

## OBSERVATION: BRIEF RESEARCH REPORT

## Preterm Birth and Stillbirth During the COVID-19 Pandemic in Sweden: A Nationwide Cohort Study

**Background:** A recent Danish study reported that the rate of extremely preterm birth was reduced during the lockdown period of the coronavirus disease 2019 (COVID-19) pandemic; the odds ratio (OR) was 0.09 (95% CI, 0.01 to 0.40) compared with previous years (1). Given the lockdown measures, potential mechanisms might include reduced exposure to various infectious agents, physical work strain, or stress; another explanation might be an increase of stillbirth, as the Danish study was based on live births. A study from the United Kingdom reported that stillbirth was more common during the pandemic; the difference was 6.93 (CI, 1.83 to 12.0) cases per 1000 births, corresponding to a 4-fold risk increase (2).

**Objective:** To investigate associations between being born during a period when many public health interventions aimed at mitigating the spread of COVID-19 were enforced and the risk for preterm birth and stillbirth.

**Methods and Findings:** We conducted a nationwide cohort study of singleton births using the Swedish Pregnancy Register. This register covers 92% of all births in Sweden and includes many variables describing the mother and newborn. The study was approved by the Swedish Ethical Review Authority.

We compared the risk for preterm birth and stillbirth among births from 1 April through 31 May 2020, a period when Swedish authorities had enforced a range of pandemic mitigation interventions, with births from all April through May periods in the years 2015 to 2019 combined. Adjusting for maternal age, birth country, body mass index, smoking status, and parity, we used logistic regression to estimate ORs for preterm birth and stillbirth (multinomial logistic regression for preterm birth categories; SAS software, version 9.4, SAS Institute). The adjusted difference (events per 1000 births) was calculated as: (adjusted OR – 1) × the proportion in the comparator group.

There was no association between being born in the period April to May 2020, compared with April to May 2015–2019,

and risk for extremely preterm birth (adjusted OR, 0.92 [CI, 0.66 to 1.28]), very preterm birth (adjusted OR, 1.09 [CI, 0.85 to 1.40]), moderately preterm birth (adjusted OR, 0.95 [CI, 0.87 to 1.03]), or stillbirth (adjusted OR, 0.78 [CI, 0.57 to 1.06]) (Table 1). In a sensitivity analysis in which mothers with COVID-19 were excluded, results were similar to those of the main analysis (Table 2). Among mothers in the cohort, the mean number of maternal health care visits was 2.3 (SD, 1.7) in April to May 2020; the corresponding number was 2.3 (SD, 1.7) in the combined April to May 2015–2019 periods.

**Discussion:** This nationwide study did not find any associations between being born during a period when many public health interventions aimed at mitigating the spread of COVID-19 were enforced and the risk for any of the preterm birth categories or stillbirth.

This study did not confirm previously reported data from Denmark and the United Kingdom (1,2). A difference between ours and the Danish study was the sample size, where our study was based on a total of 17 661 births during April to May 2020, of which 43 were extremely preterm. In the Danish study, there was 1 case of extremely preterm birth among 5162 births during the 1-month risk period. As opposed to the single-center study of stillbirth from the United Kingdom, ours was nationwide. Low event numbers and single-center designs may be sensitive to random variation. Given the observed estimates for stillbirth in the current study, further research is warranted to investigate the possibility of a decreased risk.

These findings should be interpreted in the context of the COVID-19 mitigation strategy used in Sweden. Although society was not completely closed, Swedish authorities enforced many policies—all in action April to May 2020—to mitigate the spread of COVID-19, such as promotion of general hygiene measures and social distancing (including remote working), ban of nonessential travel, prohibition of gatherings of more than 50 people, and closure of upper secondary schools and universities. In effect, Sweden is estimated to have reached a reproduction number of severe acute respiratory syndrome coronavirus 2 infection below 1.0 by mid-April (3). Further, Sweden has also seen abrupt ends of the influenza and calicivirus seasons (contrasting with the smoother epidemiologic

**Table 1.** Main Analysis of Risk for Preterm Birth and Stillbirth in Sweden: April to May 2020 Versus April to May Periods 2015–2019

Outcome	Events (Events per 1000 Births*, n (n))		Odds Ratio (95% CI)		Adjusted Difference in Events per 1000 Births* (95% CI)†
	Births in April-May 2020 (n = 17 661)	Births in April-May 2015-2019 (n = 91 262)	Unadjusted	Adjusted‡	
Preterm birth (<37 + 0 wk)	801 (45.4)	4347 (47.6)	0.95 (0.88 to 1.03)	0.96 (0.89 to 1.04)	–1.9 (–5.2 to 1.9)
Extremely preterm (<28 + 0 wk)	43 (2.4)	251 (2.8)	0.88 (0.64 to 1.22)	0.92 (0.66 to 1.28)	–0.2 (–1.0 to 0.8)
Very preterm (28 + 0 to 31 + 6 wk)	78 (4.4)	385 (4.2)	1.05 (0.82 to 1.33)	1.09 (0.85 to 1.40)	0.4 (–0.6 to 1.7)
Moderately preterm (32 + 0 to 36 + 6 wk)	680 (38.5)	3711 (40.7)	0.94 (0.87 to 1.03)	0.95 (0.87 to 1.03)	–2.0 (–5.3 to 1.2)
Stillbirth‡	47 (2.7)	303 (3.3)	0.80 (0.59 to 1.09)	0.78 (0.57 to 1.06)	–0.7 (–1.4 to 0.2)

\* The unit of measurement was number of events per 1000 live births in the analysis of preterm birth and number of events per 1000 births in the analysis of stillbirth.

† Adjusted for maternal age, birth country, parity, body mass index, and smoking status.

‡ Defined as fetal loss from 22+0 wk. The stillbirth analysis was based on 17 708 births in April to May 2020 and 91 565 births in April to May 2015–2019.

**Table 2.** Sensitivity Analysis of Risk for Preterm Birth and Stillbirth in Sweden, Excluding Mothers With COVID-19: April to May 2020 Versus April to May Periods 2015–2019

Outcome	Events (Events per 1000 Births*), n (n)		Odds Ratio (95% CI)		Adjusted Difference in Events per 1000 Births* (95% CI)†
	Births in April-May 2020 (n = 17 458)	Births in April-May 2015-2019 (n = 91 262)	Unadjusted	Adjusted‡	
Preterm birth (<37 + 0 wk)	772 (44.2)	4 347 (47.6)	0.93 (0.86 to 1.00)	0.94 (0.87 to 1.01)	-2.9 (-6.2 to 0.5)
Extremely preterm (<28 + 0 wk)	40 (2.3)	251 (2.8)	0.83 (0.59 to 1.16)	0.87 (0.62 to 1.21)	-0.4 (-1.1 to 0.6)
Very preterm (28 + 0 to 31 + 6 wk)	75 (4.3)	385 (4.2)	1.01 (0.79 to 1.30)	1.06 (0.83 to 1.36)	0.3 (-0.7 to 1.5)
Moderately preterm (32 + 0 to 36 + 6 wk)	657 (37.6)	3 711 (40.7)	0.92 (0.85 to 1.00)	0.93 (0.85 to 1.01)	-2.8 (-6.1 to 0.4)
Stillbirth‡	45 (2.6)	303 (3.3)	0.78 (0.57 to 1.06)	0.76 (0.55 to 1.03)	-0.8 (-1.5 to 0.1)

\* The unit of measurement was number of events per 1000 live births in the analysis of preterm birth and number of events per 1000 births in the analysis of stillbirth.

† Adjusted for maternal age, birth country, parity, body mass index, and smoking status.

‡ Defined as fetal loss from 22+0 wk. The stillbirth analysis was based on 17 503 births in April to May 2020 and 91 565 births in April to May 2015–2019.

curves observed in previous seasons) (4, 5), supporting the notion that the pandemic public health interventions had substantial effects on the transmission of contagious infectious diseases. Still, given the harder lockdown enforced in Denmark, it is possible that differences in pandemic interventions lead to different effects on extremely preterm birth rates.

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**Reproducible Research Statement:** Study protocol and statistical code: Available from Dr. Pasternak. Data set: Not available.

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