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Erica L. Eliason PhD, Maria W. Steenland SD, Jamie R. Daw PhD

PII: S0749-3797(22)00499-8
DOI: https://doi.org/10.1016/j.amepre.2022.09.027
Reference: AMEPRE 6989

To appear in: American Journal of Preventive Medicine

Please cite this article as: Erica L. Eliason PhD, Maria W. Steenland SD, Jamie R. Daw PhD, Perinatal Care Changes During COVID-19: A Population-Based Analysis by Race/Ethnicity, American Journal of Preventive Medicine (2022), doi: https://doi.org/10.1016/j.amepre.2022.09.027

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Perinatal Care Changes During COVID-19: A Population-Based Analysis by Race/Ethnicity

Erica L. Eliason, PhD,1 Maria W. Steenland, SD,2 Jamie R. Daw, PhD3

From the 1Department of Health Services, Policy & Practice, Brown University School of Public Health, Providence, Rhode Island; 2Population Studies and Training Center, Brown University, Providence, Rhode Island; and 3Department of Health Policy & Management, Columbia University Mailman School of Public Health, New York, New York

Address correspondence to: Erica L. Eliason, PhD, Department of Health Services, Policy & Practice, Brown University School of Public Health, 121 South Main St., Providence RI 02903. E-mail: erica_eliason@brown.edu.
**Introduction:** The COVID-19 public health emergency created unprecedented disruptions in the use of healthcare services, which could have affected long-standing racial-ethnic disparities in maternal care use and outcomes. This study evaluates population-level changes in perinatal health services associated with the COVID-19 pandemic overall and by maternal race-ethnicity.

**Methods:** In this analysis of all U.S. live births from 2016–2020, interrupted time series analysis was used to estimate the change in mean number of prenatal care (PNC) visits, and rates of hospital birth, labor induction, and cesarean delivery associated with the start of the pandemic (March 2020) overall and by maternal race-ethnicity. Analyses were conducted in 2022.

**Results:** The start of the pandemic was associated with overall decreases in the mean number of PNC visits, decreases in hospital birth rates and increases in labor induction rates. The mean number of PNC visits decreased similarly for all racial-ethnic groups, while reductions in hospital births were largest for non-Hispanic (NH) White individuals, and increases in labor induction were largest for NH White and NH Asian or Pacific Islander individuals.

**Conclusions:** Among all U.S. live births, the COVID-19 pandemic was associated with modest overall changes in perinatal care, with differential changes by maternal race-ethnicity. Differential changes in perinatal services may have implications for racial–ethnic maternal health disparities.
INTRODUCTION

The COVID-19 public health emergency (PHE) created unprecedented disruptions in perinatal care. Early studies from single centers across the U.S. found that the PHE was associated with reductions in prenatal care use and delivery length of stay, and modified birth plans. Analyses of national data have shown increases in community births (out-of-hospital home and birth center births), but no change in cesarean deliveries.

Black, Indigenous, and Hispanic people were disproportionately impacted by the effects of the PHE. Differential barriers to care during the PHE may have exacerbated racial inequities in perinatal care access and outcomes in the U.S. Using national data, this study measures population-level changes in perinatal care associated with the COVID-19 PHE overall and by race-ethnicity.

METHODS

This study used natality data from the Centers for Disease Control and Prevention WONDER database for all U.S. live births from January 1, 2016–December 31, 2020. Outcomes included mean number of prenatal care (PNC) visits, and rates of hospital birth, labor induction, and cesarean delivery per 100 live births.

Interrupted time series (ITS) analysis was used to test the hypothesis that the PHE had an immediate effect on perinatal care. The ITS model included a linear monthly time trend, an indicator for whether a month is during the PHE, an interaction between the monthly time trend and PHE indicator to test for monthly time trend changes during the PHE relative to pre-PHE,
and month fixed-effects to adjust for seasonality. This study focuses on the PHE indicator, which estimates the abrupt change in outcome means that occurred at the start of the PHE (March 2020) relative to expected means based on pre-pandemic trends (January 2016–February 2020).

Models were estimated overall and stratified by maternal race-ethnicity (non-Hispanic [NH] American Indian or Alaska Native, NH Asian or Pacific Islander, NH Black, Hispanic, or NH White). Since the pandemic may have resulted in changes in the demographic and clinical characteristics of birthing people, a sensitivity analysis was conducted excluding December 2020 births to limit the sample to pregnancies that began prior to the PHE. To adjust for seasonality, increase precision, and allow for stable pre-trend estimation, the main models include 4 pre-PHE years (2016–2019). However, sensitivity analyses were conducted with only 2 (2018–2019) or 3 (2017–2019) pre-PHE years.

Multiple-group ITS analysis was used to compare the relative changes associated with the PHE for each racial-ethnic group relative to NH White individuals. The Cumby and Huizinga general test was used to test for autocorrelation,\(^\text{10}\) and models were adjusted for serial correlation present at specific lag orders where autocorrelation was identified. Newey-West SEs were used, which account for autocorrelation and heteroskedasticity.\(^\text{11}\) This study was considered not human subjects research by the Brown University IRB.

**RESULTS**

The sample included 18,954,274 live births. Relative to expected means based on pre-pandemic trends, the mean number of PNC visits decreased by 0.27 visits at the start of the PHE (95% CI=
hospital birth rates decreased by 0.28 per 100 births (95% CI= –0.36, –0.20) and labor induction rates increased by 0.55 per 100 births (95% CI=0.07, 1.03) (Figure 1). These findings translate to a 2.4% decrease in mean PNC visits, a 0.3% decrease in the hospital birth rate, and a 2.3% increase in the labor induction rate. There was no significant change in the cesarean delivery rate overall.

Figure 2 shows the pre-pandemic baseline rate/mean of each outcome and the change associated with the start of the PHE by race-ethnicity. There were similar declines in the number of PNC visits among all groups with no significant differences by race-ethnicity.

The hospital birth rate decreased among all racial-ethnic groups except among NH American Indian or Alaska Native individuals, with the largest decline of 0.39 per 100 births (95% CI= –0.51, –0.28) among NH White individuals, representing a 0.4% decline from the pre-pandemic level. Declines in hospital birth rates were significantly smaller among NH Black, Hispanic, and NH Asian or Pacific Islander individuals relative to NH White individuals.

The labor induction rate increased only among NH Asian or Pacific Islander and NH White individuals by 4.7% and 2.5%, with no significant differences by race-ethnicity. The cesarean delivery rate increased only among NH Asian or Pacific Islander individuals by 0.59 per 100 births (95% CI= 0.11, 1.07), a 1.8% change from the pre-pandemic level.

Findings were robust overall and by race-ethnicity when excluding births in December 2020 (Appendix Table 1). Findings were consistent with main models for prenatal care and hospital
births using fewer pre-PHE years; however, estimates varied for labor inductions and cesarean deliveries (Appendix Tables 2 and 3).

**DISCUSSION**

This analysis of all U.S. live births 2016–2020 found modest but notable changes in perinatal care associated with the PHE. Findings overall are consistent with national studies that found increased community births and no change in national cesarean delivery during the PHE.\(^2,3\) However, stratified analyses reveal differential perinatal care changes by race-ethnicity. While PNC visits decreased similarly for all racial-ethnic groups, reductions in hospital births were largest for NH White individuals, and increases in induction were largest for NH White and NH Asian or Pacific Islander individuals. Despite no overall change in cesarean deliveries, there was a significant increase among NH Asian or Pacific Islander individuals.

For prenatal care, the clinical significance of the 0.27 visit reduction is unclear. Evidence from the U.S. and other high-income countries has found no significant change in adverse outcomes when low-risk pregnant people follow reduced visit schedules.\(^12,13\) While prenatal care reductions did not differ by race-ethnicity, differential impacts of these reductions cannot be ruled out. Indigenous and Black pregnant people are more likely to have risk factors such as chronic disease that could benefit from management through prenatal care.\(^14\) These groups had lower average numbers of pre-pandemic prenatal visits, which could alter the effects of small reductions in care.

**Limitations**
For delivery care, the findings suggest that racial-ethnic groups who have historically been more advantaged, namely NH White individuals, had larger changes than other groups. This suggests that there were racial-ethnic differences in preferences and/or the ability to shift birth plans during the PHE. Increases in inductions and cesarean deliveries (which can be scheduled) and community births may have occurred to minimize the impact of the PHE; e.g., to avoid hospitals or allow for pre-admission testing and attendance by a partner or birth advocate. However, it is unclear how shifts may have impacted perinatal outcomes and induction and cesarean delivery results were not robust to varying pre-PHE time periods. Another national study found increases in high-risk community births during the PHE and increases in low Apgar scores and preterm birth.² This study cannot assess the appropriateness of the delivery care changes; however, these changes warrant further investigation. Other study limitations include that changes in birth plan preferences, and the content and quality of care could not be measured, and there was limited data available since PHE onset to examine long-term changes in trends.

**CONCLUSIONS**

This study adds to the evidence base on how the PHE affected prenatal and delivery care overall and by race-ethnicity. Future research should explore if, and how, differential perinatal care changes relate to changes in birth outcomes²,³ and worsening maternal health disparities during the COVID-19 pandemic.¹⁵
ACKNOWLEDGMENTS

Dr. Eliason reports research support from the Agency for Healthcare Research and Quality under grant award T32 HS000011. Dr. Steenland was supported by the National Institute of Child Health and Human Development (P2C HD041020) and by the Agency for Healthcare Research and Quality (K01 HS027464). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. No financial disclosures were reported by the authors of this paper.
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**LIST OF FIGURE**

**Figure 1.** Trends in perinatal health services before and after the COVID-19 public health emergency.

*Notes:* Prenatal care measured as the mean number of visits for live births. Hospital birth, labor induction, and cesarean delivery measures as rates for 100 live births. Vertical dashed lined indicates March 2020, the start of the COVID-19 public health emergency.

PHE, Public health emergency.

**Figure 2.** Changes in perinatal health services before and after the COVID-19 public health emergency, by maternal race and ethnicity.

*Notes:* Prenatal care measured as the mean number of visits for live births. Hospital birth, labor induction, and cesarean delivery measured as rates for 100 live births. Pre-pandemic means and rates are for the period January 2016–February 2020. Race-ethnicity information is from the birth certificate based on self-reported information from the filing parent. The Centers for Disease Control and Prevention imputed maternal race for 6% of births. *Change associated with the COVID-19 PHE is statistically significant compared to NH White (p<0.05).*

NH, non-Hispanic; PHE, Public health emergency.
CRediT author statements:

**Erica Eliason:** Software, Formal Analysis, Writing - Original Draft, Writing - Review & Editing. **Maria Steenland:** Methodology, Writing - Original Draft, Writing - Review & Editing, Supervision. **Jamie Daw:** Conceptualization, Writing - Original Draft, Writing - Review & Editing, Supervision.