−0.26 (−6.0)	−0.16 (−10.2)	−0.08 (−5.1)
Education	0.68 (15.6)	0.49 (11.3)	0.20 (12.8)	0.14 (9.0)
Maternal nativity	−0.18 (−4.1)	−0.14 (−3.2)	−0.04 (−2.6)	−0.02 (−1.3)
Marital status and paternity acknowledgment	0.79 (18.2)	0.60 (13.8)	0.28 (17.9)	0.23 (14.7)
Source of payment for delivery	0.39 (9.0)	0.27 (6.2)	0.08 (5.1)	0.05 (3.2)
Parity and interpregnancy interval (months)	0.15 (3.4)	0.13 (3.0)	0.01 (0.6)	−0.01 (−0.6)
Maternal health and health behaviors				
Timing of prenatal care initiation	–	−0.03 (−0.7)	–	−0.02 (−1.3)
Prepregnancy BMI	–	−0.10 (−2.3)	–	0.03 (1.9)
Preconception and prenatal smoking	–	−0.17 (−3.9)	–	−0.05 (−3.2)
Diabetes in pregnancy[d]	–	0.09 (2.1)	–	0.02 (1.3)
Hypertension in pregnancy[d]	–	0.43 (9.9)	–	0.13 (8.3)
Infection in pregnancy	–	0.03 (0.7)	–	0.00 (0.0)[ns]

Note: ns based on *z*-test and SEs calculated using the delta method and *p*-value <0.5. All the other findings were significant.
[a]Adjusted for all the covariates presented in each respective column.
[b]Individual components and percent contributions should sum to their overall contribution. However, owing to rounding, some components did not sum exactly.
[c]County-level estimates. Formula: ([n of "white, non-Hispanic" high-income persons] − [n of "black alone" low-income persons])/n of persons with race/ethnicity and household income data. Measures obtained from the 2016 American Community Survey 5-year estimates.
[d]Estimation requires combining across chronic and gestational categories.
ns, not statistically significant.

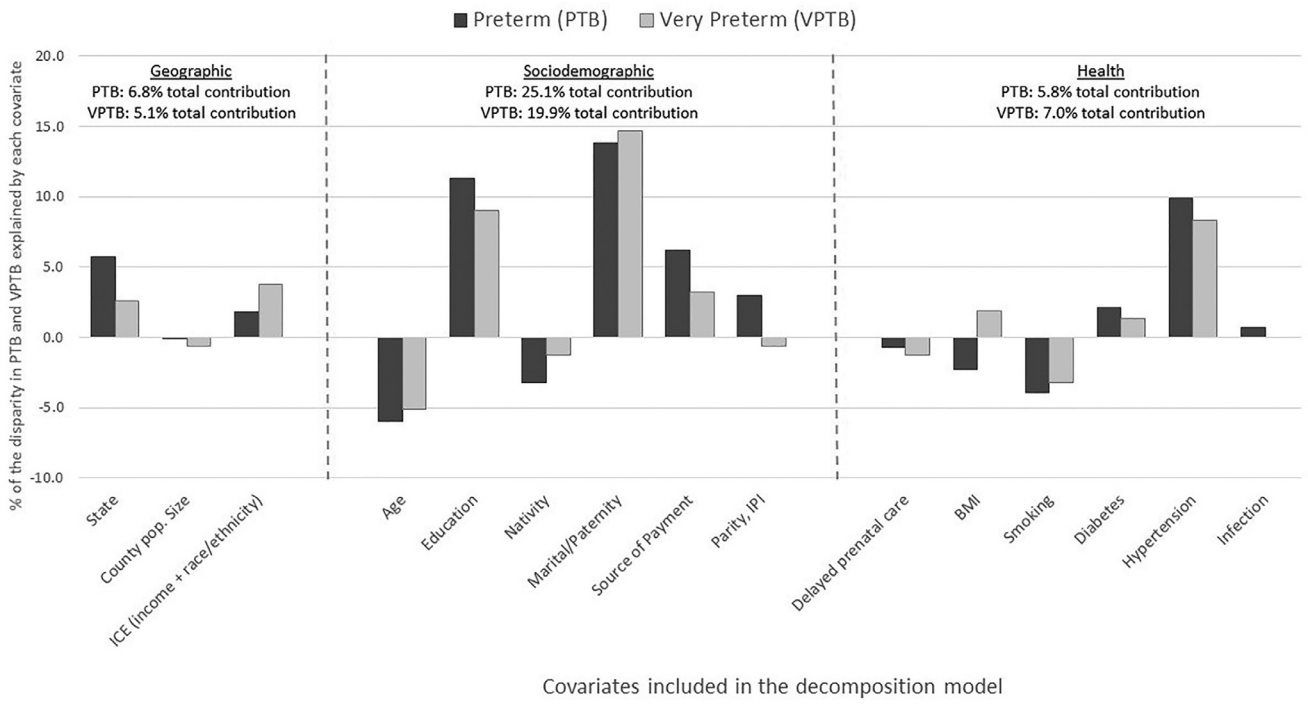

Figure 1. Percent contribution of the disparity in preterm birth (PTB) and very preterm birth (VPTB) explained by each covariate included in the decomposition model.

Note: ICE: Index of Concentration at the Extremes (income + race/ethnicity), county-level estimates. Formula for calculating ICE: ([n of "white, non-Hispanic" high-income persons] − [n of "black alone" low-income persons])/n of persons with race/ethnicity and household income data. Measures obtained from the 2016 American Community Survey 5-year estimates.

across several covariates, not all contributed to PTB disparities in decomposition analyses. In particular, black–white differences in the distribution of sociodemographic characteristics (i.e., maternal education, marital status and paternity acknowledgment, and source of payment) and maternal hypertension emerged as the largest known contributors to excess PTB among black women (Table 3). The largest black–white differences in hypertension were in chronic hypertension compared with gestational hypertension (Table 1). Adding maternal health characteristics partially reduced the contribution of sociodemographic characteristics, suggesting possible mediation through preconception and prenatal health factors.

These results explained a higher proportion of the black–white disparity in PTB (38%) compared with two previous studies using national or near-national data from the U.S, which showed <30% of the disparity could be explained by covariates on the birth certificate.[18,19] This may reflect the inclusion of additional geographic indicators, new or modified variables from the birth certificate, or more timely and complete national data. Additionally, this study found that all the covariates explained a greater portion of the black–white disparity after restricting to nonfirstborn births (PTB, 44.9%; VPTB, 40.6%), with IPI contributing a larger magnitude (PTB, 6.2%; VPTB, 6.0%). Assuming optimal birth spacing can improve birth outcomes,[31] recent efforts to increase access to family planning counseling and contraceptive methods in the postpartum period may further reduce the disparities in subsequent pregnancies.[32,33] When examining VPTB, less of the overall disparity could be explained by variables in the models examined in this study (31%). This decrease in the explanatory ability may reflect etiologic differences that distinguish VPTB from moderate-to-late PTB (i.e., 32–36 weeks) or unmeasured factors related to very early delivery.[7] This reduction in explanatory power for VPTB is consistent with other analyses.[20,34]

The study findings support the role of social determinants in driving a large portion of the black–white disparity in PTB and VPTB. The importance of education on health is well established,[35,36] and maternal education was found to be a meaningful contributor to PTB disparities in the present analyses. Similar to the study by DeSisto et al.,[19] a significant contribution of paternity acknowledgment, which may serve as a proxy for paternal involvement or financial support during the pregnancy, was observed.[37,38] Studies have found that father involvement during pregnancy improves maternal

health-seeking behaviors.[39,40] In this study, black women were more likely to be unmarried without paternity acknowledged, which may stem from financial and institutional barriers (e.g., state eligibility requirements for public assistance) that hinder the acknowledgment of the father on the birth certificate or involvement during pregnancy.[41] This finding may also reflect, more generally, a lack of social support during pregnancy.[42] New models of prenatal care, such as group prenatal care, that specifically enhance social support during pregnancy have been shown to improve birth outcomes[43]. However, findings are mixed, and African Americans may be more likely to benefit.[44]

The source of payment for delivery, specifically Medicaid, provided a moderate contribution. These findings are difficult to interpret given that the type of insurance to cover the delivery may reflect unmeasured factors, such as income, eligibility criteria, and proficiency in navigating the healthcare system.[45]

The largest geographic contributor was state fixed effects. These differences may reflect variability in other key attributes across states, such as differences in economic resources or Medicaid eligibility, but are difficult to infer from this study's models. Nevertheless, the inclusion of state fixed effects helps to ensure that the interpretation of other covariates account for this variability. By contrast, this study found a lesser contribution for county-level variables. Racial and economic segregation may be better studied at more granular levels not available in national vital records.[20,46]

Unlike other studies, this study demonstrated that the contribution of sociodemographic factors to the disparity in PTB may operate through more proximal maternal health characteristics. The findings show a sizable black–white disparity in hypertension during pregnancy, specifically chronic hypertension (Table 1). Similarly, previous studies have shown a large black–white disparity in cardiovascular disease and a growing body of evidence that supports the contribution of social and contextual factors to these differences.[47] In particular, experiences of racism have been linked to both hypertensive disorders and birth outcomes.[48–50] Consistent with the findings from this study, a study examining pregnancy-related hypertensive disease using medical record data from 19 hospitals across the U.S. found that African American women were more likely to begin pregnancy with hypertension compared with other racial and ethnic groups in the study.[51] This fits within a life course perspective, which emphasizes the importance of addressing preconception health to reduce adverse birth outcomes and disparities.[52]

Unlike other findings by Lhila and colleagues,[18] a substantial contribution of early prenatal care or other prenatal behaviors (i.e., smoking) in explaining the black–white PTB disparity was not found in this study. Although this may reflect differences in the periods between the studies, it is generally acknowledged that improvements in prenatal care utilization may have limited impact in reducing adverse birth outcomes.[53] Rather, investments in the quality of prenatal care are considered to have a greater impact.[52]

Limitations

Although this study provides a more comprehensive and timely analysis of the factors associated with the black–white disparity in PTB, it comes with limitations. This study explained a higher proportion of the disparity than previously published studies, yet more than 60% remained unexplained. This may reflect unknown or unmeasured information on key sociodemographic and health characteristics, such as mothers' cumulative life course experiences, social support, environmental factors, quality of prenatal care, and experiences of racism. Unlike standard regression models, decomposition explicitly quantifies the extent to which more information is needed to identify additional determinants. The challenge and motivation for researchers is in identifying measures that can be accurately collected at the population level to further explain the disparities and understand the state-level contribution. Additionally, some health items on the birth certificate are known to be under-reported,[22,54] which may also limit the explanatory power of these models. Furthermore, complete case analysis reduced the sample by approximately 10%; however, complete case analysis has been shown to be unbiased conditional on relevant covariates, such as age and education.[55,56] Lastly, this observational study cannot establish causality, which may be better determined from experimental and quasi-experimental designs. To partially offset this limitation, relevant covariates using an established theoretical framework were selected.

CONCLUSIONS

Annual U.S. birth certificate data are readily available at the county, state, and national level and provide a valuable resource for evaluating programs and policies to examine disparities in birth outcomes. These findings demonstrate that the racial gap in PTB may be reduced through programs that enhance social and economic support and provide preconception care, specifically focused on hypertension. However, not all black–white differences emerged as significant contributors to PTB disparities, and many remained unexplained. Further research to identify additional determinants is needed to improve the understanding of this salient public health issue.

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SUPPLEMENTAL MATERIAL

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