# Comparison of Outcomes among Pregnant Women with or without COVID-19 during Intrapartum and Postpartum Care: A Longitudinal-Study

**Shaista Zubair[1]\*, Afsheen Mahboob[2], Idoracaera Ikhwan[3], Mah Jabeen[4], Surekha Kanchanagari[5], Afshana Ali[5], Maryam Younus[6] and Zubair Anwar[7]**

[1]Senior Registrar in Obstetrics and Gynaecology Good Hope Hospitals, University Hospitals of Birmingham NHS Foundation Trust, UK
[2]Consultant Obstetrician and Gynaecologist, University Hospitals of Birmingham NHS Foundation Trust, UK, Clinical Trust Lead for Perinatal Mental Health, Obstetrics and Gynaecology Good Hope Hospitals, University Hospitals Birmingham, UK
[3]ST2 Trainee in Obstetrics and Gynaecology, University Hospitals of Birmingham NHS Foundation Trust, UK
[4]ST3 Trainee (MRCOG Part-1) in Obstetrics and Gynaecology, University Hospitals of Birmingham NHS Foundation Trust, UK
[5]Junior Specialty Doctor in Obstetrics and Gynaecology, University Hospitals of Birmingham NHS Foundation Trust, UK
[6]CPSP College of Physcician and Surgeons Pakistan/University of Karachi, Pakistan
[7]ENT Specialist, The Royal London Hospital, Barts Health NHS Trust, UK

**\*Corresponding Author:** Shaista Zubair MRCOG.UK, MRCPI. Ireland, FCPS, MCPS, Senior Registrar in Obstetrics and Gynaecology Good Hope Hospitals, University Hospitals of Birmingham NHS Foundation Trust, UK.

## Abstract

**Background:** COVID-19 is spreading quickly across the world. However, little is known about the relation between COVID-19 infection and the risk of unfavorable intrapartum, pregnancy-related fetal-maternal and postnatal outcomes in pregnant women.

**Objectives:** To determine the prevalence of COVID-19 in suspected pregnant women and compare the intrapartum care, analgesic requirements, mode of delivery, postpartum complication, feto-maternal outcomes, postnatal treatment and care amongst pregnant women with or without COVID-19.

**Subjects and Method:** This retrospective comparative study was carried out at University Hospitals Birmingham (UHB) during the first wave of COVID-19, between 20th March and 1st June 2020. Ethical approval was received from the hospital ethical committee. Detailed data was obtained of 63 admitted suspected COVID-19 pregnant women, from the hospital records. Swabs were taken for confirmation of COVID-19. All precautions and Standard Operating Procedures (SOPs) were considered to limit the transmission of disease. After confirmation, patients were separated as positive and negative cases. Details regarding demographics, medical conditions at admission, intrapartum care and analgesic requirements, mode of delivery, indications of C-section, postpartum complication, feto-maternal outcomes, postnatal treatment and care were obtained from electronic medical records using standard proforma. All patients were followed during hospitalisation until discharge. Data was entered and analyzed using SPSS Version 24.0. Descriptive statistics for quantitative variables reported as mean and standard deviation, categorical variables measured as frequency and percentages. Statistical tests including: chi-square test, fisher exact test and t-test were applied to check the association at 5% significance level.

**Results:** During study duration, 63 suspected pregnant women delivered with mean age 28.6 ± 5.64 years; 27% were COVID-19 positive. Pregnancy outcomes are shown as follows for COVID-19 positive and negative patients. Presence of partner (58.8% vs. 78.3%; P: 0.112), C-section (76.5% vs. 80.8%), low APGAR at 1 minute (12.5% vs. 14.3%: P: 0.615), low birth weight (29.4% vs. 15.9%; P: 0.200), usage of antibiotic (64.7% vs. 58.7%; P: 0.665), oxygen therapy (58.8% vs. 34.8%; P: 0.085), Maternal HDU admission (17.6% vs. 0%; P: 0.017), ITU admission (11.8% vs. 0%; P: 0.070), breast feeding (23.5% vs. 39.1%; P: 0.249)and mean length of hospital stay (3.53 vs. 2.09; P: 0.004).

**Conclusion:** This study determined that older age, overweight/obese, multiparous and obstetric comorbid patients had higher risk of getting infected. There was no difference observed in any aspect of intrapartum care. Furthermore, there was increased usage of antibiotic in COVID-19 positive cases. Similarly maternal High Dependency Unit (HDU), Intensive Care Unit (ITU) and hospital admissions were significantly higher in COVID-19 positive patients. This study concluded that: COVID-19 may not lead to unfavorable

**Keywords:** COVID-19; Pregnancy; Suspected; Intrapartum Care; Analgesic Requirements; Mode of Delivery; Postpartum Complication; Feto-Maternal Outcomes; Postnatal Treatment; Pregnant Women

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## Introduction

The current global pandemic of COVID-19 is caused by a strain of coronavirus SARS-CoV-2 which was first identified in Wuhan, China [1]. It was first recognized by the World Health Organization (WHO) as a pandemic on 11th March 2020 [2]. Horizontal transmission of SARS-CoV-2 occurs via aerosolized droplets or through contact with infected surfaces, potentially leading to the covid-19. SARS-CoV-2 is more contiguous than SARS-CoV-1 and MERS-CoV [3]. It is a single-stranded RNA, non-segmented enveloped viruses, which appears to have a halo-like appearance by electron microscopy [4].

It has brought a profound change in the way people manage their daily lives globally in response to the pandemic, including the way healthcare is being delivered [5]. With the increasing strain faced by healthcare institutions in response to the pandemic [6], there are concerns about the potential disruption in delivery of maternal health services [7]. In the first three quarters of 2020, there were 4, 64,437 live births in England and Wales, with an average of 52,000 live births per month. This is 3.6% less compared to 2019 [8], however this indicates that it is important to recognize that much of normal life still continues including childbirth.

As this is a novel virus, the medical profession has tried to determine in a very limited period the impact of this virus on pregnant women. Pregnancy itself is a state where there are immunologic changes present, which makes patients more susceptible to intracellular pathogens including viruses [9]. There are studies available that suggest pregnant women may be particularly vulnerable to COVID-19 infection [10]. The main symptoms of COVID-19 are fever, cough, dyspnea and lymphopenia. Although shortness of breath is a common symptom, it may be difficult to differentiate from other common causes in pregnancy such as anemia and physiological shortness of breath due to increased metabolism in pregnancy [11]. The symptoms experienced by patients may differ on a spectrum from mild to severe signs including acute respiratory distress syndrome which may even extend to requiring support from ITU [12].

Pregnant women are a high risk group due to concerns about the effect of COVID-19 on both mother and child during and after pregnancy. It is thought that pregnant women are more susceptible to viral infections due to immunologic and anatomic alterations. Pregnant women with severe acute respiratory syndrome (SARS) or middle east respiratory syndrome (MERS) have serious adverse outcomes, such as maternal deaths and premature births, although no evidence of vertical transmission has been found [10,13].

It is imperative for healthcare professionals to be aware of the factors that can affect the outcome of their patient's wellbeing, as it may affect the management. Risk factors that are known to be associated with severe COVID-19 in pregnancy are increased maternal age, raised Body mass Index, Chronic Hypertension, Pre-existing diabetes [13].

## Aim of the Study

We wrote this paper with aims to assess impact of 'suspected' and 'confirmed' COVID-19 upon maternal-fetal intrapartum and postnatal outcomes across Birmingham Heartlands Hospital and Good Hope Hospital, United Kingdom. It looks at the intrapartum care provided for pregnant women with 'suspected' positive confirmed COVID-19, including maternal-fetal monitoring, mode of delivery and maternal-fetal complications.

## Methodology

This retrospective comparative study was carried out at UHB during the first wave of COVID-19 from 20th March 2020 to 1st June 2020. Ethical approval was obtained from the hospital ethical committee. Retrospective data of admitted suspected COVID-19 pregnant women from hospital records, on the basis of their symptoms e.g. fever, shortness of breath, cough. was included. Swabs were taken and sent for testing at the time for confirmation of COVID-19 diagnosis. All precautions and PPE, as per trust policy, were utilized by hospital staff to limit the transmission of disease for suspected and confirmed cases, until their swab test results were back. As the data of this study is of the first wave of COVID-19, test results were taking an average of 24 - 48 hours. After confirmation of all patients COVID-19 test results,

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they were separated as positive and negative cases. Detailed information about demographics (age, BMI, ethnicity etc.), medical conditions at admission (symptoms of COVID-19, co-morbidities such as Diabetes Mellitus (DM)/Gestational Diabetes (GDM), smoking status, parity, gestational age, obstetric co-morbidities, history of C-section), intrapartum care (induction of labor, spontaneous rupture of membranes, fetal monitoring, oxygen saturation and presence/absence of partner), intrapartum analgesic requirements, mode of delivery, and indications of C-section, postpartum complication (PPH, tears, MROP), fetal outcomes (time of cord clamping, APGAR at 1 and 5 minutes, NNU admission and low birth weight), maternal complications (e.g. sepsis), and intrapartum and postnatal treatment (antibiotic use, oxygen therapy, prophylaxis, HDU/ITU admission), postnatal care included breast feeding status and hospital stay duration were obtained from electronic medical records using standard proforma. All patients were followed during hospitalisation until discharge.

Data was entered and analyzed using software IBM Corp. (released 2016), IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp. Descriptive statistics for quantitative variables reported as mean +/- standard deviation, categorical variables measured as frequency and percentages. Statistical test including: chi-square test, fisher exact test and t-test were applied at 5% significance level.

## Results

During the study period, 63 suspected COVID-19 pregnant women were enrolled with mean age 28.6 +/- 5.64 years; majority of the women (66.7%) were aged 25-35 years, mean BMI 27.8 +/- 5.5 kg/m$^2$. 38.1% women were overweight and 33.3% were obese. Mean gestational age of women was 37.2 +/- 4.1 weeks; 76.2% of the women were at term and 20.6% were nulliparous. Half of the patients (50.8%) were Caucasian and 31.7% Asian. Existing comorbidities and smoking status showed 11.1% women were smokers and only 6.3% of the patients had DM. Obstetric co-morbidities and hypertensive disorder was found in 14.3% patients, 4.8% had PPROM, 11.1% women had history of C-section, 6.3% had SGA and 12.7% diagnosed with GDM. Pregnant women presented with the following symptoms: persistent cough (34.9%), fever (74.9%); 6.3% had significant contact with suspected COVID-19. Out of total 63 pregnant women, 27% were COVID-19 positive (Table 1).

| Study variables | | Frequency (%) |
|---|---|---|
| Age group (in years) | < 25 | 11 (17.5%) |
| | 25-35 | 42 (66.7%) |
| | > 35 | 10 (15.9%) |
| Mean +/- SD | | 28.6 +/- 5.64 |
| BMI (kg/m$^2$) | Underweight | 1 (1.6%) |
| | Normal weight | 17 (27.0%) |
| | Overweight | 24 (38.1%) |
| | Obese | 21 (33.3%) |
| Mean +/- SD | | 27.8 +/- 5.2 |
| Gestational age | Pre-term | 15 (23.8%) |
| | Term | 48 (76.2%) |
| Mean +/- SD | | 37.2 +/- 4.1 |
| Parity | Nulliparous | 13 (20.6%) |
| | 1 - 2 | 40 (63.5%) |
| | > 2 | 10 (15.9%) |
| Ethnicity | Asian | 20 (31.7%) |
| | Black | 5 (7.9%) |
| | White | 32 (50.8%) |
| | Others | 6 (9.5%) |

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| Co-morbidities | Smoking status | 7 (11.1%) |
|---|---|---|
| | Diabetes Mellitus Type1-2 | 4 (6.3%) |
| Obstetric Co-morbidities | Hypertensive disorder | 9 (14.3%) |
| | PPROM | 3 (4.8%) |
| | Previous C/Section | 7 (11.1%) |
| | SGA | 4 (6.3%) |
| | GDM | 8 (12.7%) |
| COVID-19 presenting Symptoms | Persistent cough | 22 (34.9%) |
| | Fever | 50 (79.4%) |
| | Significant contact with suspected COVID-19 | 4 (6.3%) |
| COVID-19 | Negative | 46 (73.0%) |
| | Positive | 17 (27.0%) |
| Total | | 63 (100%) |

***Table 1:*** *Baseline characteristics of suspected COVID-19 pregnant women (n = 63).*

Association of COVID-19 with the patient's demographic and medical conditions are shown in table 2. There were no significant associations observed (P > 0.05). Additionally, we identified that; older pregnant women had higher risk of getting infected compared to younger women. Patients who were overweight and obese were assumed to have increased risk of getting infected. Multiparous women have a higher proportion of positive COVID-19 compared to nulliparous women. Positive cases were found more in those of Asian ethnicity. Smoking showed no effect on having COVID-19; interestingly, non-smokers showed a higher incidence of COVID-19. Similarly DM also didn't have significant association. Amongst patients with hypertensive disorders, PPROM, previous history of C-section, LGA, there were higher chances of infection.

| Patient's demographic and medical characteristics | | COVID-19 | | P-values |
|---|---|---|---|---|
| | | **Positive** | **Negative** | |
| Age group (in years) | < 25 | 3 (27.3%) | 8 (72.7%) | 0.970¥ |
| | 25 - 35 | 11 (26.2%) | 31 (73.8%) | |
| | > 35 | 3 (30%) | 7 (70%) | |
| Mean +/- SD | | 29 +/- 6.25 | 28.5 +/- 5.47 | 0.748‖ |
| BMI classification | Underweight | 0 (0%) | 1 (100%) | 0.906¥ |
| | Normal | 4 (23.5%) | 13 (76.5%) | |
| | Overweight | 7 (29.2%) | 17 (70.8%) | |
| | Obese | 6 (28.6%) | 15 (71.4%) | |
| Gestational age | Pre-term | 5 (33.3%) | 10 (66.7%) | 0.372⌐ |
| | Term | 12 (25%) | 36 (75%) | |
| Parity | 0 | 1 (7.7%) | 12 (92.3%) | 0.174¥ |
| | 1 - 2 | 12 (30%) | 28 (70%) | |
| | > 2 | 4 (40%) | 6 (60%) | |
| Ethnicity | Asian | 8 (40%) | 12 (60%) | 0.381¥ |
| | Black | 1 (20%) | 4 (80%) | |
| | White | 6 (18.8%) | 26 (81.3%) | |
| | Others | 2 (33.3%) | 4 (66.7%) | |

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|---|---|---|---|---|---|
| Smoking status | Yes | 1 (14.3%) | 6 (85.7%) | 0.385▢ | |
| | No | 16 (28.6%) | 40 (71.4%) | | |
| Diabetes Mellitus | Yes | 1 (25%) | 3 (75%) | 0.707▢ | |
| | No | 16 (27.1%) | 43 (72.9%) | | |
| Hypertensive disorder | Yes | 3 (33.3%) | 6 (66.7%) | 0.458▢ | |
| | No | 14 (25.9%) | 40 (74.1%) | | |
| PPROM | Yes | 1 (33.3%) | 2 (66.7%) | 0.618▢ | |
| | No | 16 (26.7%) | 44 (73.3%) | | |
| Previous C-Section | Yes | 3 (42.9%) | 4 (57.1%) | 0.316▢ | |
| | No | 14 (25%) | 42 (75%) | | |
| SGA | Yes | 0 (0%) | 4 (100%) | 0.274▢ | |
| | No | 17 (28.8%) | 42 (71.2%) | | |
| LGA | Yes | 2 (33.3%) | 4 (66.7%) | 0.519▢ | |
| | No | 15 (26.3%) | 42 (73.7%) | | |
| GDM | Yes | 2 (25%) | 6 (75%) | 0.631▢ | |
| | No | 15 (27.3%) | 40 (72.7%) | | |
| Persistent cough | Yes | 11 (50%) | 11 (50%) | 0.003¥ | |
| | No | 6 (14.6%) | 35 (85.4%) | | |
| Fever | Yes | 14 (28%) | 36 (72%) | 0.511▢ | |
| | No | 3 (23.1%) | 10 (76.9%) | | |
| Significant contact with suspected COVID-19 | Yes | 1 (25%) | 3 (75%) | 0.707▢ | |
| | No | 16 (27.1%) | 43 (72.9%) | | |
| Intrapartum treated as COVID-19 | Yes | 8 (28.6%) | 20 (71.4%) | 0.800¥ | |
| | No | 9 (25.7%) | 26 (74.3%) | | |

*Table 2:* Association between patient's demographic and medical characteristics and COVID-19.
*Abbreviations: BMI: Body Mass Index; PPROM: Preterm Premature Rupture of the Membranes; C-Section: Cesarean Section;*
*SGA: Small for Gestational Age; LGA: Large for Gestational Age; GDM: Gestational Diabetes Mellitus;*
*COVID-19: Coronavirus Disease of 2019.*
*¥: chi-test; ||: t-test; ▢: Fisher Exact test.; Significance level ≤ 0.05. Numbers (%).*

Intrapartum, feto-maternal and postnatal outcomes are shown in table 3. Intrapartum care was assessed as follows (positive vs. negative COVID-19 patients): induction of labour (47.1% vs. 39.1%; P: 0.570), spontaneous rupture of membranes (41.2% vs. 52.2%; P: 0.438), oxytocin augmentation (29.4% vs. 34.8%; P: 0.668), continuous fetal monitoring (82.4% vs. 80.4%; P: 0.588), hourly oxygen saturation (47.1% vs. 43.5%; P: 0.800), oxygen saturation during labor (76.5% vs. 73.9%; P: 0.557), presence of partner (58.8% vs. 78.3%; P: 0.112). There was no significant difference found in any aspect of intrapartum care between COVID-19 positive and negative patients.

| Study Outcomes | | COVID-19 | | Total | P-values |
|---|---|---|---|---|---|
| | | **Positive** | **Negative** | | |
| Intrapartum Care | Induction of labor | 8 (47.1%) | 18 (39.1%) | 26 (41.3%) | 0.570¥ |
| | Spontaneous Rupture of membranes | 7 (41.2%) | 24 (52.2%) | 31 (49.2%) | 0.438¥ |
| | Oxytocin augmentation | 5 (29.4%) | 16 (34.8%) | 21 (33.3%) | 0.688¥ |
| | Continuous fetal monitoring | 14 (82.4%) | 37 (80.4%) | 51 (81%) | 0.588▢ |
| | Hourly oxygen saturations | 8 (47.1%) | 20 (43.5%) | 28 (44.4%) | 0.800¥ |
| | Oxygen saturations maintained | 13 (76.5%) | 34 (73.9%) | 47 (74.6%) | 0.557▢ |
| | Birth partner present for labor and delivery | 10 (58.8%) | 36 (78.3%) | 46 (73%) | 0.112▢ |
| Intrapartum analgesia | Entonox | 2 (11.8%) | 9 (19.6%) | 11 (17.5%) | 0.378▢ |
| | Epidural | 1 (5.9%) | 14 (30.4%) | 15 (23.8%) | 0.038▢ |
| | Spinal | 10 (58.8%) | 25 (54.3%) | 35 (55.6%) | 0.768¥ |
| | General Anaesthesia | 3 (17.6%) | 2 (4.3%) | 5 (7.9%) | 0.117▢ |

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|---|---|---|---|---|---|
| Mode of delivery | Normal vaginal delivery | 4 (23.5%) | 9 (19.6%) | 13 (20.6%) | 0.489[Ϸ] |
| | C-Section | 13 (76.5%) | 37 (80.4%) | 50 (79.4%) | |
| | Rotational ventouse | 0 (0%) | 1 (2.2%) | 1 (1.6%) | 0.730[Ϸ] |
| | Direct forceps | 0 (0%) | 3 (6.5%) | 3 (4.8%) | 0.382[Ϸ] |
| Indication for caesarean section | Fetal distress | 4 (23.5%) | 13 (28.3%) | 17 (27%) | 0.487[Ϸ] |
| | Failure to progress | 6 (35.3%) | 14 (30.4%) | 20 (31.7%) | 0.713¥ |
| | Maternal request | 1 (5.9%) | 3 (6.5%) | 4 (6.3%) | 0.707[Ϸ] |
| | Malpresentation | 0 (0%) | 1 (2.2%) | 1 (1.6%) | 0.730[Ϸ] |
| | Breech | 1 (5.9%) | 1 (2.2%) | 2 (3.2%) | 0.470[Ϸ] |
| | Delayed delivery | 6 (35.3%) | 6 (13%) | 12 (19%) | 0.055[Ϸ] |
| 3rd stage complication | PPH | 1 (5.9%) | 7 (15.2%) | 8 (12.7%) | 0.302[Ϸ] |
| | Tear (3rd or 4th degree tear) | 0 (0%) | 1 (2.2%) | 1 (1.6%) | 0.730[Ϸ] |
| | MROP | 1 (5.9%) | 1 (2.2%) | 2 (3.2%) | 0.470[Ϸ] |
| Fetal Outcomes | Delayed cord clamping | 9 (52.9%) | 32 (69.6%) | 41 (65.1%) | 0.219¥ |
| | Low APGAR at 1 min. | 2 (12.5%) | 6 (14.3%) | 8 (13.8%) | 0.615[Ϸ] |
| | Low APGAR at 5 min. | 1 (6.3%) | 3 (7.1%) | 4 (6.9%) | 0.697[Ϸ] |
| | NNU admission | 3 (17.6%) | 7 (15.2%) | 10 (15.9%) | 0.544[Ϸ] |
| | low birth weight | 5 (29.4%) | 7 (15.9%) | 12 (19.7%) | 0.200[Ϸ] |
| Other diagnosis | UTI | 1 (5.9%) | 2 (4.3%) | 3 (4.8%) | 0.618[Ϸ] |
| | Sepsis | 0 (0%) | 11 (23.9%) | 11 (17.5%) | 0.022[Ϸ] |
| | Chorioamnionitis | 0 (0%) | 6 (13%) | 6 (9.5%) | 0.138[Ϸ] |
| Maternal treatment intrapartum and postnatal | Antibiotic use | 11 (64.7%) | 27 (58.7%) | 38 (60.3%) | 0.665¥ |
| | Oxygen therapy | 10 (58.8%) | 16 (34.8%) | 26 (41.3%) | 0.085¥ |
| | Postpartum venous thromboembolism prophylaxis | 16 (94.1%) | 38 (82.6%) | 54 (85.7%) | 0.234[Ϸ] |
| | HDU admission postnatal | 3 (17.6%) | 0 (0%) | 3 (4.8%) | 0.017[Ϸ] |
| | ITU admission postnatal | 2 (11.8%) | 0 (0%) | 2 (3.2%) | 0.070[Ϸ] |
| Maternal Postnatal care | Breast feeding | 4 (23.5%) | 18 (39.1%) | 22 (34.9%) | 0.249¥ |
| | Length of hospital stay (in days) | 3.53 +/- 2.67 | 2.09 +/- 0.17 | 2.49 +/- 1.80 | 0.004‖ |

***Table 3:*** *Association of intrapartum, feto-maternal and postnatal outcomes with COVID-19.*

*Abbreviations: PPH: Post Premature Hemorrhage; C-Section: Cesarean Section; MROP: Manual Removal of Placenta;*

*UTI: Urinary Tract Infection; HDU: High Dependency Unit; ITU: Intensive Treatment Unit, COVID-19: Coronavirus Disease of 2019.*

*¥: Chi-Test; ‖: T-Test; *=Fisher; [Ϸ]: Fisher Exact Test.; Significance Level ≤ 0.05. Numbers (%).*

Intrapartum analgesia assessment showed entonox used in 11.8% of positive COVID-19 cases vs. 19.6% of negative cases (P: 0.378); significant difference in the use of epidural (5.9% vs. 30.4%; P: 0.038); spinal anesthesia showed no significant association (58.8% vs. 54.3%: P: 0.768); general anesthesia (17.6% vs. 4.3%: P: 0.117) was not found statistically significant.

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Mode of delivery showed non-significant difference with P: 0.489; NVD was done in (23.5% vs. 19.6%) patients and C-sections were performed in (76.5% vs. 80.8%) patients. Indications among COVID-19 positive and negative patients are also showed in table 3. There were no significant associations found in 3rd stage complications with P > 0.05.

Fetal outcomes are shown as: delayed cord clamping (52.9% vs. 69.6%: P: 0.219), low APGAR at 1 minute (12.5% vs. 14.3%: P: 0.615), low APGAR at 5 minutes (6.3% vs. 7.1%: P: 0.697), NNU admission (17.6% vs. 15.2%; P: 0.554), low birth weight (29.4% vs. 15.9%; P: 0.200). Other maternal related conditions e.g. UTI, Sepsis and Chorioamnionitis were compared between positive and negative COVID-19 cases. Amongst these conditions, sepsis showed significant association (P < 0.05) - it is noticeable that no COVID-19 positive patients developed sepsis.

Intrapartum and postnatal treatment patterns showed that there is increased usage of antibiotic in COVID-19 positive patients compared to negative cases (64.7% vs. 58.7%; P: 0.665), similarly with oxygen therapy (58.8% vs. 34.8%; P: 0.085). Maternal HDU/ITU postnatal admission showed significant association, as only COVID-19 positive patients were admitted to HDU (17.6% vs. 0%; P: 0.017) and ITU (11.8% vs. 0%; P: 0.070). Maternal postnatal care showed: breast feeding women (23.5% vs. 39.1%; P: 0.249). There was a significant difference observed in the mean length of hospital stay (3.53 vs. 2.09; P: 0.004); positive cases had longer stay compared to non COVID-19 patients.

## Discussion

This analysis shows the demographics and comparison of the medical conditions, intrapartum care, analgesia requirements, mode of delivery, complications, maternal and fetal outcomes, as well as postnatal care in pregnant patients with suspected versus confirmed covid-19. The current study illustrates that older age, overweight/obese, multiparity and obstetric patients with comorbidities had higher risk of COVID-19 infection. There was no significant difference in the intrapartum care and postpartum outcome in both groups, suggesting COVID-19 positive pregnant women did not experience worse pregnancy outcomes compared to COVID-19 negative patients.

Our research findings illustrate that the most prevalent clinical symptoms in suspected COVID-19 pregnant women were fever 79.4%, persistent cough 34.9% and significant contact with suspected COVID-19 patients 6.3%. Similar to our findings, a meta-analysis identified fever and cough as the most common symptoms of COVID-19 in pregnant women [14]. Based on a CDC report, the most prevalent symptoms of COVID-19 positive patients in the general population are fever, cough, chills, myalgia, nausea, headache, respiratory distress **and shortness breath** [15]. However, cough, nausea, sore throat, dyspnoea, headache and diarrhoea were less likely to be seen in pregnant women. 50% of covid positive pregnant patients presented with cough in our study, which reflects how cough is a less prevalent symptom. This is possibly due a reduced likelihood of typical COVID-19 presentation in pregnant patients. Further studies indicated a more immunocompromised course of the disease in pregnancy [14-16]. It was revealed in our study that 27% of pregnant women were COVID-19 positive.

An additional finding of note in this study is that the ethnicity of the cohort of our study consisted mainly of the Black Asian Ethnic Minority (BAME) group in comparison to only 45% of the cohort being White British. This coincides with the UKOSS study which found pregnant women from Black, Asian and minority ethnic (BAME) backgrounds are more likely than other pregnant women to be admitted to hospital for COVID-19 [17]. However, the findings could also relate to the higher prevalence of BAME demographics in our area of study. Based on the 2011 England and Wales consensus, West Midlands has the 2nd highest percentage of Black, Asian & Mixed Ethnicity population [18].

This research also indicates that a significant proportion of COVID-19 pregnant patients were overweight or obese. Obesity is considered a potential risk factor for obstetrics complications including maternal morbidity and mortality. This is presumably due to the fact that obese women had increased exposure during frequent antenatal visits in the hospital due to predicted obstetric complications. In

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a study conducted by Tamara., *et al*. it was stated that maternal obesity is indeed an independent predictor for the severity of covid-19 [19]. A report from the US Centers for Disease Control and Prevention also found a high prevalence of cardiovascular and chronic lung disease and diabetes mellitus among pregnant women with COVID-19 [20]. Our findings showed that comorbidities are likely to play an important role in the development of complications and infection being acquired.

Furthermore, this study reported that the existing co-morbidities in the suspected COVID-19 pregnant women were DM, GDM and hypertensive disorders but there was no significant correlation found in our population with pre-existing medical conditions and intrapartum and postpartum outcome. In addition to a greater risk of COVID-19 occurrence and severity, increased proportions of co-morbidities in pregnant women may have inclined them to a higher likelihood of pregnancy related complications. A large scale cohort conflicting with the current research, showed no substantial difference in pregnancy complications among patients with and without COVID-19 [21]. There was little variation explored in intrapartum care and the need for intrapartum analgesia. Taking into consideration all appropriate prevention approaches, all patients with and without COVID-19 provided quality treatment and care at every stage.

The rate of mortality was higher in those women who are affected with COVID-19 during pregnancy as compared to non-pregnant COVID-19 women. In a meta-analysis, there was 11.3% mortality from all causes in 2660 pregnant patients with COVID-19 [3]. In another meta-analysis, among 11,580 suspected pregnant women only 0.1% were COVID-19 positive [14]. This is close to our scientific findings, as no event of maternal mortality has been recorded in the present research. The cause of the observed disparity could be numerous entities such as the strong variability of the values in the two meta-analyses. In addition, there are also other predictive factors of maternal death and mortality, such as the existence of chronic diseases, gravidity, obesity and previous history of caesarean delivery.

Based on our study findings, the most prevalent obstetric outcomes were postpartum haemorrhage, MROP, caesarean delivery, progression failure, spontaneous membrane rupture, and post-term delivery, respectively. Similarly, in another study, PPH, caesarean section, preterm labor and premature births are frequent obstetric outcomes in pregnant women with COVID-19. In our analysis, there was no significant association was found in maternal outcomes in COVID-19 when compared to pregnant women without COVID-19 (P-value > 0.05). Comparable to our findings this study also did not find any difference in maternal outcomes between groups [14].

Caesarean delivery in our study occurred in 80% of the patients. while in another study it occurred in almost 50% of the patients [3]. Other studies showed that 89% of patients went through C-section [16,22]. In several reviews, indications for the caesarean section were not evident to clarify whether they were due to medical reasons. Under this context, a significant percentage of pregnancy related complications which caused a cesarean section delivery including fetal distress, failure to progression, breech, and post-dates delivery in pregnant COVID-19 patients were identified in this analysis. In a population-based cohort study in Wuhan China, it was demonstrated that SARS-CoV-2 infection or COVID-19 diagnosis during late pregnancy is strongly correlated with an elevated risk of iatrogenic premature births and caesarean delivery. Thus, these issues need to be addressed promptly by carrying out further research [23].

In pregnant mothers, preterm labour and birth weight does not seem to have a significant correlation with COVID-19 [24]. In neonates of pregnant patients with COVID-19, admission to the neonatal intensive care unit (NICU) was found to be higher than in neonates born to patients without COVID-19 [25]. While vertical transmission was not discussed in this study, the probability of this form of transmission is still under consideration and there is no clear evidence supporting this type of disease transmission. There is no proof shown by other sources. On the contrary, there are studies present on the COVID-19 vertical transmission [3,26-28]. A recent research investigated that maternal and neonatal outcomes were correlated with the highest risk of preterm delivery, fetal distress, C-section deliveries and perinatal mortality, among COVID-19 infected patients [29].

The current study compared the fetal and neonatal outcomes including low APGAR, NNU admission and low birth weight with COVID-19 there was no impact observed of the infection on the outcomes (P-value > 0.05). In this study it was observed that intrapartum and postnatal care was needed more in patients with COVID-19 as compared to those without COVID-19. Events of antibiotic use need of

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oxygen therapy, HDU admission and ITU admission were reported more in COVID-19 positive cases. However, no pregnant patients with COVID-19 in our cohort developed sepsis. Therefore, it may be reasonable to hypothesize that early use of antibiotics may have a beneficial use as a prophylactic treatment to prevent supra added infection in COVID-19 positive patients. However, further studies need to be carried out to confirm or negate this. Due to the infection, the duration of hospital stay also has had a major effect.

This research study offered valuable insights on COVID-19 and states that patients with COVID-19 are at a potential risk of pregnancy related complications. There is a need to emphasise that it is important to inform both patients and their families about preventive measures for COVID-19 and proper monitoring for the progression of signs and symptoms of the disease. At this time there are few researches conducted on the epidemiology of traditional COVID-19 infected patients, although there are few studies to investigate the clinical characteristics and effects of COVID-19 infected pregnant women. This study will be beneficial for structuring clinical treatment strategies for COVID-19 pregnant women. The relatively small sample size was the limitation of this research and there are few studies explaining the cases within the regions. There is a need for more studies on pregnant women with COVID-19 globally.

## Conclusion

No real difference is seen in obstetrics practice in intrapartum care and outcome for suspected and positive COVID-19 patients; this might suggest that with this COVID-19 pandemic, care doesn't need to change in our obstetrics practice, after reviewing the results of maternal and fetal outcomes in our study. There is higher rate of infection in multiparous than primigravida, this might suggest that multipara/pregnant patients need awareness regarding risks around exposure to young school-attending children. In relation to obstetrics analgesia, why have very few suspected COVID-19 patients had epidurals and COVID-19 positive patients underwent GA? Is GA the reason patients needed ITU care? Further studies are required by anesthetist colleagues to comment on safety of obstetrics analgesia in COVID-19 patients.

The predominant feature was coughing rather than fever. Based on the retrospective study, there were no statistically significant associations between the patient's demographics, comorbidities and COVID-19 status. Thus, it is imperative to offer COVID-19 testing in every pregnant patient who attends as an inpatient to allow rapid identification of their infectious status. However, it is noticeable that the majority of patients who are identified as COVID-19 positive were overweight or obese; therefore it is important to monitor patients of high BMI as they are more susceptible to deteriorate. There is also an increased use of antibiotics in COVID-19 positive patients, however it is statistically significant that no COVID-19 patients developed sepsis. Therefore it may reasonable to assume that the early use of antibiotics may have a beneficial use as a prophylactic treatment to prevent supra-added infection in COVID-19 positive patients.

In those patients who were suspected COVID-19 but tested negative, the majority were diagnosed as sepsis or chorioamnionitis. This highlights the importance of ensuring all women presenting with signs of COVID-19 should also undergo septic screening.

## Bibliography

1. Valencia DN. "Brief review on COVID-19: the 2020 pandemic caused by SARS-CoV-2". *Cureus* 12.3 (2020).

2. Cucinotta D and Vanelli M. "WHO Declares COVID-19 a Pandemic". *Acta Bio-Medica: Atenei Parmensis* 91.1 (2020): 157-160.

3. Jafari M., *et al.* "Clinical characteristics and outcomes of pregnant women with COVID-19 and comparison with control patients: A systematic review and meta-analysis". *Reviews in Medical Virology* e2208.

4. Rasmussen SA., *et al.* "Coronavirus disease 2019 (COVID-19) and pregnancy: what obstetricians need to know". *American Journal of Obstetrics and Gynecology* 222.5 (2020): 415-426.

**Comparison of Outcomes among Pregnant Women with or without COVID-19 during Intrapartum and Postpartum Care: A Longitudinal-Study**

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5.  Rothan HA and Byrareddy SN. "The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak". *Journal of Autoimmunity* 109 (2020): 102433.

6.  McMahon SA., *et al.* "Healthcare providers on the frontlines: a qualitative investigation of the social and emotional impact of delivering health services during Sierra Leone's Ebola epidemic". *Health Policy and Planning* 1.9 (2016): 1232-1239.

7.  Menendez C., *et al.* "Avoiding indirect effects of COVID-19 on maternal and child health". *The Lancet Global Health* 8.7 (2020): e863.

8.  Corps D. "Provisional births in England and Wales: 2020: Office for National Statistics (2020).

9.  Madjunkov M., *et al.* "A comprehensive review of the impact of COVID-19 on human reproductive biology, assisted reproduction care and pregnancy: a Canadian perspective". *Journal of Ovarian Research* 13.1 (2020): 1-18.

10. Zhu H., *et al.* "Clinical analysis of 10 neonates born to mothers with 2019-nCoV pneumonia". *Translational Pediatrics* 9.1 (2020): 51.

11. Dashraath P., *et al.* "Coronavirus disease 2019 (COVID-19) pandemic and pregnancy". *American Journal of Obstetrics and Gynecology* 222.6 (2020): 521-531.

12. Ryan GA., *et al.* "Clinical update on COVID-19 in pregnancy: A review article". *Journal of Obstetrics and Gynaecology Research* 46.8 (2020): 1235-1245.

13. Mahase E. "COVID-19: Pregnant women with virus are more likely to need intensive care, study finds". *British Medical Journal Publishing Group* (2020).

14. Allotey J., *et al.* "Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis". *BMJ* (2020): 370.

15. Burke RM., *et al.* "Symptom profiles of a convenience sample of patients with COVID-19-United States, January–April 2020". *Morbidity and Mortality Weekly Report* 69.28 (2020): 904.

16. Chamseddine RS., *et al.* "Pregnancy and neonatal outcomes in SARS-CoV-2 Infection: a systematic review". *Journal of Pregnancy* (2020).

17. Vousden N., *et al.* "The incidence, characteristics and outcomes of pregnant women hospitalized with symptomatic and asymptomatic SARS-CoV-2 infection in the UK from March to September 2020: a national cohort study using the UK Obstetric Surveillance System (UKOSS)". *Med Rxiv* (2021).

18. Ayoubkhani D., *et al.* "Ethnic minority groups in England and Wales-factors affecting the size and timing of elevated COVID-19 mortality: a retrospective cohort study linking Census and death records". *Medrxiv* (2020).

19. Tamara A and Tahapary DL. "Obesity as a predictor for a poor prognosis of COVID-19: A systematic review". *Diabetes and Metabolic Syndrome: Clinical Research and Reviews* 14.4 (2020): 655-659.

20. Ellington S., *et al.* "Characteristics of women of reproductive age with laboratory-confirmed SARS-CoV-2 infection by pregnancy status—United States, January 22–June 7, 2020". *Morbidity and Mortality Weekly Report* 69.25 (2020): 769.

21. Adhikari EH., *et al.* "Pregnancy outcomes among women with and without severe acute respiratory syndrome coronavirus 2 infection". *JAMA Network Open* 3.11 (2020): e2029256.

22. Capobianco G., *et al.* "COVID-19 in pregnant women: A systematic review and meta-analysis". *European Journal of Obstetrics and Gynecology and Reproductive Biology* 252 (2020): 543-558.

**Comparison of Outcomes among Pregnant Women with or without COVID-19 during Intrapartum and Postpartum Care: A Longitudinal-Study**

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23. Yang R., *et al.* "Pregnant women with COVID-19 and risk of adverse birth outcomes and maternal-fetal vertical transmission: a population-based cohort study in Wuhan, China". *BMC Medicine* 18.1 (2020): 1-7.

24. Melo GCd and Araújo KCGMd. "COVID-19 infection in pregnant women, preterm delivery, birth weight, and vertical transmission: a systematic review and meta-analysis". *Cadernos de Saude Publica* 36 (2020): e00087320.

25. Levy A., *et al.* "ACE2 expression and activity are enhanced during pregnancy". *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology* 295.6 (2008): R1953-R61.

26. Fenizia C., *et al.* "Analysis of SARS-CoV-2 vertical transmission during pregnancy". *Nature Communications* 11.1 (2020): 1-10.

27. Alzamora MC., *et al.* "Severe COVID-19 during pregnancy and possible vertical transmission". *American Journal of Perinatology* 37.8 (2020): 861.

28. Yan J., *et al.* "Coronavirus disease 2019 in pregnant women: a report based on 116 cases". *American Journal of Obstetrics and Gynecology* 223.1 (2020): e1-e14.

29. Di Mascio D., *et al.* "Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: a systematic review and meta-analysis". *American Journal of Obstetrics and Gynecology MFM* 2.2 (2020): 100107.