

## CLINICAL ARTICLE

## Obstetrics

# Consequences of the COVID-19 pandemic on the postpartum course: Lessons learnt from a large-scale comparative study in a teaching hospital

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**Abstract**

**Objective:** To evaluate the consequences of COVID-19 pandemic restrictions on the postpartum course.

**Methods:** A retrospective cross-sectional study compared women who gave birth between March and April 2020 (first wave), between July to September 2020 (second wave), and a matched historical cohort throughout 2017–2019 (groups A, B, and C, respectively). Primary outcomes were postpartum length of stay (LOS), presentations to the emergency department (ED), and readmissions 30 days or longer after discharge. Following Bonferroni correction,  $p < 0.016$  was considered statistically significant.

**Results:** In total, 3377 women were included: 640, 914, and 1823 in groups A, B, and C, respectively. LOS after birth (both vaginal and cesarean) was shorter in groups A and B compared to the control group ( $2.28 \pm 1.01$  and  $2.25 \pm 0.93$  vs  $2.55 \pm 1.10$  days,  $p < 0.001$ ). Rates of ED presentations 30 days after discharge were higher in groups C and B compared to group A (6.63% and 6.45% vs 3.12%,  $p = 0.006$ ). Rates of readmissions 30 days after discharge were 0.78%, 1.42%, and 1.09% (groups A, B, and C, respectively), demonstrating no statistical difference ( $p = 0.408$ ).

**Conclusion:** During the COVID-19 pandemic, there was a reduction or no change in rates of ED presentations and readmissions, despite the shortened LOS after delivery. A shift in policy regarding the postpartum LOS could be considered.

**KEYWORDS**

COVID-19, postpartum length of stay, postpartum readmission

## 1 | INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) was first diagnosed in December 2019 in Wuhan city, Hubei province, China.<sup>1</sup> Subsequently, it spread throughout the world and created significant challenges to healthcare systems.<sup>2</sup> The virus showed a broad spectrum of clinical presentations.<sup>3</sup> It is considered highly contagious, hence many countries have enforced various degrees of restrictions

on their citizens to reduce its spread. Among such conditions were social distancing and a call to limit unnecessary contact. In response, hospitals and ambulatory care facilities have developed strategies to reduce the transmission of COVID-19 to patients and healthcare providers, hence visits were restricted. There was a complete halt of elective activity.<sup>4</sup> COVID-19 spread in two separate waves: from the beginning of March until the end of April 2020 and from July to September 2020.

Although there are limited data about the effect of COVID-19 on pregnant women,<sup>5,6</sup> it seems that they do not appear to be more severely ill if they develop COVID-19 infection; nevertheless, they are still considered a vulnerable or at-risk group.<sup>5,6</sup> In February 2020, the Ministry of Health declared a state of emergency and, as a result, the hospital and the obstetric ward have faced a new reality. In light of such challenges, the study institute has established a team composed of obstetricians, anesthesiologists, pediatricians, infectious disease specialists, and nursing leadership to create new guidelines. The following were implemented: use of personal protective equipment; triage of patients suspected or infected with COVID-19; the medical teams were divided into groups (capsules); in-person visits were limited; visiting hours were reduced; and early discharge was encouraged. Many of these are a change from the hospital's standard policy, including regular admission for 48 and 72 hours after standard vaginal delivery and cesarean delivery, respectively. Such a lenient approach did not compromise postpartum care because healthcare providers carefully monitored the standard follow-up protocols, thus minimizing the potential morbidities that might arise after delivery. However, there were no restrictions on visits to the emergency department, and both the general public and postpartum patients were encouraged to present to the emergency department if necessary.

The aim of the present study was to assess whether the changes enforced on the labor and postpartum wards at the time of the COVID-19 outbreaks led to a change in the postpartum length of stay and if it resulted in a change of presentations to the emergency department after release and readmissions compared to historical cohorts.

## 2 | METHODS

A retrospective comparative cohort study included data of parturient women who gave birth in the study institute. The first case of COVID-19 in the country was diagnosed at the end of February 2020. As a result, the government, the hospital, and the labor ward had changed their recommendations, restrictions, and policy for both the general population and for pregnant women. These guidelines were in place from the beginning of March until the end of April 2020. Therefore, records of those who delivered in this specific timeframe (group A) were included in the analysis, and were compared to the historical control cohort who gave birth during the same months in previous years (group C). From May to June 2020, there was a decrease in the incidence of cases of COVID-19 in the country. Therefore, there was some alleviation in the government and hospital restrictions. During July to September 2020, another increase in incidence was observed, leading to repeat conditions. This period was defined as the second wave of COVID-19 (group B).

Data were collected from computerized medical records and included the following: (1) maternal demographics: smoking and body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters), obstetric history including previous cesarean deliveries; (2) current pregnancy and labor: high-risk follow-up (hypertensive disease, diabetes, chronic illness, the risk

for pre-term delivery, etc.), gestational age at delivery, Group B Streptococcus (GBS) carrier (positive GBS culture or GBS bacteriuria), intrapartum fever higher than 38°C with the administration of intravenous broad-spectrum antibiotics, induction of labor and its method, epidural analgesia, mode of delivery, type of cesarean delivery, successful vaginal birth after cesarean delivery (VBAC), newborn weight, newborn Apgar score and admission to the neonatal intensive care unit (NICU); (3) postpartum: length of stay after vaginal or cesarean delivery, presentation to the emergency department in the 30 days after discharge, the nature of the presentation, and if they required readmission to hospital.

Women who either sought care in the 30 days after their delivery or were readmitted were classified as follows: surgical site infection (an abdominal scar or episiotomy); infection (urinary tract infection, mastitis, endometritis); abnormal vaginal bleeding; headache; abdominal pain; and general or non-specific.

Data were extracted into a computerized Excel spreadsheet. Subsequently, an analysis was performed comparing the parameters between the groups.

Patients who were included in the present study were those with a gestational age over 24 weeks at delivery with live births. Records without complete data, gestational age less than 24 weeks, and stillbirths were excluded.

The primary outcome was duration of postpartum admission, presentations to the emergency department, and readmissions in the 30 days after discharge. Secondary outcomes were the rate of labor inductions, mode of delivery, and rates of admission to the NICU.

### 2.1 | Statistical analysis

A statistical analysis was performed using SPSS version 24 (IBM Corp., Armonk, NY, USA). The comparison between the demographic and clinical characteristics between periods was analyzed using the  $\chi^2$  test for the categorical variables and the Anova/Kruskal-Wallis tests for the continuous variables. For the correction of multiple comparisons, a Bonferroni correction was applied, and  $p < 0.016$  was considered statistically significant.

### 2.2 | Ethics approval

The present study was approved by the institutional review board of Carmel Medical Center (Protocol No. 0070-20-CMC). Informed consent was not required due to the retrospective nature of the study.

## 3 | RESULTS

In total, 3377 cases were identified, of which 640 women gave birth at the time when the first COVID-19 pandemic restrictions were

in place, 1823 women gave birth during the matching months in the previous years, and 914 women gave birth during the second wave. There were no statistical differences with regard to maternal age, BMI, smoking status, parity, and the ratio of primigravida between the three groups. Clinically, there were no differences between subgroups in gestational age, pre-term or late-term delivery, or multiple gestations. Patient demographics and clinical characteristics are presented in Table 1. No difference was found in the rates of a previous cesarean delivery, successful VBAC, induction of labor, GBS carrier, administration of epidural analgesia, intrapartum fever with intravenous broad-spectrum antibiotics, mode of delivery, type of cesarean delivery, newborn birth weight, Apgar score at 5 minutes, umbilical pH, and admission to the NICU. Clinical and obstetrical characteristics of the delivery are summarized in Table 2.

The total length of stay after birth (both vaginal and cesarean delivery) was shorter in groups A and B ( $2.28 \pm 1.01$  and  $2.25 \pm 0.93$  vs  $2.55 \pm 1.10$  days,  $p < 0.001$ ). The length of stay after both vaginal and cesarean delivery was significantly shorter in groups A and B (Figure 1).

In total, 201 cases of presentations to the emergency department 30 days after discharge were identified. They were higher in groups B and C than in group A (6.45% and 6.63% vs 3.12%,  $p = 0.006$ ). Of the women who underwent a cesarean delivery, 9 of 142 (6.33%), 18 of 183 (9.83%), and 54 of 381 (14.17%) in groups A, B, and C, respectively, visited the emergency department 30 days after discharge. No significant difference was found between the three groups ( $p = 0.033$ ). Similarly, of the women who underwent vaginal delivery, 12 of 498 (2.40%), 41 of 731 (5.60%), and 66 of 1442 (4.57%) in groups A, B, and C, respectively, presented to the emergency department 30 days after discharge. No significant

difference was found between the groups in the rates of presentation to the emergency department ( $p = 0.0274$ ). The rates of readmission 30 days after discharge were 5 of 640 (0.78%), 10 of 914 (1.09%), and 26 of 1823 (1.42%) in groups A, B, and C, respectively, demonstrating no difference ( $p = 0.408$ ). Visits to the emergency department as well as rates of readmission are presented in Figure 2. No differences with statistical significance were found in the classification of presentations to the emergency department and readmissions presented in Table 3

## 4 | DISCUSSION

The present study shows that the implications of the COVID-19 outbreak in the study institution resulted initially in a reduction of postpartum presentations to the emergency department, but showed no significant rates of readmission after birth, despite a shortened length of stay after delivery, compared to previous years. The hospital policy modifications, aiming to reduce the spread of COVID-19, did not alter the rates of labor inductions, nor change the rate of instrumental deliveries or number of elective and emergent cesarean deliveries.

Although one might find the results of the present study to be as expected, it is important to stress the fact that, as a rule, no official limitations were placed on postpartum women and there were no restrictions on visits to the emergency department. Furthermore, these findings are significant since, despite a higher trend towards home deliveries in Israel,<sup>7</sup> a relatively higher number of deliveries has been seen compared to previous years. This is in contrast to what other institutions have reported in the city.<sup>8</sup>

**TABLE 1** Comparison of demographic and clinical characteristics between women who gave birth during the first wave of COVID-19, the second wave of COVID-19, and the matching months 3 years before<sup>a</sup>

	Group A <sup>b</sup> (n = 640)	Group B <sup>c</sup> (n = 914)	Group C <sup>d</sup> (n = 1823)	P value
Maternal age (years)	31.49 ± 4.49	31.44 ± 4.93	31.42 ± 4.91	0.940
BMI (kg/m <sup>2</sup> )	24.20 ± 5.00	24.01 ± 4.80	24.34 ± 4.86	0.316
Smoking	18 (2.81)	29 (3.17)	67 (3.67)	0.538
Primigravida	254 (39.68)	360 (39.38)	686 (37.63)	0.530
Parity	1 (0–2)	1 (0–2)	1 (0–2)	0.549
Multiple gestation	14 (2.18)	21 (2.29)	46 (2.52)	0.868
Gestational age (weeks)	39.17 ± 1.52	39.12 ± 1.62	39.18 ± 1.61	0.613
Early pre-term (<34 + 0)	6 (0.93)	13 (1.42)	19 (1.04)	0.613
Late preterm (34 + 0–36 + 6)	37 (5.78)	52 (5.68)	87 (4.77)	0.459
Early term (37 + 0–38 + 6)	171 (26.71)	243 (26.58)	466 (25.56)	0.774
Term (39 + 0–40 + 6)	373 (58.28)	516 (56.45)	1072 (58.88)	0.498
Late term (>41 + 0)	53 (8.28)	89 (9.73)	179 (9.81)	0.501

Abbreviations: BMI, body mass index; SD, standard deviation.

<sup>a</sup>Values are given as number (percentage), mean ± SD, or median (range).

<sup>b</sup>March and April 2020.

<sup>c</sup>July to September 2020.

<sup>d</sup>March and April 2017–2019.

**TABLE 2** Comparison of clinical and obstetrical characteristics of delivery between women who gave birth during the first wave of COVID-19, the second wave of COVID-19, and the matching months 3 years before<sup>a</sup>

	Group A <sup>b</sup> (n = 640)	Group B <sup>c</sup> (n = 914)	Group C <sup>d</sup> (n = 1823)	P value
Previous cesarean delivery	100 (15.62)	122 (13.34)	227 (12.45)	0.126
TOLAC	58/100 (58.00)	67/122 (54.91)	134/227 (59.03)	0.757
VBAC	39/58 (67.24)	42/67 (62.68)	97/134 (72.3)	0.362
Induction of labor (pitocin, balloon, vaginal dinoprostone)	156 (24.37)	233 (25.49)	504 (27.64)	0.203
Induction of labor (balloon, vaginal dinoprostone)	68 (10.62)	98 (10.72)	198 (10.86)	0.984
GBS carrier <sup>e</sup>	53 (8.28)	79 (8.64)	134 (7.35)	0.453
Epidural analgesia	406 (63.43)	570 (62.36)	1145 (62.8)	0.911
Intrapartum fever <sup>f</sup>	5 (0.78)	5 (0.54)	21 (1.15)	0.270
Vacuum delivery	29 (4.53)	34 (3.71)	73 (4.00)	0.723
Cesarean delivery	142 (22.18)	183 (20.02)	381 (20.89)	0.586
Elective cesarean delivery	75/142 (52.81)	92/183 (50.27)	178/381 (46.71)	0.420
Emergent cesarean delivery	54/142 (38.02)	86/183 (46.99)	172/381 (45.14)	0.233
Urgent cesarean delivery	13/142 (9.15)	5/183 (2.73)	31/381 (8.13)	0.031
Newborn birth weight (g)	3247.86 ± 71.04	3264.41 ± 492.86	3251.88 ± 504.89	0.266
Apgar at 5 min <7	3 (0.46)	4 (0.43)	14 (0.76)	0.503
Umbilical pH <7.0	5 (0.78)	7 (0.76)	4 (0.22)	0.066
Admission to NICU	60 (9.37)	87 (8.93)	170 (9.32)	0.986
Admission to NICU <37 weeks of gestation	54 (8.43)	70 (7.65)	123 (6.74)	0.33

Abbreviations: GBS, group B Streptococcus; NICU, neonatal intensive care unit; TOLAC, trial of labor after cesarean delivery; VBAC, vaginal birth after cesarean delivery.

<sup>a</sup>Values are given as number (percentage) or mean ±SD.

<sup>b</sup>March and April 2020

<sup>c</sup>July to September 2020

<sup>d</sup>March and April 2017–2019

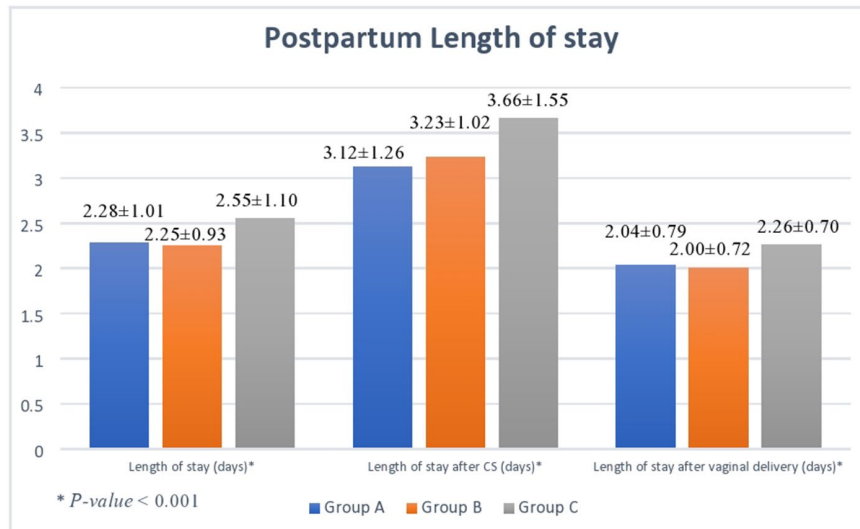
<sup>e</sup>Positive GBS culture or GBS bacteriuria.

<sup>f</sup>Fever >38°C.

The postpartum length of stay varies widely in different countries, being 1–4 days after vaginal delivery and in the range of 2–6 days after cesarean delivery.<sup>9,10</sup> There were contemporary guidelines around the world surrounding postpartum care for women with a suspected or confirmed diagnosis of COVID-19. Nevertheless, it is believed that no guidelines were issued regarding healthy women during the outbreak.<sup>11–13</sup> International obstetrics societies around the world have published guidelines, among those they have recommended encouraging early post-delivery discharge.<sup>14</sup> Although it was not made compulsory, patients were encouraged to discharge early. This recommendation was more robust in the first wave. However, it has been implemented into the second wave as well. The present study shows that the average postpartum length of stay before the COVID-19 outbreak was in the lower accepted limits and even shortened during the pandemic without compromising the health of mothers and neonates. The shorter length of stay, as a result of protocols developed in response to COVID-19, were seen in other studies as well. Greene et al.<sup>15</sup> reported that in response to labor and delivery unit policy modifications, both maternal and newborn length of stay was significantly shorter. Similar to the findings

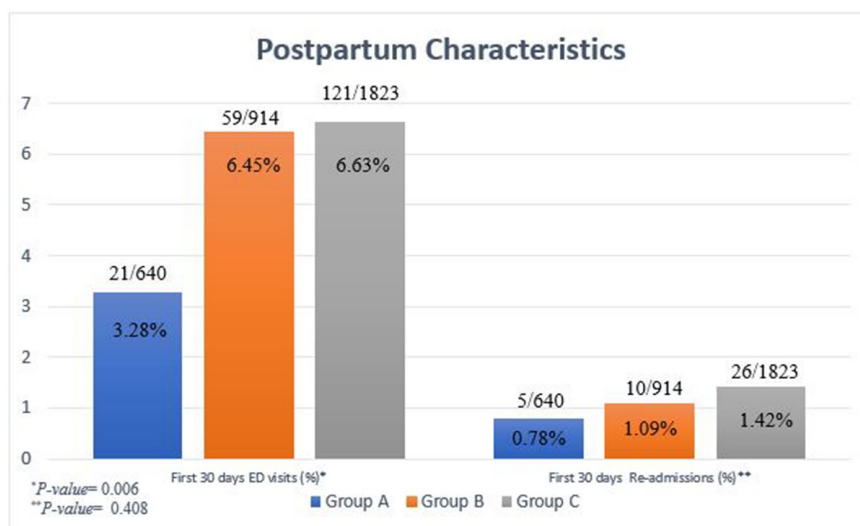
in the present study, this has not led to an increase in adverse maternal and neonatal outcomes.

While previous studies found that the rate of presentation to the obstetrical emergency department antepartum was either similar or lower during the initial wave of COVID-19 (February to March 2020), this has not resulted in a change of maternal and neonatal outcomes. This is indeed similar to the present study.<sup>16,17</sup> In contrast, the rate of presentation to the emergency department 30 days postpartum was significantly lower initially, as well as the rate of readmissions (although it has not reached statistical difference). These findings are not surprising as the patients' fear of attending hospitals during the pandemic has resulted in a delayed presentation to hospital, in cases such as acute coronary syndrome<sup>18</sup> and in increasing cases of cardiac arrest<sup>19</sup> as well as in the reduction in numbers of cases of patients being evaluated for acute stroke.<sup>20</sup> Although such fear during the pandemic is understandable, it is the hospitals' role to implement good practice to maintain patient safety and reduce the chances of exposure to infected individuals.<sup>21,22</sup> The postpartum period can be very challenging when women face physical and emotional discomfort and,



- Values are presented in mean ± St. deviation
- Group A= March and April 2020
- Group B= July to September 2020
- Group C= March and April 2017-2019

**FIGURE 1** Comparison of postpartum length of stay between women who gave birth during the first wave of COVID-19, the second wave of COVID-19, and the matching months 3 years before. Values are given as mean ± SD



- Group A= March and April 2020
- Group B= July to September 2020
- Group C= March and April 2017-2019
- ED= Emergency department

**FIGURE 2** Comparison of visits to the emergency department and rates of readmission in the first 30 days after discharge between women who gave birth during the first wave of COVID-19, the second wave of COVID-19, and the matching months 3 years before

at the same time, need to take care of their newborn. During the COVID-19 period, the need for women to protect themselves and their newborns from the comprehensive spreading virus was added to this equation. Healthcare providers encountered substantial gaps in knowledge all around the world in the matter of guidance on the management of maternity cases with and without COVID-19 during the pandemic.<sup>23,24</sup> Furthermore, during previous pandemics,

such as influenza A, WHO advised pregnant patients to minimize their visits,<sup>25</sup> and some studies have found a decreased number of admissions to hospital during the current pandemic.<sup>22</sup> One possible explanation to these initial lower rates of postpartum visits to the emergency department might have resulted from confusion regarding recommendations or fear from exposure to potential carriers of COVID-19.

**TABLE 3** Classification of presentation to the emergency department or readmission and comparison delivery between women who gave birth during the first wave of COVID-19, the second wave of COVID-19, and the matching months 3 years before<sup>a</sup>

	Group A <sup>b</sup> (n = 21)	Group B <sup>c</sup> (n = 59)	Group C <sup>d</sup> (n = 121)	P value
Surgical site infection/pain: cesarean delivery or episiotomy	4 (19.04)	19 (32.2)	34 (28.09)	0.514
General abdominal pain	4 (19.04)	5 (8.47)	20 (16.52)	0.288
Abnormal vaginal bleeding	1 (4.76)	9 (15.25)	14 (11.57)	0.435
Infection: endometriosis, urinary tract, mastitis	5 (23.80)	12 (20.30)	20 (16.52)	0.654
Headache	3 (14.28)	3 (5.08)	9 (7.43)	0.387
General/non-specific	4 (19.04)	11 (18.64)	24 (19.83)	0.981

<sup>a</sup>Values are given as number (percentage).

<sup>b</sup>March and April 2020.

<sup>c</sup>July to September 2020.

<sup>d</sup>March and April 2017–2019.

Previous studies found that readmissions due to postpartum complications occur in 1%–2% of all deliveries. The most common presenting complaints are wound complication (17.5%), fever (17.1%), abdominal pain (15.9%), headache or dizziness (12.3%), breast-related symptoms (10.7%), and hypertension (10.3%).<sup>13</sup> The main reasons patients presented to the emergency department postpartum coincide with previously reported studies as well as the general rate of readmissions. During the second wave, the quality of presentation to the emergency department had returned to the same rate as before the pandemic, even though the length of stay was shorter. This is most likely due to the exemplary implementations of hospital policy, balancing between restrictions being in place and not resulting in compromised health services.

The reasons for a reduction in length of stay, while not increasing the rate of readmissions postpartum, are multifactorial. Initially, there were strict limitations on numbers of visitors as well as dividing the obstetrical teams into separate groups to limit the spread of COVID-19. However, these restrictions were slightly liberated during the second wave. These can explain why the rate of presentation to the emergency department was initially reduced and later on returned to previously reported rates.

It is believed that this is the first study to assess the impact of the pandemic outbreak on postpartum course and repeat admission. The present study has some limitations, including the retrospective design. The exclusion of women with missing data may have led to selection bias. However, it is believed that given the constraints of the situation globally, this was the most pragmatic study design. Moreover, the research is a single-centre cross-sectional view and there is no information as to whether similar trends were observed in other settings.

## 5 | CONCLUSION

The COVID-19 outbreak leads a unique opportunity to challenge the perception of postpartum care. The present study showed that during the COVID-19 pandemic, there was a reduction or no change in presentations to the emergency department and

rates of readmission, despite the shortened length of stay after delivery. A shift in policy regarding the postpartum length of stay could be considered. However, more extensive prospective studies are needed with a comparison to the period after the COVID-19 pandemic without restrictions to be able to provide firm recommendations.

## ACKNOWLEDGMENTS

We wish to thank Ms. Nili Stein from the Department of Community Medicine and Epidemiology, the Lady Davis Carmel Medical Center, for her aid in the calculations and analysis of the statistical section of the study.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest.

## AUTHOR CONTRIBUTIONS

NK: conception of the study, design of the study, data analysis, manuscript writing/editing. MTH: conception of the study, design of the study, data analysis, manuscript writing/editing. DK: data collection, data analysis, manuscript writing/editing. YS: design of study, manuscript writing/editing. ES: data collection, data analysis, manuscript editing. AD: data collection, manuscript editing. RK: data analysis, manuscript editing. AZ: conception of the study, design of the study, data analysis, manuscript writing/editing.

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**How to cite this article:** Kugelman N, Toledano-Hacohen M, Karmakar D, et al. Consequences of the COVID-19 pandemic on the postpartum course: Lessons learnt from a large-scale comparative study in a teaching hospital. *Int J Gynecol Obstet*. 2021;153:315–321. <https://doi.org/10.1002/ijgo.13633>