



Why did preterm birth rates fall during the COVID-19 pandemic?

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In this issue of *Paediatric and Perinatal Epidemiology*, Margerison and colleagues¹ report on a study which examined the effect of the COVID-19 pandemic on preterm birth in the United States. They recreated conception cohorts and used time-series analysis to quantify the effect of exposure to the early pandemic at different periods in gestation on preterm birth. Pregnancies exposed to the pandemic in the first or third trimester resulted in fewer overall preterm and moderately preterm births, while pregnancies exposed in the late second or third trimester led to fewer early preterm births. In this Commentary, we discuss two interesting and important issues raised by Margerison et al's study: with regard to object and methods design, we review the epidemiologic utility of conception cohorts (versus birth cohorts), and on the substantive side we argue that pandemic-related changes in preterm birth were primarily due to a disruption in obstetric services.

1 | CONCEPTION COHORTS

Interest in the effects of exposures at specific periods in gestation, and in conception cohorts, can be traced back to Norman Gregg's seminal work on Congenital Rubella Syndrome in 1941.² Rubella infection during critical phases of fetal organogenesis leads to specific congenital malformations: cardiac and eye defects, such as cataracts, are more likely with infection during the first 8 weeks of pregnancy, while retinopathy and hearing defects follow infection during the first 16–20 weeks of gestation. Although Gregg's observations were not based on conception cohorts, he surmised that the

infective process, which destroyed the inner tissue of the lens in the eye and spared the outermost layers, had occurred at an early stage of fetal development (since the inner layer of the lens develops before the outer layer).²

2 | STUDYING PANDEMIC-RELATED CHANGES IN PRETERM BIRTH

Conception cohorts, which include all pregnancies conceived in any given calendar period, serve as the ideal population for assessing the effects of exposures at specific gestational ages. In contrast, birth cohorts which include all live births and stillbirths that occur in any given calendar period, consist of conceptions that occurred over a previous period. Birth cohorts also represent left-truncated populations because they exclude early pregnancy losses. Using birth cohorts to reconstruct conception cohorts permits assessment of exposure effects at different gestational ages, albeit with caveats given the potential for the left truncation to substantially affect cohort composition (as Margerison et al.¹ correctly point out).

Are conception cohorts or birth cohorts the preferred method for determining COVID-19 pandemic effects on preterm birth? The answer to this question depends on the hypothesised mechanism by which the pandemic could have affected preterm birth rates. Conception cohorts would be most appropriate if pregnancies were susceptible to pandemic influences at a specific period(s) of gestation, whereas birth cohorts would be suitable if pandemic influences were confined to a specific period in calendar time. This distinction

is analogous to a gestational age effect (i.e., the determinant is exposure to the pandemic at a specific gestation) versus a period effect (i.e., the determinant is pregnancy exposure to the pandemic at a specific point in calendar time).

Hypotheses regarding the effects of the early pandemic on preterm birth have focused on (i) increased hygiene, reduced air pollution and especially reductions in work-related stress³; and (ii) reductions in the receipt of obstetric services, whether due to contagion-related anxiety among pregnant women or reductions in the availability of health care services.³ Margerison et al.¹ examined gestational age-specific effects of the pandemic and interpreted study findings as being a consequence of multiple mechanisms acting at different trimesters of pregnancy. The alternative explanation involves a period-specific change in the provision of obstetric services, including reductions in fetal surveillance, preterm labour induction and preterm caesarean delivery.

3 | SPATIAL HETEROGENEITY OF PANDEMIC-RELATED EFFECTS ON PRETERM BIRTH

The earliest studies on the perinatal effects of the pandemic reported reductions in preterm birth in several countries, although the segment of the preterm birth range affected varied (live births <28 weeks' gestation in Denmark,⁴ live births <1000g and <1500 in Ireland,⁵ and live births 32–36 weeks' gestation in the Netherlands⁶). On the other hand, a report from Sweden showed no clinically meaningful pandemic-related change in preterm birth rates.⁷ A recent review³ documented declines in overall preterm birth rates or in a segment of the preterm birth range in several countries/regions (17 reports), no differences in preterm birth rates in others (9 studies), and an increase in preterm birth rates in a small fraction (2 studies). Study methods and quality varied considerably, and this precluded a clear and robust inference on the effect of the pandemic on preterm birth.³ In fact, the heterogeneity of findings appears to favour the proposition that pandemic-related effects on preterm birth depended on if, and how, the pandemic affected obstetric health services in any region/country.

Population rates of preterm birth depend to a significant extent on obstetric services, especially in high-income countries, since a substantial proportion of preterm birth is clinician initiated. Indications for obstetric intervention at preterm gestation are typically identified during routine antenatal care and through rigorous fetal surveillance. Canada, where the early pandemic response included changes minimising patient-health provider contact for prenatal screening and increased use of virtual visits, saw a significant decline in preterm labour induction and preterm caesarean delivery, and a corresponding change in the secular trend towards rising rates of preterm birth.⁸ Sweden, a hold-out against pandemic lockdowns and restrictions, showed no meaningful change in preterm birth rates, likely because obstetric services were mostly unaffected during the pandemic.⁷

4 | PANDEMIC EFFECTS ON CLINICIAN-INITIATED PRETERM BIRTH IN THE UNITED STATES

Figure 1 shows monthly rates of preterm birth <37 weeks' gestation among singleton live births in the United States between January 2015 and December 2020. Data on all live births were obtained from the natality files of the National Centre for Health Statistics, and gestational age was based on the clinical estimate of gestation. Preterm birth rates in monthly birth cohorts increased steadily between 2015 and 2019 and this was followed by a distinct reduction in rates immediately following the onset of the pandemic (Panel A). This pattern was closely reflected in rates of clinician-initiated preterm birth (i.e., preterm labour induction and preterm caesarean delivery at <37 weeks; Panel B). Both the reduction in rates of preterm birth and clinician-initiated preterm birth in the early months of the pandemic showed a reversal in the later months of 2020. Although preterm labor inductions and preterm caesarean deliveries include a small fraction of spontaneous preterm births, the large temporal change in this preterm birth subgroup indicates the critical role of obstetric intervention at preterm gestation in determining rates of preterm birth in the pre-pandemic and early pandemic periods. The temporal pattern of preterm birth suggests that obstetric service disruptions, which resulted in reduced fetal surveillance and fewer clinician-initiated preterm births at the onset of the pandemic, were increasingly rectified, even as the pandemic progressed, and infection rates waxed and waned.

Figure 1C,D show rates of preterm birth <37 weeks and clinician-initiated preterm birth <37 weeks among singleton live births to women with chronic hypertension in the United States. This subpopulation of relatively high-risk women is of interest as their need for fetal surveillance and clinician-initiated preterm delivery substantially exceeds that of low-risk women. The pre-pandemic increase, the early pandemic decline and the subsequent recovery in preterm birth and clinician-initiated preterm birth rates in this subpopulation is more striking than the patterns among all women. Figure S1 depicts preterm birth rates <32 weeks' gestation and shows essentially the same patterns.

5 | IMPLICATIONS

The hypothesis that changes in work-related stress led to reductions in preterm birth during the pandemic is seductive, though the patterns of clinician-initiated preterm birth suggest that obstetric service disruptions may be a simpler and more plausible explanation. Reductions in labour induction at preterm gestation and fewer preterm caesarean deliveries during the early months of the COVID-19 pandemic are consistent with other well-documented pandemic-related health service disruptions, such as delays in the diagnosis breast cancer and in the treatment for myocardial infarction. According to obstetric theory,⁹ such reductions in clinician-initiated preterm birth could have resulted in increases in obstetric

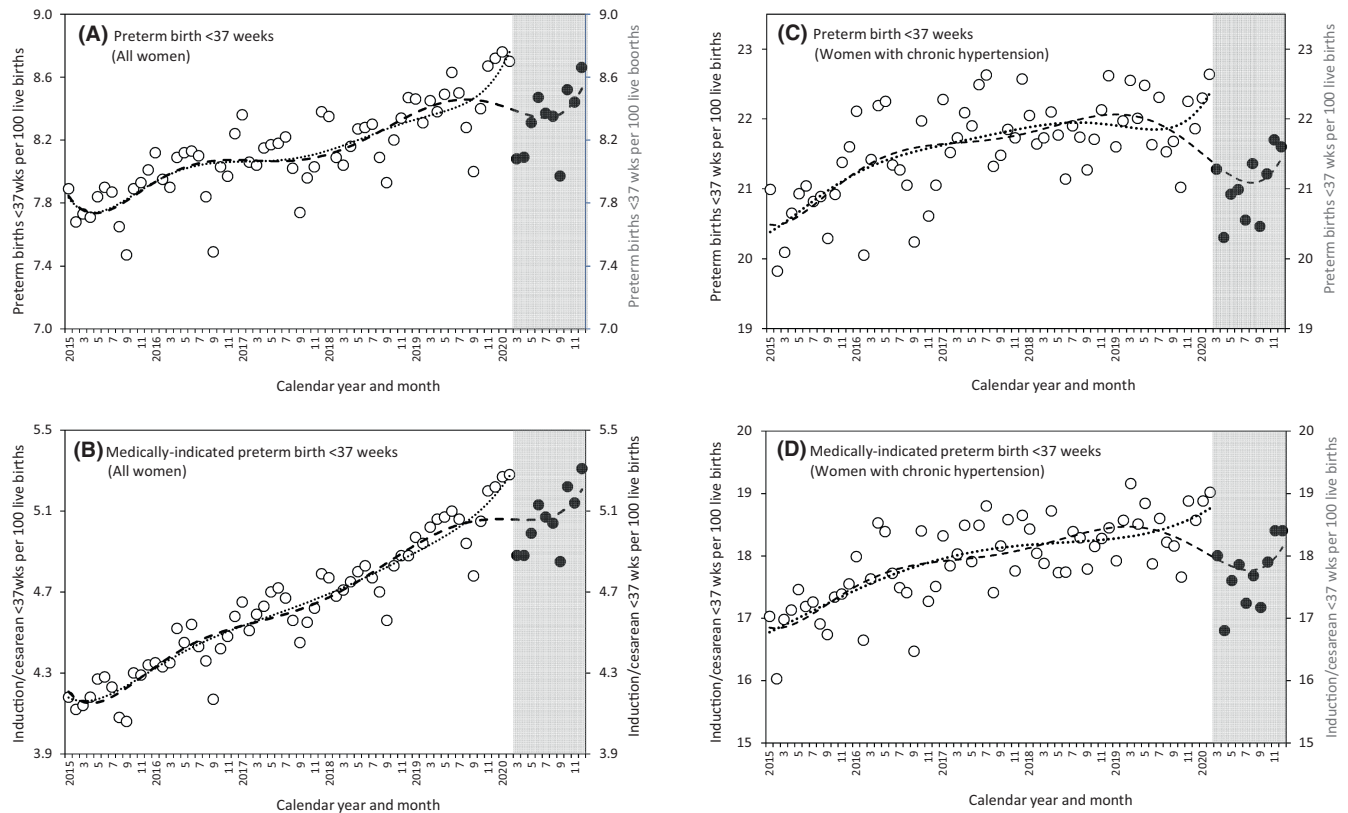


FIGURE 1 Rates of preterm birth <37 weeks (Panels A and B) and clinician initiated preterm birth <37 weeks (Panels C and D) among singleton live births to all women and to women with chronic hypertension, United States, 2015–2020. Dotted lines model the temporal trend in preterm birth rates between January 2015 and February 2019, while dashed lines model the temporal trend in preterm birth rates between January 2015 and December 2020

intervention at term gestation and, unfortunately, increases in perinatal morbidity and mortality at both preterm and term gestation. There is some evidence for a pandemic-related increase in stillbirth rates,¹⁰ although again this is likely to be spatially variable and dependent on the magnitude of reductions that occurred in antenatal care, fetal surveillance, and obstetric intervention. Experience with the COVID-19 pandemic highlights the need to reduce activities associated with higher rates of infection during a pandemic, while maintaining activities critical for healthy pregnancy and childbirth.

AUTHOR CONTRIBUTIONS

SL: Conceptualization, Manuscript Writing, Funding Acquisition. KSJ: Conceptualization, Data Analysis, Manuscript Writing, Editing.

DATA AVAILABILITY STATEMENT

All data used in this study are publicly available in de identified form at https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article. **How to cite this article:** Lisonkova S, Joseph KS. Why did preterm birth rates fall during the COVID-19 pandemic? *Paediatr Perinat Epidemiol*. 2022;00:1-4. doi: [10.1111/ppe.12916](https://doi.org/10.1111/ppe.12916)