Clinical strategies of obstetric emergency and changes of delivery under COVID-19 epidemic situation: a retrospective study

--Manuscript Draft--

Manuscript Number: THELANCET-D-20-03591

Article Type: Article

Keywords: COVID-19; Obstetric strategies; Intrapartum Caesarean section; Intrapartum fever; Pregnancy outcomes

Corresponding Author: Chenghong Yin, M.D.
Beijing Obstetrics and Gynecology hospital Capital Medical University
Beijing, CHINA

First Author: HAILI JIANG

Order of Authors:
HAILI JIANG
Ruixia Liu
Enjie Zhang
Yue Zhang
Cuicun Han
Yue Li
Zhengchao Chen
Wentao Yue
Chenghong Yin

Manuscript Region of Origin: CHINA

Abstract:

Summary

Background

During the period of COVID-19 epidemic, there was no report on the clinical strategies for the delivery of pregnant women. This study aimed to develop the emergent treatment procedure for obstetric emergency with fever and coping strategies in delivery room, analyse the changes in intrapartum caesarean section (ICS), indications of caesarean section and adverse outcomes, and make sure the delivery safety in delivery room.

Methods

In this retrospective, single-centre study, we included 4157 delivered women with observation and treatment of delivery room from Oct 1, 2019 to Feb 23, 2020 in Beijing Obstetrics and Gynecology hospital Capital Medical University, in which excluded pregnancy < 24 weeks and multiple pregnancy. According to the development of the epidemic, the participants were divided into three groups: pre-outbreak group (Dec 9, 2019 – Jan 22, 2020, 1230 cases), outbreak group (Jan 23, 2020 – Feb 23, 2020, 839 cases), and control group (Oct 1, 2019 - Dec 8, 2019, 2088 cases). The rate of ICS, indication of cesarean section, and adverse outcomes were analysed.

Findings

The rates of cesarean section (CS) were 15·6% (131/839), 15·9% (195/1230), and 12·6% (263/2088) in the outbreak group, the pre-outbreak group, and the control group, respectively. The difference among the three groups was statistically significant (P=0·014). Additionally, the proportion of ICS due to intrapartum fever suspected...
intrauterine infection was 21.8% (32/131), 15.9% (33/195), and 12.3% (32/263) in the above three groups, respectively, with significant difference (P=0.012). Moreover, the incidence of postpartum hemorrhage > 1000ml was 0.60% (5/839), 0.73% (9/1230), and 0.77% (16/2088) in the three groups, respectively, with no significant difference (P=0.084). There was also no significant difference found in neonatal asphyxia among the three groups (P=0.084). The incidence was 0.95% (8/839), 0.33% (4/1230), and 0.38% (8/2088) in the outbreak, pre-outbreak, and control group, respectively.

Interpretation

During the period of prevention and control of COVID-19, the screen of pregnant women through the emergent treatment procedure for obstetric emergency with fever and the reception and treatment procedure of delivery room ensures the safety of outpatient and emergency treatment and delivery of pregnant women effectively. The rate of ICS in delivery room increased obviously, which may be mainly caused by intrapartum fever suspected intrauterine infection. The incidence of the adverse outcomes such as postpartum hemorrhage and neonatal asphyxia did not increase.
Clinical strategies of obstetric emergency and changes of delivery under COVID-19 epidemic situation: a retrospective study


* Department of Perinatal Medicine, Beijing Obstetrics and Gynecology hospital Capital Medical University

** Central Laboratory, Beijing Obstetrics and Gynecology hospital Capital Medical University

*** Department of Internal Medicine, Beijing Obstetrics and Gynecology hospital Capital Medical University

Corresponding author: Chenghong Yin yinchh@ccmu.edu.cn

Summary

Background

During the period of COVID-19 epidemic, there was no report on the clinical strategies for the delivery of pregnant women. This study aimed to develop the emergent treatment procedure for obstetric emergency with fever and coping strategies in delivery room, analyse the changes in intrapartum caesarean section (ICS), indications of caesarean section and adverse outcomes, and make sure the delivery safety in delivery room.

Methods

In this retrospective, single-centre study, we included 4157 delivered women with observation and treatment of delivery room from Oct 1, 2019 to Feb 23, 2020 in Beijing Obstetrics and Gynecology hospital Capital Medical University, in which excluded pregnancy < 24 weeks and multiple pregnancy. According to the development of the epidemic, the participants were divided into three groups: pre-outbreak group (Dec 9, 2019 – Jan 22, 2020, 1230 cases), outbreak group (Jan 23, 2020 – Feb 23, 2020, 839 cases), and control group (Oct 1, 2019 - Dec 8, 2019, 2088 cases). The rate of ICS, indication of cesarean section, and adverse outcomes were analysed.
Findings

The rates of cesarean section (CS) were 15.6% (131/839), 15.9% (195/1230), and 12.6% (263/2088) in the outbreak group, the pre-outbreak group, and the control group, respectively. The difference among the three groups was statistically significant (P=0.014). Additionally, the proportion of ICS due to intrapartum fever suspected intrauterine infection was 21.8% (32/131), 15.9% (33/195), and 12.3% (32/263) in the above three groups, respectively, with significant difference (P=0.012). Moreover, the incidence of postpartum hemorrhage > 1000ml was 0.60% (5/839), 0.73% (9/1230), and 0.77% (16/2088) in the three groups, respectively, with no significant difference (P=0.084). There was also no significant difference found in neonatal asphyxia among the three groups (P=0.084). The incidence was 0.95% (8/839), 0.33% (4/1230), and 0.38% (8/2088) in the outbreak, pre-outbreak, and control group, respectively.

Interpretation

During the period of prevention and control of COVID-19, the screen of pregnant women through the emergent treatment procedure for obstetric emergency with fever and the reception and treatment procedure of delivery room ensures the safety of outpatient and emergency treatment and delivery of pregnant women effectively. The rate of ICS in delivery room increased obviously, which may be mainly caused by intrapartum fever suspected intrauterine infection. The incidence of the adverse outcomes such as postpartum hemorrhage and neonatal asphyxia did not increase.

Funding

Beijing Municipal Administration of Hospitals' Ascent Plan.

Introduction

In December 2019, a COVID-19 disease with person-to-person transmission emerged in Wuhan, Hubei, China. Dec 30, 2020, the nucleic acid of coronavirus was detected from the bronchoalveolar lavage fluid samples obtained from patients in Wuhan and the whole genome sequence of this virus was determined successfully.1 This virus is named as Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2) by the Coronavirus Study Group of the International Committee on Taxonomy of Virus.2 This virus spreads quickly and has strong pathogenicity. It spread out fast to the rest of the country and overseas in a short time with population mobility of “Chinese Spring Festival”.3,4 On Jan 23, 2020, the traditional Chinese New Year’s Eve, the Chinese government announced the “closure” of Wuhan City and started to implement the most stringent prevention and control measures in history. According to the World Health
Organization, as of 16:00 on Mar 8, 2020, a total of 106893 confirmed cases have been reported in 103 countries across the globe, of which 80859 cases were confirmed in China. Beijing, 1200 kilometers away from Wuhan in Hubei Province, carried out epidemic prevention and control work quickly and publicized the epidemic situation to all levels of government departments, medical institutions, and every family.

A study showing the human general susceptibility of COVID-19 published on The Lancet in Feb 2020, and pregnant women are a special group. The latest research by Chen et al. reported the clinical characteristics, pregnancy outcomes, and vertical transmission of COVID-19 in pregnant women confirmed with COVID-19 infection. Qiao J believes that although there is no reliable evidence to support the possibility of vertical transmission from mother to child of COVID-19 infection, pregnant women and newborn babies should be considered key at-risk populations during the prevention and management work of COVID-19 infection.

Since the outbreak of the epidemic, Beijing Obstetrics and Gynecology hospital Capital Medical University as the only A tertiary maternity hospital in Beijing, held a staff training on prevention and control of COVID-19 on Jan 18, 2020, in order to ensure the safety of pregnant women. On Jan 23, the emergent treatment procedure against COVID-19 pneumonia was developed, the protection level of delivery room was improved, family members were prohibited from accompanying the delivery, and the epidemiological history of pregnant women and their families would be checked. Additionally, we need to strengthen the management of the delivery, carry out the risk assessment for high-risk pregnant women seriously and comprehensively, and observe and deal with the labor process actively. This study retrospectively analysed the changes in ICS, indication of caesarean section, and adverse outcomes in outbreak group, pre-outbreak group, and normal delivery group, which would provide diagnosis and treatment basis for the delivery safety under the COVID-19 epidemic situation.

**Methods**

**Cases**

For this retrospective, single-centre study, we recruited 4157 delivered women with observation and treatment of delivery room from Oct 1, 2019 to Feb 23, 2020, in Beijing Obstetrics and Gynecology hospital Capital Medical University. Pregnancy < 24 weeks and multiple pregnancy were excluded. According to the development of the epidemic, the participants were divided into three groups: pre-outbreak group (Dec 9, 2019 – Jan 22, 2020, 1230 cases), outbreak group (Jan 23, 2020 – Feb 23, 2020, 839 cases) and control group (Oct 1, 2019 – Dec 8, 2019, 2088 cases). The rate of ICS, indication of cesarean section, the timing of cesarean section, and adverse outcomes were analysed.
by chi-square test.

**Admission criteria of delivery room for pregnant women**

All the booked and un-booked pregnant women would be carried out the 37 week prenatal evaluation in outpatient reception or emergence evaluation, including: (1) No contraindication of vaginal delivery such as fetal distress, cephalopelvic disproportion; (2) No serious cardiopulmonary dysfunction and immune diseases; (3) No serious surgical disease; (4) Pregnant women who agree to give birth in the delivery room of Beijing Obstetrics and Gynecology hospital Capital Medical University.

**Data observation**

Retrospective analysis of delivery information included natural delivery in delivery room, forceps delivery, ICS, indication of cesarean section (intrapartum fever and fetal distress, relative cephalopelvic disproportion, umbilical cord prolapse, placental abruption, etc.), the timing of cesarean section (latent period, active period and second stage of labor), neonatal asphyxia (Apgar score 1 minute $\leq 7$ as the diagnostic criteria) and postpartum hemorrhage $> 1000$ml.

**Developing the screening produces**

( 1 ) The emergent treatment procedure for obstetric emergency with fever under COVID-19 epidemic situation was developed (Figure 1), and the emergent negative-pressure isolation operating room and delivery room were set up at the 9th floor of obstetric building.

( 2 ) The reception and treatment procedure of delivery room was shown in Figure 2.

**Clinical diagnosis criteria of COVID-19 disease (Trial version seven)**

Suspected cases

(1) Epidemiology history.

(a) Had travel or residence history of Wuhan and its surrounding areas or community with confirmed cases, within 14 days before onset;

(b) Had contact history of COVID-19 infected persons (positive for nucleic acid detection) with in 14 days before onset;
(c) Exposed to patients with fever or respiratory symptoms who were from Wuhan and its surrounding areas or community with confirmed cases within 14 days before onset;

(d) Clustering onset (there are two patients with fever and / or respiratory symptoms in a small area such as family homes, offices, school classes, and other places with in two weeks);

(2) Clinical features.

(a) Fever and / or respiratory symptoms;

(b) Having image features of COVID-19 pneumonia;

(c) In the early stage of onset, the white cell count is normal or decreased and the lymphocytes count is normal or below the normal range.

If there is any epidemiological history and two of the clinical features, or if there is no clear epidemiological history, but containing three of the clinical features are diagnosed as suspected cases.

Confirmed cases

The suspected case with one of the following pathogenic or serological evidences is determined as the confirmed case:

(a) The novel coronavirus nucleic acid is detected by real-time fluorescence RT-PCR;

(b) The sequence of virus genome is highly homologous to the novel coronavirus;

(c) Serum specific IgM and IgG antibody positive for COVID-19; serum specific IgG antibody of COVID-19 turned from negative to positive or four times or more higher in recovery period than acute period.

**Indications of cesarean section**

(1) Intrapartum fever suspected intrauterine infection is one of the main indications of CS. Intrapartum fever is defined as the temperature of maternal body > 38°C during delivery.\(^{10,11}\)

(2) Other indications of CS include fetal distress, relative cephalopelvic disproportion, umbilical cord prolapse, placental abruption, etc.

**Statistical analysis**

SPSS17.0 software was used for statistical analysis. Categorical variables were expressed as rate (%). The differences between groups were compared by Chi-square
test and Cochran-Armitage trend test. P value < 0.05 was considered statistically significant.

Role of the funding source

The funder of this study had no role in study design, data collection, data analysis, data interpretation, writing of the manuscript, and decision to submit. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Changes of delivery volume and the rate of cesarean section before and after the outbreak of epidemic in delivery rooms

During the outbreak period of 32 days, 839 cases delivered, the rates of ICS and forceps delivery were 15.6% (131/839) and 15.1% (107/708); during the pre-outbreak period of 44 days, 1230 cases delivered, the rates of the above two delivery methods were 15.9% (195/1230), and 16.2% (168/1035); during the normal delivery period of 69 days, 2088 cases delivered, the rates of above two delivery methods were 12.6% (263/2088) and 14.1% (257/1825). The rate of ICS was significantly different among the three groups (P=0.014); compared to the control group, the rate of ICS in outbreak and pre-outbreak groups was significantly different (P=0.031 and 0.009, respectively). There was no significant difference among the three groups (P=0.296). Details are shown in table 1.

Changes of indications and the timing of cesarean section before and after the outbreak of epidemic in delivery rooms

The proportion of ICS due to intrapartum fever suspected intrauterine infection was 21.8% (32/131) in outbreak group and 15.9% (33/195) in pre-outbreak group, but only 12.3% (32/263) in control group. The significant difference was found among the three groups with P=0.012. The CS due to intrapartum fever was increased from normal delivery period to outbreak period analysed by Cochran-Armitage trend test. For the timing of CS, there was no significant difference among latent period, active period, and second stage of labor (P=0.402). Details are shown in table 2.

Comparison of severe adverse outcomes before and after the outbreak of epidemic
in delivery rooms

The postpartum hemorrhage > 1000ml and neonatal asphyxia were used as the observation indicators of adverse outcomes of delivery. There was no significant difference in them among the three groups of outbreak, pre-outbreak, and control groups (P > 0.05). Details are shown in table 3.

Discussion

Strategies for delivery in delivery room under COVID-19 epidemic situation

In December 2019, a pneumonia with COVID-19 started to break out nationwide. The common symptoms of this disease are respiratory syndromes, 26% of the patient need to be monitored and treated in ICU due to the severe complications such as acute respiratory distress syndrome, arrhythmia, and shock, the mortality rate is as high as 4.3%. It is rare that the disease is serious and spreads fast, however, Zhong Nanshan et al. found some confirmed cases with no fever and abnormal imaging manifestations, which not only brought difficulties to the early diagnosis of the disease, but also increased the risk of potential cross infection. Additionally, Chan et al. confirmed person-to-person transmission of this virus through the investigation of six family members in the same family.

The outbreak of the epidemic and the most stringent prevention and control measures cannot block the progress of pregnancy and labor progression. To ensure the successful and smooth delivery and neonatal health, the effective prevention and control measures have been developed by Beijing Obstetrics and Gynecology hospital Capital Medical University. During the outbreak of COVID-19, 2,069 women delivered in the delivery room, six suspected cases whose family members had contact history in Wuhan and the isolation was less than 14 days were identified.

According to the emergent treatment procedure for obstetric emergency with fever, the temperature of pregnant women should be measured first when they go to the clinic for prenatal examination or emergency treatment. If they do not have the epidemiological history and fever, they will follow the normal clinical consultation procedure. However, if their temperature is more than 37.3°C or having the respiratory symptoms, they will be sent to the fever clinic and be screened, including clinical symptom examination, laboratory examination, chest X-ray or CT and COVID-19 nucleic acid detection. The suspected and confirmed cases will be transferred to COVID-19 designated hospital immediately. However, if these cases have obstetric emergence and without referral conditions, they will be transferred to the negative pressure isolation operating room or delivery room through special channels and full-time medical staff. After delivery, COVID-19 nucleic acid is detected for newborn, then
parturient and newborn are transferred to a single isolation ward for observation then will be sent to COVID-19 designated hospital.

To ensure the safety of pregnant women and newborns, the reception and treatment procedure of delivery room was developed. It is important to not only pay attention on the isolation of pregnant women, but also strengthen the protection of medical staff to reduce the cross infection in hospital. (1) After the emergent treatment procedure for obstetric emergency check by the emergence department or the ward, the pregnant women at onset of labor are required to be examined for the second time in delivery room, mainly for maternal temperature and epidemiological history, and the single delivery room is prepared for isolation. (2) Dealing with the suspected or confirmed cases, it is required to reduce the contact of unrelated medical staff, and carry out the third-level protection for the related medical staff, including wearing hat, N95 mask, protective clothing, isolation clothing, shoe covers, surgical mask, goggles/face screen, and three-layer gloves. After delivery, the isolation ward should be disinfected thoroughly. During the medical treatment, staff with exposure to infection should be sent for 14-day medical observation.

Changes of delivery in delivery room under COVID-19 epidemic situation

The first confirmed case of COVID-19 in Beijing was found on Jan 19, 2020, and as of 24·00 on Mar 8, a total of 428 confirmed cases have been reported. There was no COVID-19 infection found in pregnant women in Beijing, however, the COVID-19 epidemic still had some impacts on the delivery of pregnant women.

The average delivery volume decreased slightly. After the outbreak of COVID-19, the average delivery showed a decrease from normal delivery period to outbreak period, which was 30 cases, 28 cases and 26 cases per day in control, pre-outbreak and outbreak group, respectively. Traffic disruption is the most important way to prevent and control the epidemic, but it brings a lot of influences to pregnant women. (1) Many pregnant women are unable to return to the booked hospital on time due to traffic reasons after going back home for the Spring Festival. (2) Many high-risk pregnant women around Beijing cannot be referred because of traffic blocking and worries about contact infection.

The ICS and indications of caesarean section changed. After the outbreak of COVID-19, the rate of ICS and the proportion of CS due to intrapartum fever suspected intrauterine infection were both increased. There are some reasons for this. (1) Medical staff pay more attention to the maternal temperature and increase the frequency of temperature monitoring and testing. Acute chorioamnionitis is one of the independent factors of intrapartum fever, and it is difficult to distinguish the other factors and intrauterine infection, which are causing intrapartum fever. To get the fetus out of the
infection environment as soon as possible, CS is often recommended by the obstetricians. (2) The unprecedented pressure from epidemic prevention and control measures, the worries about fever patients and the adverse outcomes due to intrapartum fever, make the diagnosis of intrauterine infection and operation more activated. (3) It is not clear the potential risk of COVID-19 to pregnant women and newborns. However, the previous experience of pregnant women and newborns infected with SARS, MERS and other coronaviruses indicates that coronaviruses may bring potential risks and adverse consequences to maternal and neonatal health. Face to the COVID-19 epidemic, this information may lead pregnant women to choose CS rather than vaginal trials which takes more time.

No change found in important indicators of obstetric quality

Neonatal asphyxia and postpartum hemorrhage > 1000ml are the important indicators of obstetric quality. This study shows that there was no significant difference in the two indicators before and after the outbreak of COVID-19. During the epidemic prevention and control period, in addition to the check of maternal fever and epidemiological history, we should also strengthen the management of delivery room to ensure the quality of obstetrics. (1) For the pregnant women at onset of labor, the medical staff should carry out the risk assessment for high-risk pregnant women, and provide special care to the pregnant women with complications, such as hypertensive disorders of pregnancy, gestational diabetes mellitus, pregnancy with uterine fibroids, advanced maternal age (> 40 years old), macrosomia, etc. The medical staff should pay attention to the diet and fluid supplement during labor, and regularly monitor the maternal temperature, blood pressure, blood glucose, blood routine test result, urine ketone bodies, and other indicators. (2) More importantly, medical staff should observe and manage the labor progression actively. During the latent period of the first stage of labor, we need to observe the labor progression and if necessary, try to give pethidine for labor pain, rupture the membrane artificially and enhance uterine contractions with oxytocin. During the active period, it is easy to slow down the fetal heart rate and lead to fetal distress because of the rapid dilation of the uterine orifice and the obvious decrease of the fetal head. Therefore, continuous monitoring of fetal heart rate, evaluation of fetal position, and correction of fetal position by ball sitting or other methods should be carried out in order to promote labor progression. During the second stage of the labor, for the high-risk pregnant women, it is necessary to shorten the labor progression, pay more attention on postpartum hemorrhage, use forceps assistant if required and prepare ready for neonatal resuscitation.

Conclusion
The COVID-19 epidemic spread rapidly, China and the whole world responded positively. Beijing Obstetrics and Gynecology hospital Capital Medical University as the only tertiary maternity hospital in Beijing, developed the emergent treatment procedure for obstetric emergency with fever and the reception and treatment procedure of delivery room for maternal delivery, which can reach the goal of early detection, early screening, early diagnosis, and early isolation of maternal infection to avoid the cross infection in hospital.

The rate of ICS in delivery room was increased obviously in pre-outbreak and outbreak periods, which may be mainly caused by intrapartum fever suspected intrauterine infection, but the adverse outcomes were not changed significantly. This suggests that we should strengthen the management of labor progression, reduce the CS without indication then reduce the rate of CS, if we can exclude the COVID-19 infection.

This study did not summarize the delivery situation of pregnant women in the epidemic area of COVID-19, and the results cannot directly reflect the impact of COVID-19 on the delivery of pregnant women. Therefore, more direct evidence is required to verify the findings in this study.

**Research in context**

**Evidence before this study**

We searched PubMed and Wanfang databases for articles published in Chinese and English up to March 6, 2020, using the keywords “2019-nCoV”, “COVID-19”, “maternal infection”, “fetal infection”, “labor progression management”, “intrapartum cesarean section”, “intrapartum fever”, “intrauterine infection”, “postpartum hemorrhage”, “neonatal asphyxia”, etc. We found three articles: two of them published in The Lancet, titled Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records and The frequency of intrapartum caesarean section use with the WHO partograph versus Zhang’s guideline in the Labour Progression Study (LaPS): a multicentre, cluster-randomised controlled trial, and another titled Clinical Characteristics of Coronavirus Disease 2019 in China, published in the New England Journal of Medicine. We identified no published studies on clinical strategies against the COVID-19 for pregnant women, however, the investigations of coping strategies in delivery room and the analysis of delivery changes under the COVID-19 epidemic situation could avoid the cross infection in hospital and ensure the safety of pregnant women.
Added value of this study

We developed the emergent treatment procedure for obstetric emergency with fever under COVID-19 epidemic situation and set up the emergent negative-pressure isolation operating room and delivery room at the 9th floor of obstetric building. These strategies could effectively screen, diagnosis and isolate the pregnant women with higher temperature or contact history in epidemic area and ensure the safety of outpatient and emergency treatment and the delivery of pregnant women.

We also developed the reception and treatment procedure of delivery room, there are 2069 pregnant women delivered and none of them were infected with COVID-19. Additionally, six suspected cases were identified. This effectively avoids the potential cross infection between pregnant women and medical staff in hospital.

Although there were no pregnant women confirmed with COVID-19 in our hospital, strict epidemic prevention and control measures still had some impacts on the delivery of pregnant women. The total number of deliveries was decreased slightly, the rate of intrapartum cesarean section was increased significantly, and the proportion of cesarean section due to intrapartum fever suspected intrauterine infection was also increased.

Postpartum hemorrhage > 1000ml and neonatal asphyxia are the important indicators of obstetric delivery quality. The adverse outcome of delivery did not increase significantly in delivery room through the risk assessment for high-risk pregnant women and the active observation and management of labor progression.

Implications of all the available evidence

Under the situation of COVID-19, the effective prevention and control measures and emergency procedures could provide accurate screening and diagnosis for pregnant women with suspected COVIE-19 infection in time, which can ensure the safety of delivery. The changes of delivery situation and reasonable management of delivery room provide diagnosis and treatment basis for safe delivery during the period of prevention and control of COVID-19. However, if we could exclude the COVID-19 infection, we should strengthen the management of labor progression, reduce the caesarean section without indication then reduce the rate of caesarean section.

References


This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3555221


**Authors contributions**

CY made substantial contributions to design the study, make revisions to the manuscript and had full access to all data in this study. HJ and EZ contributed to the manuscript. ZC, HJ and YZ took responsibility for statistical analysis. HJ, CH and YL participated in collecting data. RL and WY made contributions to data interpretation. All authors reviewed and approved the final version of the manuscript.

**Conflict of interest statements**

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3555221
We declare no competing interests.

**Ethics committee approval**

This study was approved by the Medical Ethics Committee of Beijing Obstetrics and Gynecology Hospital, Beijing, China. Informed consent was obtained from each participant for their clinical records.
Table 1: Comparison of delivery situation before and after the epidemic in delivery rooms

<table>
<thead>
<tr>
<th></th>
<th>Control group N (%)</th>
<th>Pre-outbreak group N (%)</th>
<th>Outbreak group N (%)</th>
<th>χ2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICS</td>
<td>263 (12.6)</td>
<td>195 (15.9)</td>
<td>131 (15.6)</td>
<td>8.560</td>
<td>0.014</td>
</tr>
<tr>
<td>VD</td>
<td>1825 (87.4)</td>
<td>1035 (84.1)</td>
<td>708 (84.4)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Forceps delivery</td>
<td>257 (14.1)</td>
<td>168 (16.2)</td>
<td>107 (15.1)</td>
<td>2.434</td>
<td>0.296</td>
</tr>
</tbody>
</table>


Table 2: Comparison of indications and the timing of CS before and after the epidemic in delivery rooms

<table>
<thead>
<tr>
<th></th>
<th>Control group N (%)</th>
<th>Pre-outbreak group N (%)</th>
<th>Outbreak group N (%)</th>
<th>χ2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication of CS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrapartum fever</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>suspected intrauterine infection</td>
<td>32 (12.3)</td>
<td>33 (15.9)</td>
<td>32 (21.8)</td>
<td>6.28</td>
<td>0.012*</td>
</tr>
<tr>
<td>Other indications</td>
<td>229 (87.7)</td>
<td>174 (84.1)</td>
<td>115 (78.2)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>The timing of CS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latent period</td>
<td>207 (78.7)</td>
<td>166 (85.1)</td>
<td>108 (82.4)</td>
<td>4.0312</td>
<td>0.402</td>
</tr>
<tr>
<td>Active period</td>
<td>37 (14.1)</td>
<td>22 (11.3)</td>
<td>15 (11.5)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Second stage of labor</td>
<td>19 (7.2)</td>
<td>7 (3.6)</td>
<td>8 (6.1)</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Cochran-Armitage trend test.
CS: cesarean section. NA: not applicated.
<table>
<thead>
<tr>
<th></th>
<th>Control group N (%)</th>
<th>Pre-outbreak group N (%)</th>
<th>Outbreak group N (%)</th>
<th>$\chi^2$</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postpartum hemorrhage &gt; 1000ml</td>
<td>16 (0.77)</td>
<td>9 (0.73)</td>
<td>5 (0.60)</td>
<td>0.2448</td>
<td>0.885</td>
</tr>
<tr>
<td>Neonatal asphyxia</td>
<td>8 (0.38)</td>
<td>4 (0.33)</td>
<td>8 (0.95)</td>
<td>4.9535</td>
<td>0.084</td>
</tr>
</tbody>
</table>

Table 3: Comparison of adverse delivery outcomes before and after the epidemic in delivery rooms
Figure 1 The emergent treatment procedure of obstetric emergency with fever under COVID-19 epidemic situation (version 2020-02-26)

Onset of labor/Severe emergency patients with fever (Temperature > 37.3 °C)

Pre-examination reception at Emergency entrance/Outpatient hall, give notice to emergency room.

Call emergency doctor and nurse

Emergency nurses ask for medical history (epidemiologic history, clinical symptom), immediately place the patient in the emergency isolation room.

An emergency doctor and a nurse should protect well then go to see patients in the emergency isolation room. The nurse monitors the vital signs of the patient and the doctor gives the evaluation quickly (systemic condition, specialist condition).

Onset of labor without referral conditions

Emergency call

① Delivery room;
② Attending physician group in obstetric ward;
③ Medical administration division (working days) /administration on duty (holidays/nightshifts).

Immediately go to the isolation delivery room on the 9th floor

Give notice to elevator 3 and ask them to protect adequately

Re-evaluate the patient

Try vaginal labor and observe the labor progression. Report to the upper superior doctor. Collect the cord blood samples and swab from the newborn.

Transfer to caesarean section

Give notice to the chief physician

Perform emergency operation and notify pediatrics to be present. Collect the cord blood samples and swab from the newborn.

After emergency treatment, medical administration division/ administration on duty talk about the patient’s situation with chief physician, conduct the clinical analysis. The clinical department cannot exclude suspected cases independently.

Medical administration division (working days) / administration on duty (holidays/nightshifts) organize the expert consultation within the hospital and screen suspected cases, then report to the duty dean in time.

Suspected cases of COVID-19 are still considered after consultation.

Doctor takes swab samples for nucleic acid detection. Medical administration division/ administration on duty contact the infection control office. The infection control office should report through network, contact clinical laboratory to take the samples and contact Chaoyang district CDC.

Medical administration division/ administration on duty contact referral and consultation, and report to obstetric quality management office of Chaoyang district.

The attending physician group improve the documents of the cases, medical administration division will do the follow-up visit.

The infection control office helps the clinical department with final disinfection.

Non suspected cases

Patients with stable condition of return to the corresponding ward for treatment.

Patients with fever or suspected cases: referral to Aviation General hospital of China medical university carrying high-risk maternal referral form by ambulance.

Confirmed cases: referral to Beijing Ditan Hospital Capital Medical University.

Figure 1 This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3555221
Figure 2 The reception and treatment procedure of delivery room.

Onset of labor in obstetric ward or emergency department

Temperature examination at the entrance of delivery room

Temperature

\( > 37.3 \, ^\circ\text{C} \)

Pregnant women and their families return back to Beijing;

Ask for epidemiological history of pregnant women and families;

Blood routine test, CRP, chest X-ray or CT, internal medicine consultation;

Screen suspected cases and report the situation immediately.

Take swab samples for nucleic acid detection;

Medical administration division/administration on duty contact the out of hospital consultation;

Pregnant women and their families are Beijing residents without going out.

Pregnant women and their families return back to Beijing.

No travel history of Wuhan or community with confirmed cases;

Had travel history of Wuhan or community with confirmed cases;

Had contact history of confirmed or suspected cases of COVID-19;

Isolation less than 14 days;

No clustering onset;

Had travel history of Wuhan or community with confirmed cases;

Had contact history of confirmed or suspected cases of COVID-19;

Isolation less than 14 days;

No clustering onset.