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COVID-19 infection in pregnancy, clinical characteristics, maternal and neonatal outcomes among women admitted at KCMC, Tanzania April 2021-March 2022

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Abstract

Introduction: *coronavirus is an enveloped, positive-stranded ribonucleic acid (RNA) virus of the family of coronaviridae belonging to the order Nidovirales. Generally causing respiratory and gastrointestinal infections that might range from mild, self-limiting conditions to more serious disorders, such as viral pneumonia with systemic impairment. This study aims to examine the clinical characteristics, and adverse maternal and neonatal outcomes, and find the association between clinical characteristics and maternal outcomes related to COVID-19 among pregnant women in the KCMC isolation ward.* ***Methods:*** *this study employed a retrospective analytical cross-sectional design at Kilimanjaro Christian Medical Center (KCMC), Northern Tanzania, from April 2021 to March 2022. The research aimed to assess the impact of COVID-19 on maternal and neonatal outcomes among pregnant women admitted to the hospital. Data was collected retrospectively from the hospital's COVID-19 database and birth registry, focusing on women who tested positive or negative for COVID-19 via RT-PCR and met the inclusion criteria. Out of 312 eligible women, 278 were included in the analysis.* ***Results:*** *the study showed that COVID-19 infected pregnant women with RT-PCR positive the most commonly reported symptoms were cough (82.1%), shortness of breath (SOB)/dyspnea (75,9%), chest pain (75.1) fever (61.6%). There were significant differences in Apgar score at 5-minute postdelivery and early neonatal death between pregnant women with and without COVID-19. Cesarean section deliveries were more common 67.3% among COVID-19-positive pregnant women. Also, among pregnant mothers 67.9% were PCR positive and 32.1% died due to COVID-19 related conditions. Study results also revealed no significant relationship between clinical presentation like fever aOR 1.38 (0.57-3.33) p-value 0.473 cough aOR 0.36 (0.11-1.19 p-value 0.094, and maternal mortality of pregnant women with/without COVID-19 infection.* ***Conclusion:*** *understanding disease characteristics, neonatal, and maternal outcomes, and the association between clinical characteristics and maternal death can help clinicians take more care in the early provision of appropriate medical management to patients with COVID-19 symptoms to reduce adverse maternal and neonatal outcomes.*

Introduction

The unusual coronavirus disease (COVID-19) was first recognized in December 2019 in Wuhan, China [1]. Due to its highly contagiousness, the infection blew out quickly reaching all continents, and was declared by the World Health Organization (WHO) as a pandemic on 11th March 2020. There is a high probability the disease is a zoonosis, and its source was probably Wuhan Seafood Wholesale Market, where numerous species of animals, either dead or alive, were being sold for cooking purpose [2]. The COVID-19 pandemic has affected huge numbers of individuals worldwide. Until February 13th 2022, COVID-19 has spread to more than 223 countries, with a total of 411,512,153 confirmed cases and 5,831,23 deaths [3].

Initial information worldwide has shown that elderly (>65 years) individuals with comorbidities and those immunocompromised people are at more risk of getting COVID-19 infection [4]. It is acknowledged that pregnancy is a state of unusual immune tolerance that prejudices women to various infections and those who are infected with COVID-19 are at an increased risk of admission to intensive care units and even death [5]. The presence of comorbidities, like chronic hypertension, obesity, and gestational diabetes are vulnerable factors to severe COVID-19 in pregnancy [6].

World Health Organization (WHO) also nominated pregnant women as a vulnerable group based on preliminary viral infections reports which showed there is an increased risk of stillbirth, preterm birth, fetal growth restriction (FGR), and an increased number of neonatal admissions based on experience with previous respiratory virus outbreaks, including severe acute respiratory

syndrome (SARS), Middle East respiratory syndrome (MERS) and influenza [7]. Tanzania received the first imported case on 16 March 2020 [8].

We have seen quite many patients with features of COVID-19 in our hospital but we had no data to show the burden of COVID-19 infection in pregnancy, clinical characteristics, and maternal and neonatal outcomes in Northern Tanzania so we relied on the data from nearby countries. Most studies have compared the data of pregnant women with non-pregnant women who were admitted with COVID-19 infection but this study uses only pregnant women who were tested COVID-19 by RT- PCR only and describes the clinical characteristics, maternal and neonatal outcomes after being in an isolation ward, all the information from admission till the outcomes of her pregnancy when she was discharged will be traced. Despite the above-discussed clinical characteristics, adverse pregnancy outcomes including maternal and neonatal outcomes to patients attending for care in Northern Tanzania are still unclear. The association between clinical presentation and the maternal outcome is also not known, which is important in providing good care preventing adverse outcomes, and ensuring a healthy mother and child.

Objectives: the broad objective of this study was to investigate the clinical characteristics, maternal and neonatal outcomes, and the association between clinical characteristics and maternal outcomes among pregnant women with COVID-19 admitted to the KCMC isolation ward. The specific objectives were to describe the common clinical characteristics of COVID-19 in pregnant women, determine the maternal outcomes of those testing positive or negative for COVID-19, examine the association between these clinical characteristics and maternal outcomes, and compare the early neonatal outcomes of babies born to mothers who tested positive versus those who tested negative for COVID-19.

Methods

Study design and settings: this was a hospital-based analytical cross-sectional study conducted at Kilimanjaro Christian Medical Center (KCMC) from April 2021 to March 2022. The study was conducted at Kilimanjaro Christian Medical Centre (KCMC) from April 2021 to March 2022, focusing on pregnant women admitted to the Obstetrics and Gynecology isolation ward. Kilimanjaro Christian Medical Center is a tertiary referral hospital located in the Kilimanjaro region in the Northern part of Tanzania, serving patients from the Kilimanjaro region and its neighboring regions in the Northern zone such as Arusha, Manyara, Tanga, and even other parts of the United Republic of Tanzania and sometimes serves people from neighboring countries like Kenya. Kilimanjaro is one of the regions in the Northern part of Tanzania comprised of seven districts, covering 13250 Km^2. The region was projected by the year 2020 to have an estimated population of 1,951,252 people and an annual growth rate of 2.3% [9].

Study population: this study included all multiparous and pregnant patients admitted to the obstetrics and gynecology isolation ward and the regular maternity ward at KCMC Hospital between April 2021 and March 2022. The study population comprised those who tested positive for COVID-19 via RT-PCR and those who showed signs of COVID-19 but tested negative. Patients with missing or pending RT-PCR results and those lacking necessary study variables were excluded from the study. A purposive/deliberate sampling method selected 278 out of 312 admitted pregnant women, resulting in both positive and negative test outcomes. Among these, 122 women tested positive, while 166 tested negative.

Participants: participants in this study were selected based on specific inclusion and exclusion criteria. The inclusion criteria were all pregnant women admitted to the Obstetrics and Gynecology ward during the study period who tested either positive or negative for COVID-19 via RT-PCR.

Women with incomplete data or pending RT-PCR results were excluded from the study. A total of 278 women were purposively selected out of 312 eligible participants, ensuring a representative sample of both COVID-19 positive and negative cases. This study included all multiparous and pregnant patients admitted to the obstetrics and gynecology isolation ward and the regular maternity ward at KCMC Hospital between April 2021 and March 2022. The study population comprised those who tested positive for COVID-19 via RT-PCR and those who showed signs of COVID-19 but tested negative. Patients with missing or pending RT-PCR results and those lacking necessary study variables were excluded from the study. A purposive/deliberate sampling method selected 278 out of 312 admitted pregnant women, resulting in both positive and negative test outcomes. Among these, 122 women tested positive, while 166 tested negative.

Variables: the study focused on key variables related to COVID-19 infection during pregnancy, including outcomes, exposures, predictors, confounders, and effect modifiers. The primary maternal outcomes assessed were the mode of delivery (cesarean section or spontaneous vaginal delivery) and maternal mortality, with a higher incidence of cesarean sections and maternal deaths observed among COVID-19-positive mothers. Neonatal outcomes included Apgar scores at 1 and 5 minutes post-delivery, neonatal death rates, premature births (before 37 weeks of gestation), and low birth weight (less than 2.5 kg). The central exposure was maternal COVID-19 infection, determined by RT-PCR testing. Predictors analyzed included maternal age, the presence of comorbidities, the severity of COVID-19 symptoms (such as cough, shortness of breath, and fever), gestational age at delivery, and gravidity. These factors were crucial in evaluating the impact of COVID-19 on maternal and neonatal health. Potential confounders, including maternal age, comorbidities, and gravidity, were controlled for in the analysis to ensure an accurate assessment of the relationships between COVID-19 and the outcomes. Effect modifiers explored in the study included the severity of COVID-19 infection and the mode of delivery, both of which could influence maternal and neonatal outcomes. Diagnostic criteria used in the study included confirmation of COVID-19-positive status through RT-PCR testing, defining preterm labor as occurring before 37 weeks of gestation, low birth weight as less than 2.5 kg, and maternal mortality as death within 42 days post-pregnancy related to the pregnancy or its management. These criteria provided a robust framework for understanding the impact of COVID-19 on pregnancy and neonatal outcomes.

Data source/measurement: data for this study were meticulously extracted from the KCMC-COVID-19 database and the KCMC birth registry. These sources provided comprehensive information on the variables of interest, ensuring that the data collection process was thorough and consistent. The measurement of outcomes was standardized across the study population to ensure consistency in the analysis. For instance, Apgar scores were systematically recorded at 1 and 5 minutes post-delivery, while neonatal outcomes were categorized based on NICU admission status and survival rates. This standardized approach helped maintain the reliability and validity of the study´s findings, enabling a robust analysis of the impact of COVID-19 on maternal and neonatal outcomes.

Bias: to address potential confounding variables, such as age and gestational age, multivariate analyses were performed. This helped isolate the effects of these variables on the study outcomes. Additionally, data consistency was maintained by employing standardized data extraction forms, which were used to cross-check and verify information from the birth registry and hospital COVID-19 database. These measures ensured a more accurate and reliable analysis, minimizing the impact of bias on the study's findings.

Study size: the sample size was determined by the total number of eligible participants during the study period. Out of the 312 pregnant women

admitted, 278 met the inclusion criteria and were included in the analysis.

Quantitative variables: quantitative variables, such as age and gestational age, were analyzed as both continuous and categorical variables where appropriate. For example, age was categorized into three groups: 18-27 years, 28-37 years, and over 37 years, to explore potential age-related differences in outcomes. Gestational age was also categorized into early preterm, late preterm, and term, to assess its impact on neonatal outcomes. Statistical analyses included the use of logistic regression to explore the relationship between clinical characteristics and maternal mortality, adjusting for potential confounders. Fisher´s exact test and Chi-square tests were employed for the analysis of categorical variables, with a p-value of less than 0.05 considered statistically significant.

Qualitative variables: qualitative variables in this study included maternal status (alive or deceased), mode of delivery (cesarean section or spontaneous vaginal delivery), and clinical symptoms (e.g. presence of fever, cough, shortness of breath). These variables were categorized into binary or nominal categories. For instance, maternal status was coded as a binary variable (1 for alive, 0 for deceased), while the mode of delivery was categorized into two groups: cesarean section (C/S) and spontaneous vaginal delivery (SVD). Clinical symptoms were treated as dichotomous variables (presence or absence of symptoms such as fever, cough, and shortness of breath). These qualitative variables were analyzed using Chi-square tests for associations with categorical outcomes, and logistic regression models were employed to assess the relationship between these variables and the risk of maternal death, adjusting for potential confounders.

Statistical methods: the study employed both descriptive and inferential statistical techniques to analyze the data. Descriptive statistics were summarized using frequencies, percentages, means, and standard deviation values, and were presented in tables and figures for clear visualization. Logistic regression was employed to determine associations between clinical characteristics and maternal death, utilizing crude odds Ratios (cOR) with a significance level (α) of <0.05 and a 95% confidence interval (95% CI) to measure the magnitude of the association. In the univariate analysis, characteristics with odds ratios (OR) exceeding 1 were identified for further exploration. A multivariate analysis was then conducted to calculate adjusted odds ratios (aOR) and control for potential confounding characteristics. Additionally, Fisher's exact test and Chi-square tests were used to examine the relationship between maternal outcomes and PCR results. Cleaned datasets were analyzed by using IBM SPSS Statistics version 23.0.

During the recruitment phase, cases with missing variables and incomplete PCR results were excluded. The study focused on subgroup analyses by categorizing participants based on their COVID-19 polymerase chain reaction (PCR) test results (positive vs. negative) and examining variations in clinical characteristics, maternal outcomes, and neonatal outcomes. Logistic regression analysis was also used to explore interactions between clinical characteristics and outcomes, such as maternal death and neonatal health. The study adopted a retrospective design with purposive sampling to select 278 pregnant women tested for COVID-19, ensuring targeted representation, particularly in delivery outcomes and neonatal health. While the study focused on controlling for confounding factors through multivariate analysis, it did not explicitly mention conducting sensitivity analyses.

Ethical consideration: ethical clearance certificate No. PG. 138/2022 was obtained from the Tumaini University College Research Ethical Committee and the KCMU College Research Ethics Review Committee before initiating the study. Permission was also granted by the Head of the Department of Obstetrics and Gynecology and the Administration to obtain data from the KCMC COVID-19 database and birth registry. Privacy and confidentiality were maintained by using serial numbers instead of

names to ensure the anonymity of patient information.

Results

Recruitment of the study participants: the study included 278 pregnant women tested for COVID-19, with 112 testing positive and 166 negative via PCR. Among these, 112 multiparous women gave birth during the study period. Neonatal outcomes were analyzed for 122 babies born to PCR-positive mothers and 166 babies born to PCR-negative mothers (Figure 1).

Demographic characteristics of the study participants: a total of 278 pregnant women were tested for COVID-19 and were admitted. The participants aged 98 (35.3%) ranged between 28 to 37 years old and overall had a median (IQR) of 38 (30 - 42). Of the participant's addresses, 93 (33.5%) came from Moshi DC, and 78 (28.1%) from Moshi MC. Also, 151 (54.3%) had 2 to 3 on gravidity. Participants' gestational age, 162 (58.3%) had ≥37 (term pregnancy). Of the hospital duration, 162 (58.3%) stayed for more than a week with a median (IQR) of 9.0 (3.0 - 28.5) days (Table 1).

The common clinical characteristics of COVID-19 infection in pregnancy by polymerase chain reaction status: the common clinical characteristics of COVID-19 in pregnancy, categorized by PCR status among 278 cases (166 negative and 112 positive), include fever or chills in 52.4% of PCR-negative and 61.6% of PCR-positive cases; cough in 81.9% of PCR-negative and 82.1% of PCR-positive cases; shortness of breath in 80.7% of PCR-negative and 75.9% of PCR-positive cases; chest pain in 58.4% of PCR-negative and 75.0% of PCR-positive cases; and loss of smell or taste in 2.4% of PCR negative and 8.9% of PCR-positive cases. General body weakness or fatigue was common in both groups. Among 278 pregnant women, 112 (40.3%) were COVID-19 PCR positive. The clinical characteristics most commonly presented by COVID-19-positive women were 92 (82.1%) coughing, 85 (75.9%) shortness of breath, 84 (75.0%) chest pain, and 69 (61.6%) fever. For COVID-19-negative women, the most common symptoms were 136 (81.9%) coughing, 134 (80.7%) shortness of breath, 97 (58.4%) chest pain, and 87 (52.4%) fever (Table 2).

The relationship between maternal outcomes and the mode of delivery in mothers with COVID-19 who tested polymerase chain reaction positive and negative: the relationship between maternal status and PCR outcomes was analyzed among 278 women. Of these, 91.6% of PCR-negative mothers were alive compared to 67.9% of PCR-positive mothers. Conversely, 8.4% of PCR-negative mothers and 32.1% of PCR-positive mothers were deceased. The Chi-square test yielded a value of 25.486 with a p-value of 0.000, indicating a significant association between COVID-19 status and maternal survival. These findings suggest that COVID-19 positivity significantly impacts maternal mortality (Table 3) and (Figure 2). The mode of delivery among 278 pregnant women with COVID-19, categorized by PCR status, was also examined. Among PCR-negative women, 32.6% underwent cesarean sections (C/S) and 67.4% had spontaneous vaginal deliveries (SVD). For PCR-positive women, 86% had C/S and 14% had SVD. This indicates a strong association between COVID-19 status and the choice of delivery method (Table 4) and (Figure 3).

Association between clinical characteristics and maternal outcomes: logistic regression was used to identify the clinical characteristics associated with maternal outcomes, using crude odds ratio (cOR) with a p-value <0.05 and 95% CI. Characteristics with OR >1 from univariate analysis were included in multivariate analysis to adjust for confounders, yielding adjusted odds ratios (aOR). Women over 37 years had significantly lower odds of maternal death compared to those aged 18-27 years (aOR 0.14, 95% CI: 0.03-0.66, p=0.013). Similarly, term pregnancies (≥37 weeks) were associated with lower odds of maternal death (aOR 0.20, 95% CI: 0.08-0.53, p=0.001) Other factors, such as gravidity, length of hospital stay, and most symptoms, did not

show significant associations. An exception was the loss of smell or taste, which significantly increased the odds of maternal death (aOR 6.62, 95% CI: 1.57-27.81, p=0.010) (Table 5).

Early neonatal outcome of babies delivered by COVID-19 mothers: among the babies who died, 65.4% were PCR positive, whereas 34.6% were PCR negative. In contrast, of the babies who survived, 73.3% were PCR negative, and 26.7% were PCR positive. Regarding Apgar scores, 63.6% of babies with a score less than 7 were PCR positive, compared to 36.4% who were PCR negative. For babies with an Apgar score of 7 or higher, 73.4% were PCR negative, while 26.6% were PCR positive. These findings suggest that PCR-positive babies had poorer outcomes, reflected by higher mortality rates and lower Apgar scores, compared to PCR negative babies (Table 6).

Discussion

Results from this study showed that COVID-19-infected pregnant women with RT-PCR positive, the most commonly reported symptoms were cough (82.1%), shortness of breath (SOB)/dyspnoea (75,9%), chest pain (75.1) fever (61.6%), fatigue/malaise/general body weakness (68,8%), and anosmia/ageusia (18.8%) as the same symptoms observed in pregnant women with RT-PCR negative group. Among Pregnant women, there was higher CS delivery by 47% due to COVID-19-related conditions followed by 44% who delivered by SVD. Cesarean section deliveries were more common (67.3%) among COVID-19-positive pregnant women than among COVID-19-negative women (33.7%). Among pregnant mothers who delivered 242 (87%) were alive of which 76 (67.9%) were PCR positive and (32.1%) died due to COVID-19-related conditions compared to 9% who died due to other causes not related to COVID-19 from PCR negative group and the United Kingdom [10] COVID-19-infected pregnant women also reported similar results.

The study findings suggest that COVID-19 infection was more prevalent at 51.1% among older pregnant women ≥37 years than younger ones ≤37 years. The study result is similar to a report given by the CDC which reported that pregnant women aged 35-44 years with COVID-19 infection were about 4 times more likely to require invasive ventilation and 2 times more likely to die than nonpregnant women of the same age group [7]. The maternal mortality differed between studies, our study showed there were more maternal deaths in the group of COVID-19 RT-PCR positive mothers than in a group RT-PCR negative, the factors mostly affecting maternal mortality were disease severity and maternal age. Results also revealed no significant relationship between clinical presentation like fever aOR 1.38 (0.57-3.33) p-value 0.473 cough aOR 0.36 (0.11-1.19 p-value 0.094, difficulty in breathing/shortness of breath aOR 0.65 (0.19-2.14) p-value 0.481 and maternal mortality of pregnant women with or without COVID-19. Nevertheless, evidence about the relationship between SARS-CoV-2 and morbidity and mortality from obstetric complications is limited and mixed, our study results are similar to the study done by [4,11] which showed that the relationship between COVID-19 and maternal death was not significant.

The present study shows that among 254 babies delivered, 116 (42%) of neonates born were preterm babies and all were admitted to the NICU. Eighty-eight (88 (75.8%)) neonates were from COVID-19 positive mothers compared to 28 (24.2%) who were from COVID-19 negative mothers. Fifty-five (55 (20.5%)) were admitted to NICU due to a low Apgar score of below 7 at 5 minutes and among them 35 (63.6%) were born from mothers with COVID-19 positive. In our study, early neonatal death was high 52 (20.5%), and among term 34 (65.4%) died from mothers who were COVID-19 positive compared to 18 (34.6) who died from mothers with COVID-19 negative group.

Strength: the study included a comparison group of COVID-19-negative pregnant women, enabling a more comprehensive analysis of the impact of COVID-19 on maternal and neonatal outcomes. As

an analytical cross-sectional study conducted in a hospital setting, it ensured high accuracy and detail in data collection. Utilizing diverse data sources, including clinical characteristics, laboratory test results, and maternal and neonatal outcomes from medical records, the study enhanced the depth and comprehensiveness of its analysis. Furthermore, the use of a meticulously crafted extraction checklist in Excel format ensured consistency and precision in data collection, significantly contributing to the overall reliability and validity of the study findings.

Limitations: the relatively small sample size from a single tertiary referral hospital restricts the generalizability of the results to larger populations. Despite conducting a multivariate analysis, the possibility of residual confounding factors influencing the results cannot be completely ruled out. Furthermore, due to limited time and poor record-keeping at nearby hospitals during the pandemic, data from other peripheral hospitals could not be included, potentially limiting the comprehensiveness of the study.

Conclusion

In our study, the most common clinical presentation of COVID-19 infection in pregnancy was a cough, shortness of breath (SOB)/dyspnoea chest pain, fever, fatigue/malaise/general body weakness but there was no significant difference between pregnant mothers with and without COVID-19. Also, it was observed neonatal death was high at 65.4% in neonates who were born from COVID-19-positive mothers compared to 34.6% from COVID-19-negative groups. Furthermore, a low Apgar score of ≤7 at 5 minutes was 63.6% among neonates born from mothers with COVID-19 positive compared to 36.4% which was observed in neonates born from COVID-19 negative mothers. Pregnant women with COVID-19 are at higher risk of C/S and maternal mortality compared to those without COVID-19. In our study, we found there was no association between clinical characteristics and maternal outcome.

Recommendations: clinicians should take more care in the provision of appropriate medical management to patients with COVID-19 symptoms to reduce adverse maternal and neonatal outcomes observed. Additional studies are needed on COVID-19 severity during pregnancy and the causal-effects relationship among COVID-19 pregnant women.

What is known about this topic

- *COVID-19 has a significant impact on pregnant women and their babies worldwide;*
- *The data we have are not from Northern Tanzania.*

What this study adds

- *The study documents maternal health outcomes, including rates of severe illness, ICU admissions, and maternal mortality; this helps identify risk factors prevalent in the Tanzanian context that may contribute to severe outcomes;*
- *Data on maternal and neonatal outcomes can support the development of targeted vaccination campaigns for pregnant women.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Emmanuel Chogo, John Lugata and Upendo Kibona designed the study and drafted the manuscript; Florida Muro, Olola Oneko, and Pendo Mlay analyzed the data; all authors verified the data and analysis; Emmanuel Chogo and Innocent Kamwamwa performed inclusion, collected all study data, and follow-up of all patients. All the authors read and approved the final version of this manuscript.

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Tables and figures

Table 1: demographic characteristics of the study participants (n=278)

Table 2: the common clinical presentation of COVID-19 infection during pregnancy (N=278)

Table 3: the common clinical presentation of COVID-19 infection in pregnancy by PCR status (n=278)

Table 4: common mode of delivery for pregnant mothers based on PCR outcome (positive/negative)

Table 5: bivariate and multivariable logistic regression showing an association between clinical characteristics of pregnant women and maternal outcome (n=278)

Table 6: early neonatal outcomes of babies by PCR outcome (positive/negative) gestation age of babies delivered by COVID-19 PCR positive/negative mothers

Figure 1: recruitment of participants and distribution of cases among pregnant women at KCMC

Figure 2: common mode of delivery

Figure 3: association between maternal status and PCR outcomes (positive/negative)

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Table 1: demographic characteristics of the study participants (n=278)

Demographic characteristics	**N**	**%**
Age (in years), category; median (IQR)	38 (30 – 42)	
18-27	38	13.7
28-37	98	35.3
>37	142	51.1
Address		
Moshi MC	78	28.1
Moshi DC	93	33.5
Same	11	4.0
Mwanga	7	2.5
Hai	25	9.0
Rombo	13	4.7
Others	51	18.3
Gravidity		
Prime	41	14.7
2-3	151	54.3
>3	86	30.9
G/age		
<34 (early preterm)	50	18.0
34-36(late preterm)	66	23.7
>(term)	162	58.3
LHS (days); median (IQR)	9.0 (3.0 28.5)	
≤7	116	41.7
>7	162	58.3

IQR-interquartile range, MC-municipal council, DC- district council

Table 2: the common clinical presentation of COVID-19 infection during pregnancy (N=278)		
Common clinical presentation	**n**	**%**
Fever/chills	156	56.1
Headache	73	26.3
Nausea/vomiting	43	15.5
Cough	228	82.0
Shortness of breath/difficulty in breathing	219	78.8
Chest Pain	181	65.1
General body weakness/fatigue	176	63.3
Sore throat	30	10.8
Loss of smell or taste	14	5.0
Diarrhea	24	8.6

Table 3: the common clinical presentation of COVID-19 infection in pregnancy by PCR status (n=278)			
Maternal status	**PCR (outcomes)**		**Row total**
	Negative	**Positive**	
Alive	n=152	n=76	n=228
	Row %; 152/228=66.7%	Row %; 76/228=33.3%	
	Column%; 152/166=91.6%	Column%; 76/112=67.9%	
Dead	n=14	n=36	n=50
	Row %;14/50= 28.0%	Row %; 36/50=72.0%	
	Column%; 14/166=8.4%	Column%; 36/112=32.1%	
Column total	n=166	n=112	n=278
Footnote Chi-square value=25.486, p-value=0.000			

Table 4: common mode of delivery for pregnant mothers based on PCR outcome (positive/negative)				
The common mode of delivery	**Negative**		**Positive**	
	n	**%**	**n**	**%**
C/S	56	33.7	76	86.4%
SVD	110	66.3	12	13.6%
TOTAL	166	100%	88	100%
Footnote: S-Cesarean Section, SVD-spontaneous vaginal delivery				

Table 5: bivariate and multivariable logistic regression showing an association between clinical characteristics of pregnant women and maternal outcome (n=278)				
Clinical characteristics	**Maternal death**			
	cOR(95%CI)	**p-value**	**aOR(95%CI)**	**p-value**
Age (years), category; median (IQR)				
18-27	Ref		ref	
28-37	0.56(0.24-1.43)	0.242	0.48(0.12-1.92)	0.298
>37	0.19(0.07-0.51)	0.001	0.14(0.03-0.66)	0.013
Gravidity				
Prime	Ref		ref	
2-3	0.42(0.17-1.04)	0.061	1.34(0.33-5.42)	0.678
>3	0.52(0.19-1.38)	0.190	2.35(0.52-12.01)	0.253
G/age				
<34 (early)	Ref		ref	
34-36(late)	0.43(0.18-1.02)	0.056	0.61(0.23-1.61)	0.323
≥37(term)	0.13(0.05-0.31)	0.000	0.20(0.08-0.53)	0.001
LHS (days); median (IQR)				
≤7	Ref		ref	
>7	1.74(0.82-3.70)	0.156	1.85(0.76-4.49)	0.177
Fever/chills				
No	Ref		ref	
Yes	1.11(0.55-2.26)	0.774	1.38(0.57-3.33)	0.473
Headache				
No	Ref		ref	
Yes	1.28(0.59-2.75)	0.531	0.98(0.37-2.59)	0.960
Nausea/vomiting				
No	Ref		ref	
Yes	1.69(0.71-4.01)	0.234	1.56(0.52-4.77)	0.429
Cough				
No	Ref		ref	
Yes	0.52(0.23-1.15)	0.106	0.36(0.11-1.19)	0.094
Shortness of breath/difficulty in breathing				
No	Ref		ref	
Yes	0.07(0.29-1.46)	0.305	0.65(0.19-2.14)	0.481
Chest pain				
No	Ref		ref	
Yes	1.25(0.59-2.67)	0.559	1.53(0.48-4.87)	0.474
General body weakness/fatigue				
No	Ref		ref	
Yes	1.59(0.74-3.46)		2.79(0.91-8.58)	0.072
Sore throat				
No	Ref		ref	
Yes	0.45(0.10-1.97)	0.290	0.23(0.04-1.37)	0.106
Diarrhea				
No	Ref		ref	0.227
Yes	0.56(0.13-2.62)	0.486	0.34(0.06-1.96)	
Footnote: COR=Crude Odds Ratio; AOR= Adjusted Odds Ratio; Bolded p-value indicates significance at <0.05				

Table 6: early neonatal outcomes of babies by PCR outcome (positive/negative) gestation age of babies delivered by COVID-19 PCR positive/negative mothers		
Early neonatal outcome	**n**	**%**
Baby status		
Died	52	20.5
Alive	202	79.5
Apgar score		
<7	55	21.7
≥7	199	78.3

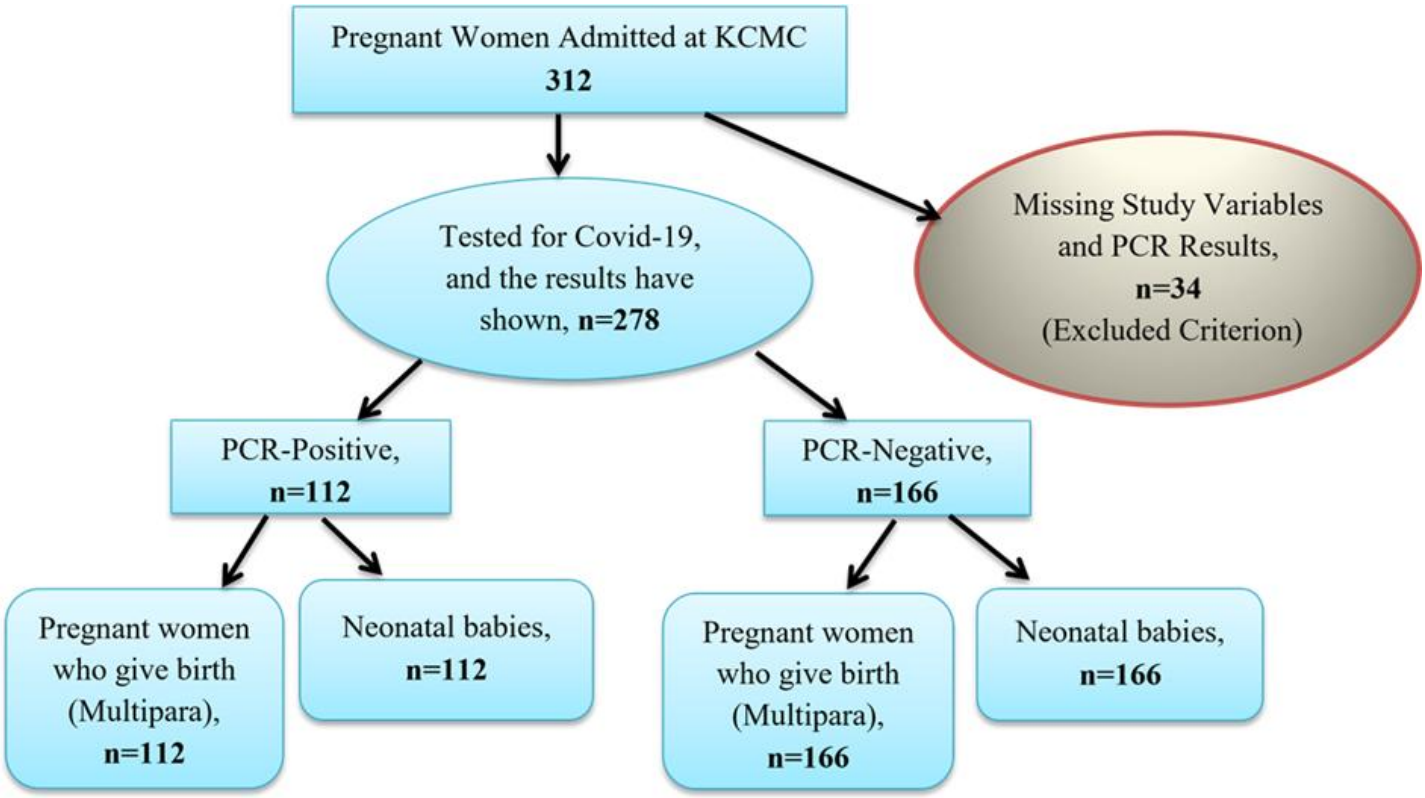

Figure 1: recruitment of participants and distribution of cases among pregnant women at KCMC

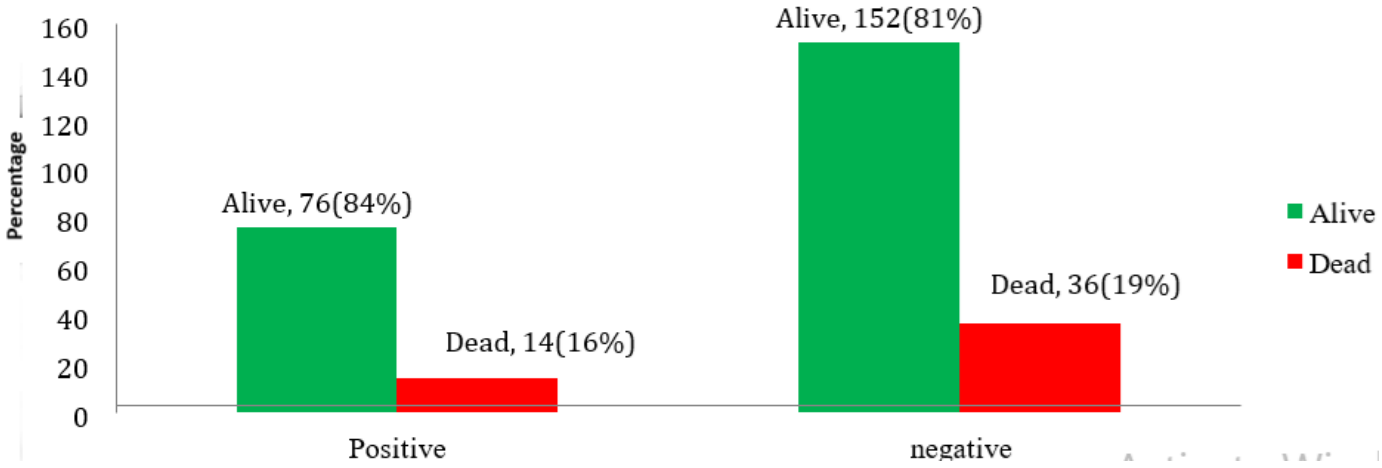

Figure 2: common mode of delivery

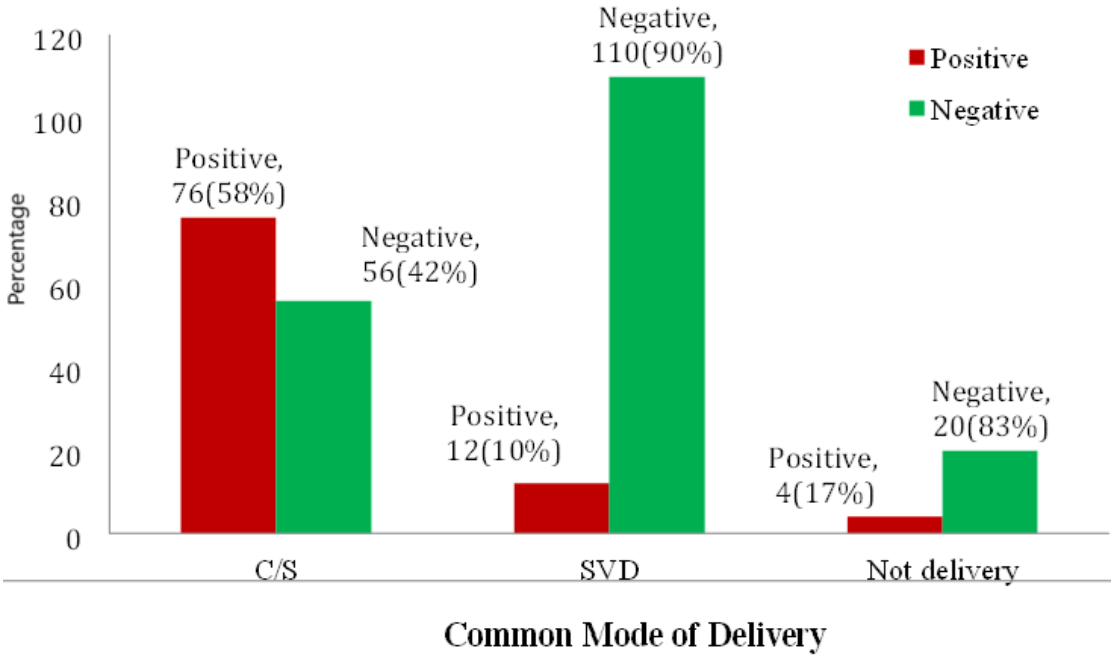

Figure 3: association between maternal status and PCR outcomes (positive/negative)