



# Investigating Decreased Rates of Nulliparous Cesarean Deliveries during the COVID-19 Pandemic

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## Abstract

**Objective** Preventing the first cesarean delivery (CD) is important as CD rates continue to rise. During the novel coronavirus disease 2019 (COVID-19) pandemic, quality improvement metrics at our hospital identified lower rates of CD. We sought to investigate this change and identify factors that may have contributed to the decrease.

**Study Design** We compared nulliparous singleton deliveries at a large academic hospital during the COVID-19 pandemic (April through July 2020 during a statewide “stay-at-home” order) to those in the same months 1 year prior to the pandemic (April through July 2019). The primary outcome, mode of delivery, was obtained from the electronic medical record system, along with indication for CD.

**Results** The cohort included 1,913 deliveries: 892 in 2019 and 1,021 in 2020. Patient characteristics (age, body mass index, race, ethnicity, and insurance type) did not differ between the groups. Median gestational age at delivery was the same in both groups. The CD rate decreased significantly during the COVID-19 pandemic compared with prior (28.9 vs. 33.6%;  $p = 0.03$ ). There was a significant increase in the rate of labor induction (45.7 vs. 40.6%;  $p = 0.02$ ), but no difference in the proportion of inductions that were elective (19.5 vs. 20.7%;  $p = 0.66$ ). The rate of CD in labor was unchanged (15.9 vs. 16.3%;  $p = 0.82$ ); however, more women attempted a trial of labor (87.0 vs. 82.6%;  $p = 0.01$ ). Thus, the proportion of CD without a trial of labor decreased (25.1 vs. 33.0%;  $p = 0.04$ ).

**Conclusion** There was a statistically significant decrease in CD during the COVID-19 pandemic at our hospital, driven by a decrease in CD without a trial of labor. The increased rate of attempted trial of labor suggests the presence of patient-level factors that warrant further investigation as potential targets for decreasing CD rates. Additionally, in a diverse and medically complex population, increased rates of labor induction were not associated with increased rates of CD.

## Keywords

- ▶ COVID-19
- ▶ cesarean delivery prevention
- ▶ singleton deliveries

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## Key Points

- Primary CD rate fell during COVID-19 pandemic.
- Decrease was driven by more women attempting labor.
- Higher rate of induction without rise in CD rate was found.

Cesarean delivery (CD) rates have risen significantly in the United States over the past decades.<sup>1</sup> While it is already established that cesarean deliveries are associated with higher maternal morbidity, newer literature have also suggested increased neonatal morbidity and financial consequences related to the rising rate of CD.<sup>2-4</sup> As many women will opt for elective repeat cesarean after a primary CD, campaigns to prevent the primary CD have developed.<sup>5</sup>

Suggestions have included allowing for a longer second stage, implementing a CD “checklist” to avoid nonindicated cesarean sections or incorporating more “midwifery-style care,” such as positional changes during labor and intermittent fetal heart auscultation.<sup>6-8</sup> These interventions have met with varying levels of success, and preventing the primary CD remains a major focus of investigation.

On March 23, 2020, in response to the novel coronavirus disease 2019 (COVID-19) pandemic, a state-wide stay-at-home order was issued. Additionally, hospital-wide policy changes occurred, including an increased emphasis on telemedicine and remote care in outpatient obstetric (OB) clinics and limiting the number of support people for laboring women on labor and delivery.

During the time of hospital protocol changes, quality improvement data for our institution suggested a reduction in the rate of CD by several percentage points. Our primary objective was to quantify the reduction in the rate of CD associated with the COVID-19 pandemic and identify factors potentially related to this decrease. Identification of such factors could help inform counseling and management to reduce the CD rate, as well as associated maternal and neonatal morbidity and health care costs, in the long-term.

## Materials and Methods

This was a retrospective cohort study comparing all nulliparous singleton deliveries at a single large academic hospital in Boston, MA, during the months of a state-wide stay-at-home recommendation during the COVID-19 pandemic (April through July 2020) to those singleton deliveries at the same hospital and in the same months during the same time period 1 year prior in a pre-COVID era (April through July 2019). The same four months were chosen for both cohorts to account for any potential variation in delivery patterns and patient characteristics throughout the calendar year. The study was approved by the Partners Human Research Committee (protocol no.: 2020P001887).

All singleton deliveries occurring to nulliparous women were identified by review of the electronic medical record system. Data regarding these deliveries, including demographics and delivery type and indication for CD or induction

of labor, were then obtained from the electronic medical record system. “Trial of labor” was defined as either spontaneous labor or induced labor.

CDs were grouped as occurring “during labor” or “not during labor.” CD during labor included indications such as fetal intolerance of labor, failure to progress, worsening maternal status during labor, and failed operative delivery. CD, not during labor, included indications such as malpresentation/breech, prior uterine surgery, maternal medical complication, fetal anomalies, and placenta or vasa previa. If the indication for CD was not listed in the electronic medical record, individual chart review was performed by the primary author (C.M.S.).

Additional chart review of operative reports, ultrasound imaging, and prenatal records was performed for all women in the “cesarean delivery without a trial of labor” group to determine whether these women met criteria for a trial of labor. For example, chart review was performed to assess whether external cephalic version was attempted prior to CD for breech presentation. Similarly, operative notes were reviewed where available for women who underwent CD for a history of prior uterine surgery to determine if future CD had been recommended. For any CD with an unclear contraindication to trial of labor, the chart was then separately reviewed by a second author for clarity (S.E.L.).

## Statistical Methods

All data were analyzed in SAS 9.4 (Cary, NC). Binary outcomes were compared with Chi-squared or Fisher’s exact testing, where appropriate. Continuous variables were compared with nonparametric methods using Wilcoxon’s testing.

## Results

There were 1,909 nulliparous singleton deliveries during the two cohorts of interest: 890 in April to July of 2019 and 1,019 in April to July of 2020. Patient characteristics including age, body mass index, race, ethnicity, and insurance type did not differ significantly between the groups. Median gestational age at delivery was the same in both groups (39.4 weeks,  $p = 0.12$ , ▶ **Table 1**).

During the COVID era, the CD rate was lower than in the pre-COVID era (28.8 vs. 33.5%,  $p = 0.03$ , ▶ **Table 2**). There was no difference in the rate of CD during labor (19.1 vs. 19.8%,  $p = 0.72$ ); however, the rate of CD without trial of labor decreased (9.6 vs. 13.7%,  $p < 0.01$ ). This appeared to be driven by an increase in the proportion of women attempting a trial of labor during the COVID-era (90.4 vs. 86.3%,  $p < 0.01$ ). Additionally, the rate of labor induction increased (45.8 vs. 40.7%,  $p = 0.02$ ). Of note, there was no difference in the rate of

Table 1 Patient characteristics			
	Year		p-Value
	2019 (n = 890)	2020 (n = 1,019)	
Age (IQR) in years	31 (29–34)	32 (29–34)	0.51
BMI (IQR) in kg/m <sup>2</sup>	29.4 (26.6–33.1)	29.4 (26.5–33.4)	0.96
Race n (%)			
White	585 (65.7)	650 (63.8)	0.62
Black	85 (9.6)	115 (11.3)	
Asian	104 (11.7)	116 (11.4)	
Other/unknown <sup>a</sup>	116 (13.0)	138 (13.5)	
Ethnicity n (%)			
Hispanic	119 (13.4)	127 (12.5)	0.62
Not Hispanic	749 (84.2)	855 (83.9)	
Unknown	22 (2.5)	37 (3.6)	
Insurance type n (%)			
Public	113 (12.7)	119 (11.7)	0.50
Private			

Abbreviations: BMI, body mass index; IQR, Interquartile range.

Note: Data presented with IQR represents median value with associated IQR.

<sup>a</sup>Other includes Native American, Pacific Islander, and patients who reported multiple races.

elective inductions of labor despite the increase in overall induction rate (19.5 vs. 20.7%,  $p = 0.66$ ).

There was no change in the rate of operative delivery between the two cohorts (11.1 vs. 10.5%,  $p = 0.66$ ).

Subgroup analysis of all individual indications for CD without trial of labor, including breech/malpresentation, placenta previa, prior uterine surgery, fetal anomaly, or maternal medical showed no difference between the two groups (→ Table 3).

For these same indications, there was no difference in the proportion of women who underwent CD but who were candidates for trial of labor. Among women who had a CD for breech/malpresentation, there was no difference in the rates of attempted external cephalic version (ECV). In both cohorts, there were relatively low rates of primary CD for maternal request (→ Table 4).

## Discussion

Our study found that the CD rate decreased nearly 5% points at one institution during the COVID-19 pandemic; however, this decrease was driven entirely by a decrease in the rate of CD without a trial of labor. There was no change in the rate of CD after a trial of labor despite an increase in the rate of labor induction during the COVID-19 pandemic. Among CDs performed without a trial of labor, there was no change in the distribution of indication, nor was there any change in the

Table 3 Indications for cesarean delivery without trial of labor			
	2019 (n = 122) n (%)	2020 (n = 98) n (%)	p-Value
Breech/malpresentation	63 (51.6)	46 (41.9)	0.61
Placenta previa (placenta or vasa)	8 (6.6)	7 (7.1)	
Prior uterine surgery <sup>a</sup>	11 (9.0)	13 (13.3)	
Fetal anomaly	10 (8.2)	5 (5.1)	
Nonreassuring fetal testing <sup>b</sup>	4 (3.3)	4 (4.1)	
Maternal medical condition	17 (13.9)	10 (10.2)	
Elective	9 (7.4)	13 (13.3)	

<sup>a</sup>All cases reviewed in this category were prior myomectomies.

<sup>b</sup>This category included exclusively patients in whom nonreassuring fetal testing outside of labor was identified and the patient then proceeded directly to primary cesarean delivery.

Table 2 Delivery methods and trial of labor			
	2019 (n = 890) n (%)	2020 (n = 1,019) n (%)	p-Value
Gestational age at delivery (IQR) in weeks	39.43 (38.3–40.1)	39.4 (38.4–40.3)	0.12
Trial of labor, all	768 (86.3)	921 (90.4)	<0.01 <sup>a</sup>
Cesarean delivery, all	298 (33.5)	293 (28.8)	0.03 <sup>b</sup>
Cesarean delivery, during labor	176 (19.8)	195 (19.1)	0.72
Cesarean delivery, without labor	122 (13.7)	98 (9.6)	<0.01 <sup>a</sup>
IOL total	362 (40.7)	467 (45.8)	0.02 <sup>b</sup>
Proportion of IOL elective	20.7%	19.5%	0.66
Operative vaginal delivery	99 (11.1)	107 (10.5)	0.66

Abbreviations: IOL, labor induction; IQR, interquartile range.

<sup>a</sup> $p < 0.05$ .

**Table 4** Candidates for labor among patients who underwent cesarean delivery without trial of labor

	2019	2020	p-Value
Breech, total	63	46	
ECV attempted (%)	19 (30.2)	15 (32.6)	0.79
Placenta previa, total	8	7	
Candidate for labor <sup>a</sup> (%)	2 (2.5)	1 (14.5)	0.60
Prior uterine surgery, total	11	13	
Candidate for labor (%)	0 (0)	0 (0%)	–
Maternal medical condition, total	17	10	
Candidate for labor (%)	6 (35.3)	3 (30.0)	0.78
Fetal abnormality, total	10	5	
Candidate for labor	2 (20)	0 (0)	0.28
Nonreassuring fetal testing, total	4	4	
Candidate for labor (%)	0 (0)	0 (0)	–
Elective, total	9	13	
Candidate for labor (%)	9 (100)	13 (100)	–
Any unlabored cesarean delivery, total	122	98	
Candidate for labor (%)	19 (15.6)	17 (17.4)	0.72

Abbreviation: ECV, external cephalic version.

<sup>a</sup>Candidacy for labor determined by chart review of operative reports, ultrasound images, and other documentation for criteria including distance of placental edge to cervical os, extent of prior uterine surgery, and other characteristics.

proportion of women who may have otherwise been considered a candidate for labor.

We initially postulated that due to the COVID-19 pandemic, more mothers may have chosen the concrete certainty of an induction date rather than awaiting spontaneous labor, and that this increase in labor induction rate was directly tied to the falling CD rate. In other words, it seemed a real world manifestation and perhaps even confirmation of the ARRIVE trial.<sup>9</sup> Another theory was that due to the COVID-19 pandemic, OB providers, including nurses, physicians, and midwives, simply entered labor and delivery rooms with less frequency in an attempt to maintain as much social distancing as possible, and that perhaps this decrease in “interventional-ism” in labor resulted in the decreased CD rate. However, when specifics of the Cesarean deliveries were more carefully examined, these initial hypotheses do not seem to hold true.

When it became clear that the driving force behind the decrease in CD rates was indeed among CD without a trial of labor, we hypothesized that rates of nonindicated CD may have decreased during the COVID-19 pandemic due to more stringent restrictions on surgical procedures. However, this was ultimately not found to be the case, as despite review of these cases by at least one obstetrician, and in more complex cases two obstetricians, there were very few marginally indicated CD cases identified in the prepandemic time peri-

od. Attempts to avoid the primary CD in the 2019 cohort were admirable but did not support a theory of less-strict implementation of CD criteria prior to the COVID-19 pandemic.

At the conclusion of this analysis, it appears that there must be, as of yet, unrecognized factors at play, either related or unrelated to the COVID-19 pandemic, and likely patient-driven, as no changes in labor practices were identified. One potential explanation could be that women who required scheduled primary CDs and were otherwise healthy, uncomplicated patients may have sought care at smaller hospitals closer to home to avoid spending time in a large urban hospital during the COVID-19 pandemic; however, this seems an incomplete explanation as there were more total deliveries in the 2020 pandemic cohort as compared with the year prior. Further monitoring of the CD rate over the coming months at our institution will be critical to assess whether the decrease persists or whether the rate returns to the prepandemic mean.

Reassuringly, despite an increase in the rate of labor inductions, there was no change in the rate of CD after trial of labor. In a population diverse in age, ethnicity, body mass index, and medical complexity, this is a reassuring validation of recent data, showing that induction of labor in a low-risk population of nulliparous women is associated with lower rates of CD.<sup>9</sup> Moreover, our study population's heterogeneity and varying levels of maternal medical risk adds to its generalizability, suggesting that induction of labor in higher risk populations is not associated with higher rates of CD.

## Limitations

The major limitation of this study was the short time period used in the analysis. This was specifically chosen in an attempt to isolate the true impact of the COVID-19 pandemic, as after July 2020, while the pandemic persisted, it briefly lessened in severity in our area, leading to resumption of nearer normal hospital activity. However, as demonstrated in this investigation, studying large-scale metrics, such as CD rates, would likely be more accurate over longer time periods to decrease the impact of variation around the mean. Additionally, our study was not powered to detect small differences in the individual indications for CD, limiting our conclusion.

## Conclusion

Despite initially promising findings of a sharp decrease in primary CD during the COVID-19 pandemic, analysis ultimately demonstrated that this decrease was entirely driven by a decrease in CD without trial of labor, although we could not isolate specific changes in indication. Encouragingly there was no change in the rate of CD after trial of labor despite a marked rise in the rate of labor induction. In a population diverse in age, ethnicity, body mass index, and medical complexity, increased rates of labor induction are not associated with increased rates of CD.

**Note**

Findings of this study were previously presented at the 41st Annual Pregnancy Meeting of the Society for Maternal Fetal Medicine, virtually, from January 25 to 30, 2021.

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None.

**Conflict of Interest**

None declared.

**References**

- 1 Centers for Disease Control and Prevention. Cesarean delivery rate by state. Accessed April 18, 2021 at: [https://www.cdc.gov/nchs/pressroom/sosmap/cesarean\\_births/cesareans.htm](https://www.cdc.gov/nchs/pressroom/sosmap/cesarean_births/cesareans.htm)
- 2 Forde B, DeFranco EA. Association of prior cesarean delivery with early term delivery and neonatal morbidity. *Obstet Gynecol* 2020; 135(06):1367–1376
- 3 DeJoy SA, Bohl MG, Mahoney K, Blake C. Estimating the financial impact of reducing primary cesareans. *J Midwifery Womens Health* 2020;65(01):56–63
- 4 Creanga AA, Bateman BT, Butwick AJ, et al. Morbidity associated with cesarean delivery in the United States: is placenta accreta an increasingly important contributor? *Am J Obstet Gynecol* 2015; 213(03):384.e1–384.e11
- 5 Caughey AB, Cahill AG, Guise JM, Rouse DJ; American College of Obstetricians and Gynecologists (College) Society for Maternal-Fetal Medicine. Safe prevention of the primary cesarean delivery. *Am J Obstet Gynecol* 2014;210(03):179–193
- 6 Zipori Y, Grunwald O, Ginsberg Y, Beloosesky R, Weiner Z. The impact of extending the second stage of labor to prevent primary cesarean delivery on maternal and neonatal outcomes. *Am J Obstet Gynecol* 2019;220(02):191.e1–191.e7
- 7 Toumi M, Lesieur E, Haumonte J-B, Blanc J, D'ercole C, Bretelle F. Primary cesarean delivery rate: potential impact of a checklist. *J Gynecol Obstet Hum Reprod* 2018;47(09):419–424
- 8 Cox KJ, King TL. Preventing primary cesarean births: midwifery care. *Clin Obstet Gynecol* 2015;58(02):282–293
- 9 Grobman WA, Rice MM, Reddy UM, et al; Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal–Fetal Medicine Units Network. Labor induction versus expectant management in low-risk nulliparous women. *N Engl J Med* 2018;379(06):513–523