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Vincenzo Berghella, MD, Julia Burd, MD, Kathryn Anderson, BA, Rupsa Boelig, MD, Amanda Roman, MD



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Decreased incidence of preterm birth during COVID-19 pandemic

Vincenzo Berghella, MD¹; Julia Burd, MD²; Kathryn Anderson, BA³; Rupsa Boelig, MD¹; Amanda Roman, MD¹

¹Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Sidney Kimmel Medical College of Thomas Jefferson University, Philadelphia, PA, USA

²Department of Obstetrics and Gynecology, Sidney Kimmel Medical College of Thomas Jefferson University, Philadelphia, PA, USA

³Sidney Kimmel Medical College of Thomas Jefferson University, Philadelphia, PA, USA

Correspondence: Vincenzo Berghella, MD, Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Thomas Jefferson University, 833 Chestnut, Philadelphia, PA 19107, USA. E-mail: vincenzo.berghella@jefferson.edu

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Short title: Preterm birth in COVID-19 pandemic

1 **Introduction**

2 While most studies have reported an increase in preterm birth (PTB) in pregnant women with
3 severe or critical COVID-19 infection (1), population level European reports offer conflicting
4 data on a decrease (2,3) or stability (4) in the overall rate of PTB during the pandemic. Our
5 objective was to evaluate the incidence of PTB at our institution, in the North-East of the US,
6 during the COVID-19 pandemic in 2020 compared to the similar period in 2019.

7 **Methods**

8 Birth data at Thomas Jefferson University Hospital were accessed by a query of the electronic
9 medical record. Two time periods were examined: March 1-July 31 2020 (during COVID-19
10 pandemic) and March 1-July 31, 2019 (prior to onset of COVID-19 pandemic). Inclusion criteria
11 were all births ≥ 20 weeks, inclusive of those with intrauterine fetal death, fetal anomalies, and
12 multiple gestations. Individual charts were accessed for women who delivered preterm to
13 confirm indication for delivery. The primary outcome was the incidence of PTB between the two
14 groups, before and during the COVID-19 pandemic. Secondary outcomes included the
15 incidences of late PTB (34 0/7-36 6/7 weeks), early PTB (<34 weeks) and very early PTB (<28
16 weeks), and perinatal death (fetal and neonatal death) between periods. Analyses by subgroups
17 of spontaneous and iatrogenic PTB were also performed. Chi square analysis using odds ratios
18 (ORs) and 95% confidence intervals (CIs) was used for categorical variables, and adjusted OR
19 (aOR) for demographic differences using multivariable logistic regression analysis. A p value
20 <0.05 was considered significant.

21 **Results**

22 There was a significantly decreased incidence of PTB in 2020 during the COVID-19 pandemic
23 compared to the 2019 period (9.9% vs 12.6%; OR 0.76, 95% CIs 0.58-0.99) (Table). After
24 adjusting for race/ethnicity, the 2020 period remained associated with a significantly decreased
25 incidence of PTB (aOR 0.75, 95% CIs 0.57-0.99) compared to the 2019 pre-COVID period.
26 There were also significant decreases in PTB <34 weeks (2.5% vs 4.7%; aOR 0.51, 95% CIs
27 0.31-0.82) and PTB <28 weeks (0.6% vs 1.5%, aOR 0.37, 95% CIs 0.15-0.93) in 2020 compared
28 to 2019. The rate of late PTB 34-36 weeks was similar between groups (Table). Subgroup
29 analyses of just spontaneous or just iatrogenic PTB did not reveal significant differences, except
30 for a 60% decrease in iatrogenic PTB < 34 weeks in 2020 compared to 2019 (Table). The
31 incidences of mode of delivery, and perinatal death were similar between time periods (Table).
32 Eight (6.8%) of the 118 PTB in the 2020 period occurred in COVID-19 positive women. The
33 incidence of PTB in COVID-19 positive women (most diagnosed during pregnancy because of
34 symptoms) was 14.5% (8/55), and did not differ significantly compared to the rest of the women
35 in the 2020 group (110/1142, 9.6%; OR 1.60, 95% CIs 0.74-3.47). The incidence of SARS-CoV-

36 2 positivity upon labor and delivery universal screening between April 13, 2020 (when we
37 started) and July 31, 2020, was 4.5% (40/878).

38 **Discussion**

39 To our knowledge, this is the first US study reporting a significant (25%) decrease in the odds of
40 PTB during the COVID-19 pandemic compared to a similar pre-pandemic period in the peer-
41 reviewed literature. Specifically, we identified a significant decrease in early PTB (49% decrease
42 for <34 and 63% decrease for <28weeks), which have the highest risk of neonatal morbidity and
43 mortality (Table). When analyzing the subgroup of spontaneous PTB, data pointed to a decrease
44 in spontaneous PTB at different cutoffs, but none were significant, probably due to a type II
45 error. When analyzing the subgroup of iatrogenic PTB, most – but not all - data also pointed to a
46 decrease in iatrogenic PTB at different cutoffs and by race/ethnicity, with iatrogenic PTB < 34
47 weeks significantly decreased by 60% (Table). The incidences of cesarean delivery, and perinatal
48 death were not different. The major limitation of this study is only accounting for race/ethnicity
49 and no other sociodemographic data as possible confounders. The decrease in PTB, in particular
50 in early (<34 weeks) and very early (<28 weeks) PTBs, is consistent with two prior reports from
51 Denmark (2) and Ireland (3), but differs from a UK report which did not report changes in
52 incidence of PTB (4).

53 The reasons for a decrease in PTB during COVID-19 pandemic are unclear and it is notable that
54 the decrease seemed to be both in spontaneous and indicated PTB, but these subgroup analyses
55 were small and probably underpowered. Several hypotheses can be postulated (Box). In
56 particular, reduced work hours, reduced physical and/or emotional stress of work, being home
57 with support from family, able to have time to exercise, and reduced exposure to environmental
58 pollutants from reduced air pollution, could all be plausible explanations, among others, but
59 require further study. Specifically the decrease in iatrogenic PTB could be related to reduced
60 antepartum surveillance that would prompt a delivery. Examination of PTB rate should be
61 evaluated in conjunction with fetal demise/neonatal morbidity and mortality rates as reduced
62 access to care can certainly result in a rise in both (5). Further research is needed on the potential
63 differential benefit among racial/ethnic groups (current analysis being limited by sample sizes
64 and potential for type II error), and on how practice changes during the pandemic impact
65 population level outcomes. If replicated in larger populations, this decrease in PTB opens a
66 whole new avenue for investigation, as no single intervention has been shown to have such a
67 major effect on the incidence of PTB in the general population.

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102 Table: Demographic characteristics and outcomes

	March-July 2020	March-July 2019	P value or aOR (95% CIs) ^c
Total Births	1197	911	
<i>Race/Ethnic group</i>			
Black or African American	448 (37.4%)	343 (37.7%)	0.001
Hispanic	177 (14.8%)	87 (9.5%)	
Non-Hispanic, non-Black	572 (47.8%)	481 (52.8%)	
<i>Preterm Births</i>			
PTB < 37 weeks overall	118 (9.9%)	115 (12.6%)	0.75 (0.57-0.99)
PTB 34-36 weeks	88 (7.4%)	72 (7.9%)	0.93 (0.67-1.28)
PTB < 34 weeks	30 (2.5%)	43 (4.7%)	0.51 (0.32-0.83)
PTB < 28 weeks	7 (0.6%)	14 (1.5%)	0.37 (0.15-0.93)
SPTB < 37 weeks overall	57 (4.8%)	59 (6.6%)	0.75 (0.52-1.10)
SPTB 34-36 weeks	44 (3.7%)	44 (4.8%)	0.76 (0.49-1.16)
SPTB <34 weeks	14 (1.2%)	15 (1.6%)	0.76 (0.36-1.60)
SPTB<28 weeks	3 (0.3%)	7 (0.8%)	0.33 (0.09-1.30)
IPTB < 37 weeks overall	60 (5.0%)	56 (6.1%)	0.78 (0.53-1.10)
IPTB 34-36 weeks	44 (3.7%)	28 (3.1%)	1.19 (0.73-1.93)
IPTB <34 weeks	16 (1.3%)	28 (3.1%)	0.40 (0.21-0.75)
IPTB <28 weeks	4 (0.3%)	7 (0.8%)	0.42 (0.12-1.44)
COVID positive preterm deliveries^a	8 (3.4%)	Not applicable	-
<i>Mode of delivery</i>			
Cesarean delivery	344 (28.7%)	236 (25.9%)	0.15
Vaginal delivery	853 (71.3%)	675 (74.1%)	

Perinatal death	7 (0.6%)	12 (1.3%)	.08
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103 PTB, preterm birth; SPTB, spontaneous PTB; IPTB, iatrogenic PTB.

104 a Women with positive SARS-CoV-2 PCR test result within Jefferson Healthcare system at any
105 point during pregnancy prior to delivery

106 b Spontaneous PTB included preterm labor and preterm prelabor rupture of membranes
107 (PPROM)

108 c aOR is odds ratio adjusted for race

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126 **Box**

127 **Possible reasons for decrease in the incidence of PTB during COVID-19 pandemic**

- 128 - Less stress, anxiety: work from home
- 129 - Other work changes: no shift work; no long hours; less physical work
- 130 - Better support systems: partner; family
- 131 - Better nutrition
- 132 - More exercise
- 133 - Better hygiene, less social interactions: less infections
- 134 - Less smoking since indoor; less chance for drug use given lockdown
- 135 - Less car driving: less stress, less accidents
- 136 - Less air pollution
- 137 - Government financial assistance
- 138 - Less medical interventions

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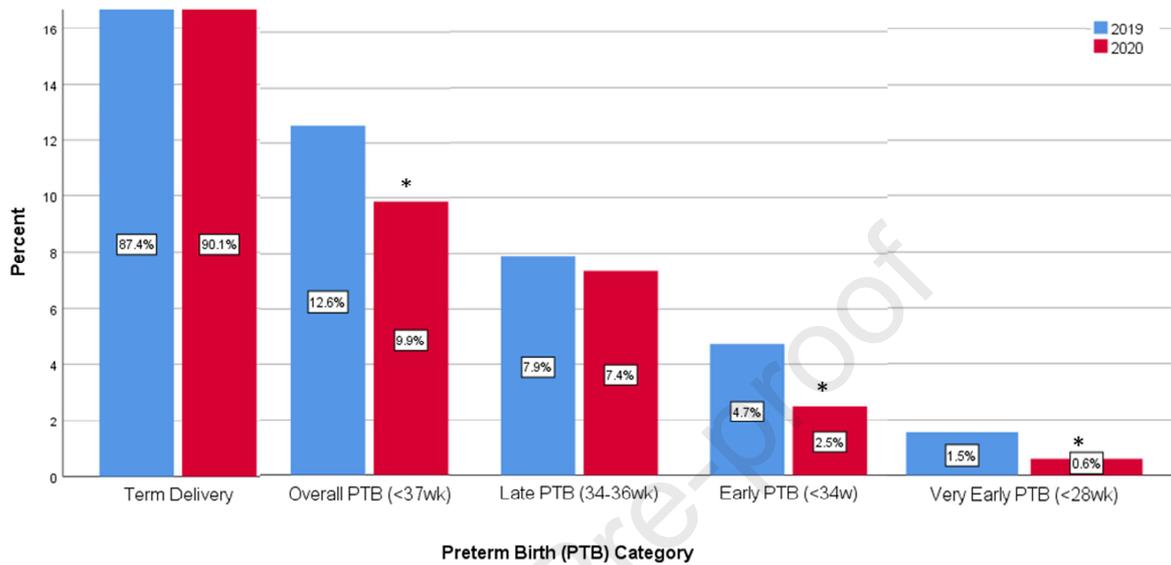
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162 **Figure: Preterm birth by gestational age at delivery divided into 2019 pre-COVID-19 and**
163 **2020 COVID-19 periods**

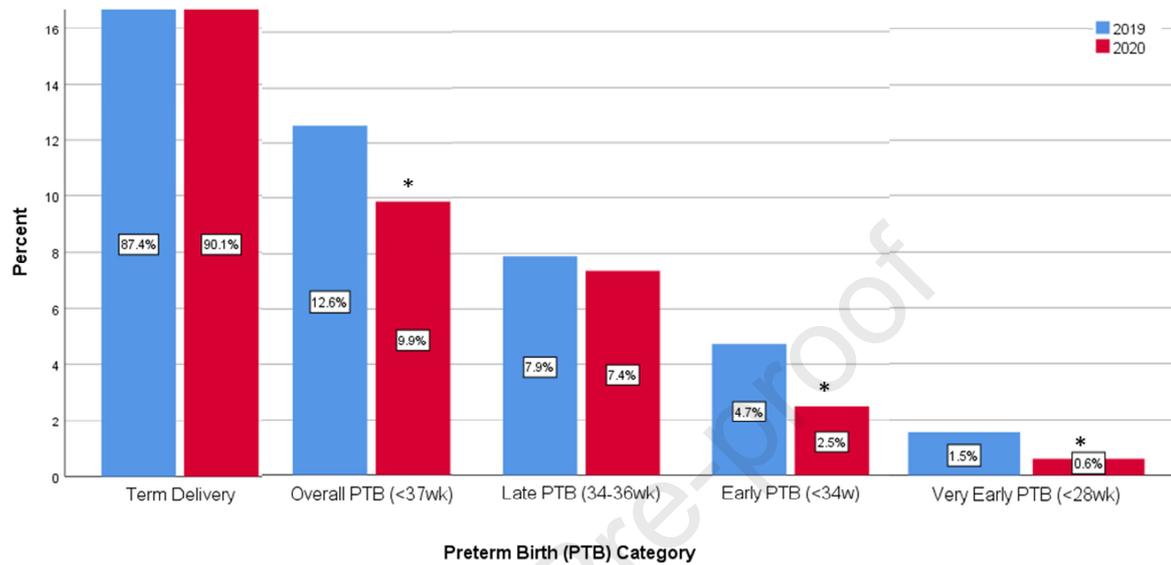


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166 Rate of term and preterm delivery comparing March-July 2019 (blue) and March-July 2020
167 (red). *indicates a statistically significant difference between periods at $p<0.05$.

Figure: Preterm birth by gestational age at delivery divided into 2019 pre-COVID-19 and 2020 COVID-19 periods



Rate of term and preterm delivery comparing March-July 2019 (blue) and March-July 2020 (red). *indicates a statistically significant difference between periods at $p < 0.05$.

