

A RETROSPECTIVE TELEPHONIC INTERVIEW ON THE IMPACT OF COVID-19 IN PREGNANCY - MATERNAL AND NEONATAL OUTCOMES IN KANCHIPURAM, TAMIL NADU

Dr. Harsavarthini. K.R ^{1*}, Dr. G. Shiny Chrism Queen Nesan ²,
Dr. Sree Arthi. D ³ and P.E Joshikasri ⁴

¹ Postgraduate, Department of Community Medicine,
Saveetha Medical College and Hospital, Chennai.

² Associate Professor, Department of Community Medicine,
Saveetha Medical College and Hospital, Chennai.

³ Postgraduate, Department of Community Medicine,
Saveetha Medical College and Hospital, Chennai.

⁴ MBBS Student, Saveetha Medical College and Hospital, Chennai.

*Corresponding Author Email: harsavarthini@gmail.com

DOI: 10.5281/zenodo.12754491

Abstract

Background: The COVID-19 pandemic, an acute respiratory illness caused by the coronavirus, has swiftly disseminated over the globe but has not been eradicated. The illness poses a particularly high risk of mortality in people who are susceptible or at greater risk. Current research suggests that pregnant women are more susceptible to experiencing severe illness. While foetuses provide some protection against sickness, the new discovery indicates that the COVID-19 pandemic may lead to an increase in health problems for both the foetus and the mother. **Objectives:** The main objective of the study was to assess the maternal and neonatal outcomes in covid 19 positive pregnancies. **Methodology:** A cross-sectional study (Interview method) was conducted in a tertiary care teaching hospital in Kanchipuram, Tamil Nādu. The study included 181 women who suffered COVID 19 infection which was confirmed by rt-PCR test during their antenatal period. A structured questionnaire was used to collect data about the patient's demographic details, details about the antenatal period, obstetric outcomes and neonatal outcomes through a telephonic interview. **Results:** An association between maternal complications and the following maternal details and outcomes such as primigravida women, women diagnosed in the 1st trimester and induced LSCS were found to be statistically significant. On the contrary, Women who were diagnosed with COVID-19 in the 3rd trimester had a higher incidence of neonatal complications (14.4%). Neonatal complications were more among neonates which were term (9.2%), low birth weight (12.5%) and had a low APGAR score (12.5%). **Conclusion:** Pregnant COVID-19-positive individuals exhibit fewer symptoms than the normal population. There are several adverse maternal and perinatal outcomes associated with COVID-19 infection. COVID-19 infection in the preconception period certainly had a less favorable prognosis.

Keywords: COVID-19, Pregnancy, Miscarriage, LSCS, Low Birth Weight.

INTRODUCTION

In December 2019, an initial cluster of four cases of pneumonia of unknown origin in Wuhan, China, was reported to the World Health Organization (WHO), marking the beginning of the COVID-19 pandemic caused by the SARS-CoV-2 virus.¹ By March 12, 2020, the WHO officially declared it a pandemic as the virus spread rapidly worldwide.² Coronaviruses can range from asymptomatic cases to severe respiratory illness and have characteristic features such as abnormal chest radiographic imaging, lymphopenia, leukopenia, and thrombocytopenia.³

Pregnant individuals are particularly vulnerable to developing severe illness following respiratory virus infections due to changes in their immune and cardiopulmonary systems.⁴

Previous coronavirus outbreaks, such as SARS-CoV and MERS-CoV, have shown severe complications, especially during the third trimester, including pneumonia, ICU admissions, mechanical ventilation needs, and high fatality rates.⁵ However, there is currently no definitive evidence suggesting that pregnant women are more susceptible to COVID-19 infection or are at a higher risk of developing severe pneumonia. Studies on COVID-19 in pregnant women have reported varying symptoms and treatment outcomes.

A study conducted in India on 141 COVID-19 patients found that pregnant women experienced mild respiratory symptoms, particularly those without pre-existing health conditions, leading to favorable maternal and fetal outcomes.⁶ Despite this, COVID-19 has presented significant challenges for pregnant individuals globally, increasing the risks of preterm birth, preeclampsia, and potential vertical transmission to the fetus.

Managing COVID-19 during pregnancy requires specialized care to address respiratory distress and other severe symptoms. While most babies born to mothers with COVID-19 do not experience severe complications, cases of fetal distress and neonatal respiratory issues have been reported.

Preventive measures such as practicing good hygiene, wearing masks, maintaining physical distance, and getting vaccinated are crucial for reducing the risk of COVID-19 in pregnancy.

Additionally, the pandemic has accelerated the adoption of telehealth services for prenatal care and delivery, highlighting the need for innovative healthcare solutions. Ongoing research aims to better understand the impact of COVID-19 on pregnancy outcomes and guide healthcare providers in managing and preventing COVID-19-related complications during pregnancy.

Objective:

The main objective of the study was

- 1) To assess the obstetric and neonatal outcomes in the COVID 19 positive pregnant mothers
- 2) To determine the association between the baseline maternal details with the obstetric and neonatal outcomes in the COVID 19 positive pregnant mothers

METHODOLOGY

In a tertiary care teaching hospital in Kanchipuram, Tamil Nadu, a cross-sectional study using the interview method was conducted. The study focused on women who had contracted COVID-19 during their antenatal period and had subsequently recovered. Records from the Obstetrics and Gynecology department showed a total of 273 COVID-19-positive pregnancy cases reported between May 2020 and February 2022.

The study specifically included antenatal women who tested positive for COVID-19 using the rt-PCR test, excluding those who tested positive using the rapid antigen test. Telephone numbers of eligible women were obtained from the medical records department, and duplicates were removed after thorough screening based on the eligibility criteria. Of the 211 contacted women, 30 declined to participate, resulting in a total of 181 pregnant antenatal women with laboratory-confirmed COVID-19 infection included in the study.

A structured, pre-tested and pre-validated questionnaire was used based on the below criteria

Part 1 - Demographic details

Part 2 - Details of the antenatal period such as the obstetric score, no. of antenatal visits, immunization status, intake of IFA tablets and respective trimester history along with relevant family history and past medical history. This section also included information about the time of diagnosis of COVID 19.

Part 3 - Obstetric outcomes such as onset of labor, mode of delivery, period of gestation, respiratory & pregnancy related complications associated with maternal mortality, any breastfeeding problems and maternal ICU admission.

Part 4 - Neonatal outcomes such as neonatal COVID status, APGAR score, NICU admission, weight of the newborn, neonatal complications & associated neonatal mortality

Telephonic interviews were conducted on every patient from the list after obtaining the informed consent for telemedicine services. The information which was not available from the interview was collected from the case record after obtaining permission from the medical superintendent to access the medical records. Ethical approval was obtained from the institutional review board.

Statistical analysis:

The collected data was entered in the MS Excel and analyzed using SPSS version 22 software. Frequencies and percentages were calculated for categorical variables. Chi square test was applied to observe the association between outcomes and maternal details (p value <0.05 significant).

RESULTS

Maternal characteristics of all pregnant women admitted for delivery has been summarized in **Table 1**.

Table 1: Baseline Maternal characteristics of the study participants during the antenatal period (n=181)

Description	Frequency	Percentage (%)
Age (in years)		
18-25	82	45.3%
25-30	58	32%
30-35	32	17.7%
>35	9	5%
Parity		
Primigravida	98	54.1%
Multigravida	83	45.9%
Type of pregnancy		
Singleton	174	96.1%
Multiple	7	3.90%
Number of antenatal visits		
One visit	20	11%
Two visits	18	10%
Four visits	20	11%
More than four visits	123	68%
Comorbidities		
Present	39	21.6%
Absent	142	78.4%

Time of diagnosis of COVID-19		
Before conception	7	3.9%
After conception	174	96.1%
Trimester in which COVID-19 was diagnosed		
1st trimester	20	11%
2nd trimester	19	10.5%
3rd trimester	142	78.5%

The age distribution among the antenatal cases was maximum in the 18-25 years category 82 (45.3%). Majority of the antenatal mothers were primigravida 98 (54.1%). COVID-19 was diagnosed in most of the ANMs after conception 174 (96.1%) & in the 3rd trimester 142 (78.5%). **Table 2** gives the maternal outcomes of COVID-19 positive pregnancies.

Table 2: Maternal outcomes of COVID 19 among the study participants (n=181)

Description	Frequency	Percentage (%)
COVID Symptoms		
Present	77	42.5%
Absent	104	57.5%
Symptoms of COVID-19 seen* (N= 77)		
Fever	16	20.7%
Fatigue	6	7.8%
Headache	5	6.5%
Dry cough	16	20.8%
Breathlessness	9	11.7%
Diarrhea	5	6.5%
Loss of smell	6	7.8%
Loss of taste	14	18.1%
Onset of labor		
Spontaneous	153	84.5%
Induced	28	15.5%
Mode of delivery		
NVD	73	40.3%
LSCS	108	59.7%
Period of gestation at the time of delivery		
Preterm	42	23.2%
Term	130	71.8%
Post-term	9	5.0%
Pregnancy related complications		
Present	75	41.5%
Absent	106	58.5%
Pregnancy related complications		
Anemia	19	25.2%
Oligohydramnios	8	10.7%
Gestational diabetes mellitus	12	16.0%
Pre-eclampsia	8	10.7%
Respiratory complications	5	6.7%
Premature rupture of membranes	4	5.3%
Postpartum hemorrhage	4	5.3%
Cephalo-pelvic disproportion	2	2.7%
Miscarriage	4	5.3%
Abortions	2	2.7%
Intrauterine deaths	2	2.7%
Others	5	6.7%
Maternal ICU admission	18	9.9%

* -multiple options applicable

The most common symptom of COVID observed was dry cough 16 (20.8%) followed by fever 16 (20.7%) & loss of taste 14 (18.1%). The pregnancy related complications noted were anemia 19 (25.2), GDM 12 (16%), oligohydramnios 8 (10.7%), Pre-eclampsia 8 (10.7%), PROM 4 (5.3%), Postpartum hemorrhage 4 (5.3%), CPD 2 (2.7%) & Others 5 (6.7%) like Cholelithiasis, Hepatitis, bradycardia, Placenta previa & Abruption placenta. There was significant pregnancy loss due to miscarriage 4 (5.3%), Abortions 2 (2.7%) & Intrauterine deaths 2 (2.7%). Onset of labor was spontaneous in 85 (47%) ANCs. The most common mode of delivery was LSCS 126 (69.6%). The period of gestation at the time of delivery was preterm in 35 (19.3%), term in 117 (64.6%) and post term in 2 (1.1%). Respiratory complications were observed in 5 (6.7%) of the ANCs and 18 (9.9%) were admitted in the ICU for the reasons depicted in **Fig. 1**.

Reasons for maternal ICU Admission

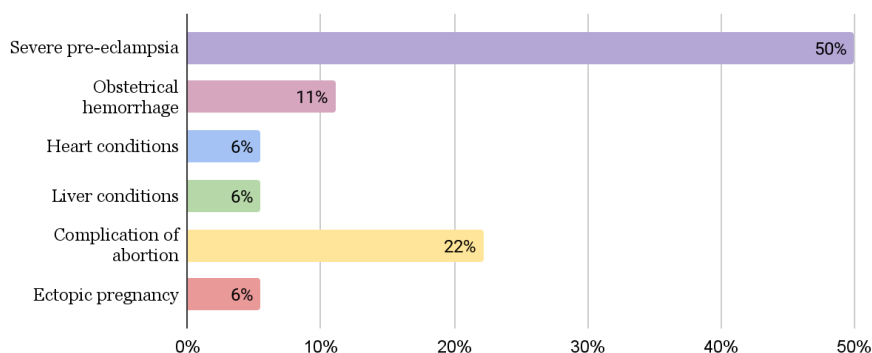


Fig 1: Reasons for Maternal ICU Admission among the study participants (n=18)

The most common comorbid factor present was hypothyroidism (10.5%) followed by hypertension (6.1%), asthma (3.3%) & type 2 diabetes (2.8%). None of the women faced breastfeeding difficulties. There were no adverse outcomes in the maternal status on discharge. The neonatal outcomes are given by **Table 3**.

Table 3: Neonatal outcomes among the newborn of the study participants (n=152)

Descriptions	Frequency	Percentage (%)
APGAR Score		
07-Apr	121	79.0%
04-Jul	31	20.9%
Weight of newborn		
Normal	109	71.2%
Low	43	28.7%
NICU Admission		
Yes	43	28.1%
No	109	71.8%
Neonatal complication		
Present	31	20.2%
Absent	121	79.7%
Neonatal complications		
Respiratory distress	23	15.0%
Intrauterine growth restriction	4	2.6%
Jaundice	3	1.9%
Rh incompatibility	1	0.6%

APGAR scores were found to be 7-4 (Normal) in 121 (79%) neonates and 4-7 (Intermediate) in 32 (20.9%). The weight of the newborn was normal in 109 (71.2%) and low for 43 (28.7%). NICU admission was done for 43 (28.1%) of the neonates for the reasons depicted by **Fig. 2**. There were no neonatal deaths. None of the neonates tested positive for COVID-19 infection.

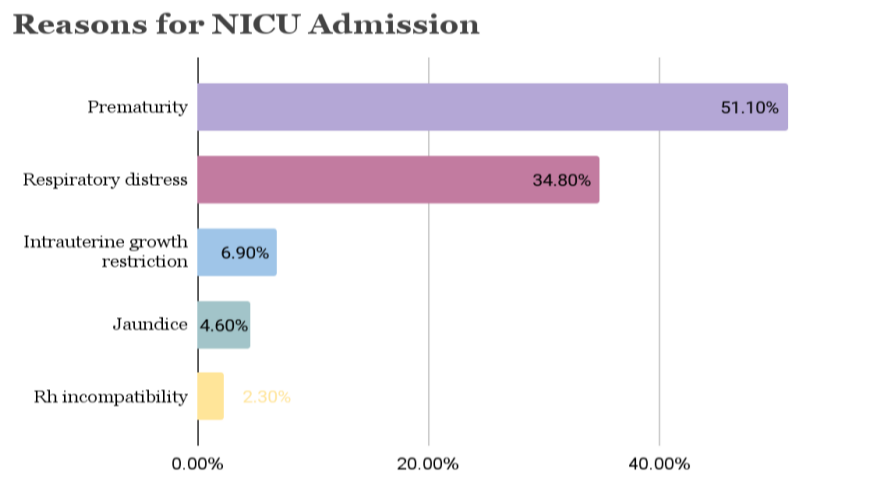


Fig 2: Reasons for NICU Admission among the new born of the study participants (n=43)

According to **Table 4**, 48 (49%) of the primigravida were more prone to maternal complications when compared to multigravida which was significant according to the chi-square test of significance.

Table 4: Association between maternal complications and maternal factors among the study participants (n = 181)

Variables	Maternal Complications N (%)		Chi-square	P value (< 0.05) *
	Present N = 75 (41.5%)	Absent N = 106 (58.5%)		
	Age of the mother			
18-25	38 (46.3%)	44 (53.7%)	1.789	0.617
25-30	23 (39.7%)	35 (60.3%)		
30-35	11 (34.4%)	21 (65.6%)		
>35	3 (33.3%)	6 (66.7%)		
Obstetric score				
Primigravida	48 (49%)	50 (51%)	5.01	0.025*
Multigravida	27 (32.5%)	56 (67.5%)		
No. of antenatal visits				
1 visit	16 (80%)	4 (20%)	20.03	<0.001*
2 visits	11 (61.1%)	7 (38.9%)		
4 visits	9 (45%)	11 (55%)		
>4 visits	39 (31.7%)	84 (68.3%)		
Time of diagnosis of COVID-19				
Before conception	5 (71.4%)	2 (28.6%)	2.699	0.1
After conception	70 (40.2%)	104 (59.8%)		
Trimester of diagnosis of COVID-19				
1st trimester	16 (80%)	4 (20%)	20.018	<0.001*
2nd trimester	12 (63.2%)	7 (36.8%)		
3rd trimester	47 (33.1%)	95 (66.9%)		

Presence of COVID symptoms				
Present	37 (48.7%)	39 (51.3%)	2.835	0.092
Absent	38 (36.1%)	67 (63.9%)		
Onset of labor				
Spontaneous	27 (22.7%)	58 (77.3%)	6.177	<0.013*
Induced	48 (38.5%)	48 (61.5%)		
Mode of delivery				
Normal vaginal delivery	16 (13.3%)	39 (86.7%)	4.962	0.026*
Lower segment cesarean section	59 (38%)	67 (62%)		

* Chi square test (p value < 0.05 will be statistically significant)

Out of various maternal outcomes analyzed in our study, 16 (80%) and 11 (61.1%) of the antenatal women who only came for a single and two visits respectively and antenatal women who were diagnosed with COVID-19 in the first trimester 16 (80%) faced more complications than the rest which was also statistically significant. **Table 5** gives the association between neonatal complications and maternal and neonatal factors.

Table 5: Association between neonatal complications and maternal & neonatal factors

Variables	Neonatal complications N (%)		Chi-square	P value (< 0.05)*
	Present N = 31 (20.2%)	Absent N=121 (79.8%)		
	Maternal factors			
Age			2.436	0.487
18-25	13 (8.5%)	55 (36.1%)		
25-30	8 (5.2%)	40 (26.3%)		
30-35	6 (3.9%)	21 (13.8%)		
>35	0	9 (5.9%)		
Obstetric score			0.829	0.362
Primigravida	16 (10.5%)	62 (40.7%)		
Multigravida	11 (7.2%)	63 (41.4%)		
No. of antenatal visits			9.85	0.02*
1 visit	0	3 (1.9%)		
2 visits	5 (3.2%)	4 (2.6%)		
4 visits	3 (1.9%)	16 (10.5%)		
More than 4 visits	19 (12.5%)	102 (67.1%)		
Trimester of diagnosis of COVID-19				
1st trimester	0	3 (1.9%)	9.849	0.007*
2nd trimester	5 (3.2%)	4 (2.6%)		
3rd trimester	22 (14.4%)	118 (77.6%)		
Presence of COVID symptoms			2.692	0.101
Present	15 (9.8%)	48 (31.5%)		
Absent	12 (7.8%)	77 (50.6%)		
Onset of labor			5.104	0.024*
Spontaneous	8 (5.2%)	67 (44%)		
Induced	19 (12.5)	58 (38.1%)		
Mode of delivery			1.936	0.164
Normal vaginal delivery	5 (3.2%)	40 (26.3%)		
Lower segment cesarean section	22 (14.4%)	85 (55.9%)		
Neonatal factors				
Period of gestation			11.69	<0.001*
Term	14 (9.2%)	103 (67.7%)		
Preterm	13 (8.5%)	22 (14.4%)		

Weight of newborn				
Normal	8 (5.2%)	100 (65.7%)	27.389	1.663
Low	19 (12.5%)	25 (16.4%)		
APGAR score				
07-Oct	8 (5.2%)	112 (73.6%)	48.046	4.414
04-Jul	19 (12.5%)	13 (8.5%)		
NICU Admission				
Yes	22 (14.4%)	21 (13.8%)	45.791	1.314
No	5 (3.2%)	104 (68.4%)		

* Chi square test (p value < 0.05 will be statistically significant)

Women who were diagnosed with COVID-19 in the 3rd trimester had more incidence of neonatal complications (14.4%). Neonatal complications were more among neonates which were term (9.2%), low birth weight (12.5%) and had a low APGAR score (12.5%). Most of the neonates that had complications were delivered by induced (12.5%), LSCS (14.4%).

DISCUSSION

The coronavirus infection is putting an unprecedented and unthinkable pressure on our healthcare system. A woman's experience with COVID-19 infection during pregnancy is even more severe than it is at other times in her life. In order to understand the clinical spectrum and the effects of COVID-19 on expecting women, both maternal and neonatal, this research was conducted.

We included 181 moms who tested positive for COVID-19 in our research; 140 of them, or 77.3 percent, were in the third trimester. Of these individuals, 42.5% had a moderate form of the condition, and 104 (57.5%) were asymptomatic. These results were in agreement with research carried out in Jamshedpur by Singh V et al.,⁷ and in Massachusetts by A Angelidou et al.,⁸ The most frequent symptoms that were noted were fever and a dry cough. Research by Gajbhiye RK et al.,⁹ and Novoa RH et al.,¹⁰ revealed similar patterns. Cough, fever, and dyspnea were the most common symptoms among pregnant women with symptomatic COVID-19 positive, according to findings by Pereira A et al.¹¹ Pregnant women were less likely than non-pregnant women with COVID-19 to exhibit fever, dyspnea, cough, and myalgia, according to a systematic review and meta-analysis conducted in Britain.¹²

2.7% of the cases were abortions, while 5.3% of the cases were spontaneous first-trimester miscarriages. Even though they were not statistically significant, these figures were nonetheless higher than those of earlier investigations carried out by Novoa RH et al.,¹⁰ Gajbhiye RK et al.,⁹ and Singh V et al.⁷ With 126 women undergoing LSCS, our caesarean section rate was 69.6%, which is in line with previous research.¹⁰ The main reasons for the operation were foetal discomfort and unsuccessful induction of labour.

Regarding the C-section rate, no statistically significant variations were seen based on whether COVID-19 symptoms were present or absent. There may be other indications for the surgery, which would account for the comparatively greater occurrence of caesarean sections. In addition, no incidences of maternal death were noted among our patients, and 9.9% of the patients needed critical care, mostly for difficulties linked to pregnancy. Furthermore, a small number of studies (12,13) have shown that COVID-19 does not manifest itself more strongly during pregnancy. We found a significant percentage of preterm births (19.3%) in our research.

Common problems were respiratory distress (15%) and intrauterine growth restriction (2.6%), both of which were considerably higher than the findings from previous investigations.^{7,9,14,15} The World Health Organization's (WHO) COVID-19 database, Medline, Embase, the Cochrane database, the China National Knowledge Infrastructure (CNKI), and the Wanfang databases were all thoroughly reviewed by Allotey J et al.¹², who also came to the conclusion that pregnant women infected with COVID-19 had a higher incidence of neonatal admissions to the intensive care unit and a higher risk of preterm birth.

We observed a high frequency of low birth weight infants (28.7%) and NICU hospitalisations (28.1%) in addition to a significant proportion of preterm deliveries. 2.6% was the rate of intrauterine fatalities, which is consistent with findings from previous Indian research, including those by Singh V et al.⁷. Nayak MK et al.¹⁵ similarly found low birth weight in 29.77% and intrauterine mortality in 2.23% of COVID-19-positive pregnant women included in their research, which is consistent with our results.

Even while pregnant women with COVID-19 are more likely to have preterm delivery, low birth weight infants, and neonatal hospitalisations, Allotey J et al.¹² found that overall stillbirth and neonatal death rates are not greater than background rates. Neonates delivered to mothers diagnosed with COVID-19 also had higher rates of respiratory symptoms and NICU hospitalisation. This suggests that whether neonatal testing are positive or negative, maternal illness has an immediate impact on the infant.

Limitation

The present study has a few limitations. Firstly, the relatively small sample size limits the generalizability of the study results. Furthermore, the study's observational nature and lack of a control group mean that causality cannot be firmly established. These limitations highlight the need for larger, more comprehensive studies to better understand the effects of COVID-19 on pregnant individuals.

CONCLUSION

Pregnant COVID-19-positive individuals exhibit fewer symptoms than the normal population. The majority of pregnant women were asymptomatic at the time of admission, which is consistent with studies conducted universally. We did not observe a severe clinical presentation of COVID-19 during pregnancy. There are several adverse maternal and perinatal outcomes associated with COVID-19 infection, such as higher rates of cesarean deliveries, preterm births, fetal distress, low birth weights, and low Apgar scores, and higher rates of obstetric complications among pregnant women. There were clinically significant numbers of miscarriages and intrauterine deaths during the first trimester.

The majority of our patients came to us in the third trimester, so the teratogenic potential of COVID-19 could not be determined. Nevertheless, COVID-19 infection in the preconception period certainly had a less favorable prognosis. Despite the small number of participants, our study provides useful information for improving our understanding of COVID-19 infection in pregnancy and for creating a solid foundation for future long-term follow-up studies.

Reference

- 1) Mohan BS, Nambiar V. COVID-19: an insight into SARS-CoV-2 pandemic originated at Wuhan City in Hubei Province of China. *J Infect Dis Epidemiol*. 2020 Jul 18;6(4):146.
- 2) Zanke AA, Thenge RR, Adhao VS. COVID-19: A pandemic declare by world health organization. *IP International Journal of Comprehensive and Advanced Pharmacology*. 2020 Jul 15;5(2):49-57.
- 3) Słomka A, Kowalewski M, Żekanowska E. Coronavirus disease 2019 (COVID-19): A short review on hematological manifestations. *Pathogens*. 2020 Jun 20;9(6):493.
- 4) Mehta N, Chen K, Hardy E, Powrie R. Respiratory disease in pregnancy. *Best practice & research Clinical obstetrics & gynaecology*. 2015 Jul 1;29(5):598-611.
- 5) Schwartz DA, Graham AL. Potential maternal and infant outcomes from coronavirus 2019-nCoV (SARS-CoV-2) infecting pregnant women: lessons from SARS, MERS, and other human coronavirus infections. *Viruses*. 2020 Feb 10;12(2):194.
- 6) Goyal LD, Garg P, Verma M, Kaur N, Bakshi D, Arora J. Effect of restrictions imposed due to COVID-19 pandemic on the antenatal care and pregnancy outcomes: a prospective observational study from rural North India. *BMJ open*. 2022 Apr 1;12(4): e059701.
- 7) Singh V, Choudhary A, Datta MR, Ray A. Maternal and neonatal outcomes of COVID-19 in pregnancy: a single-centre observational study. *Cureus*. 2021 Feb 6;13(2).
- 8) Angelidou A, Sullivan K, Melvin PR, Shui JE, Goldfarb IT, Bartolome R, Chaudhary N, Vaidya R, Culic I, Singh R, Yanni D. Association of maternal perinatal SARS-CoV-2 infection with neonatal outcomes during the COVID-19 pandemic in Massachusetts. *JAMA network open*. 2021 Apr 1;4(4): e217523-.
- 9) Gajbhiye RK, Tilve A, Kesarwani S, Srivastava S, Kore SJ, Patil K, Mahale SD, Mahajan NN. Increased rate of miscarriage during second wave of COVID-19 pandemic in India. *Ultrasound in Obstetrics & Gynecology*. 2021 Dec;58(6):946.
- 10) Novoa RH, Quintana W, Llancari P, Urbina-Quispe K, Guevara-Rios E, Ventura W. Maternal clinical characteristics and perinatal outcomes among pregnant women with coronavirus disease 2019. A systematic review. *Travel medicine and infectious disease*. 2021 Jan 1; 39:101919.
- 11) Pereira A, Cruz-Melguizo S, Adrien M, Fuentes L, Marin E, Perez-Medina T. Clinical course of coronavirus disease-2019 in pregnancy. *Acta obstetrica et gynecologica Scandinavica*. 2020 Jul;99(7):839-47.
- 12) Allotey J, Fernandez S, Bonet M, Stallings E, Yap M, Kew T, Zhou D, Coomar D, Sheikh J, Lawson H, Ansari K. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. *bmj*. 2020 Sep 1;370.
- 13) López M, Gonce A, Meler E, Plaza A, Hernández S, Martínez-Portilla RJ, Cobo T, García F, Gomez Roig MD, Gratacos E, Palacio M. Coronavirus disease 2019 in pregnancy: a clinical management protocol and considerations for practice. *Fetal diagnosis and therapy*. 2020 Jul 7;47(7):519-28.
- 14) Vouga M, Favre G, Martínez-Perez O, Pomar L, Acebal LF, Abascal-Saiz A, Hernandez MR, Hcini N, Lambert V, Carles G, Sichitiu J. Maternal outcomes and risk factors for COVID-19 severity among pregnant women. *Scientific reports*. 2021 Jul 6;11(1):13898.
- 15) Nayak MK, Panda SK, Panda SS, Rath S, Ghosh A, Mohakud NK. Neonatal outcomes of pregnant women with COVID-19 in a developing country setup. *Pediatrics & Neonatology*. 2021 Sep 1;62(5):499-505.