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Maternal and Immediate Neonatal Morbidity and Mortality Associated with COVID-19: A Retrospective Cohort Study at Georgetown Public Hospital Corporation

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ABSTRACT

Introduction: Previous outbreaks of coronavirus (SARS-CoV-1) and Middle East respiratory syndrome coronavirus (MERS-CoV) have been associated with unfavorable pregnancy outcomes. With SARS-CoV-2 infection, emerging data suggest that pregnancy may be associated with increased maternal morbidity and mortality. This study describes maternal and immediate neonatal outcomes among COVID-19-positive pregnant women delivering at Georgetown Public Hospital Corporation.

Material & Methods: A retrospective cohort study was conducted on 301 pregnant patients diagnosed with COVID-19 and their neonates who delivered at GPHC during the study period. Maternal demographic variables, comorbidities, clinical features, and neonatal outcomes were extracted from medical records. Data were analyzed using SPSS version 23. Descriptive statistics and measures of association were calculated.

Results: COVID-19-related maternal complications occurred in 2.9% of patients. The maternal case fatality rate was 1.6% (5 out of 301 cases), with all deaths occurring in patients admitted to the ICU. The mean maternal age was 24.9 years (S.D. 6.8 years). Most patients had no comorbidities (76.3%); Pregnancy-induced hypertension was the most common comorbidity, 11.7% (n=35). Fever was the most frequently reported symptom (65.1%), while 26.3 % were asymptomatic. Neonatal outcomes were generally favorable; 85.0% experienced no complications. No statistically significant association was found between maternal COVID-19-related complications and neonatal complications.

Conclusions: COVID-19-related complications were uncommon in this cohort; however, a small yet significant burden of maternal mortality was observed, particularly among critically ill patients requiring ICU care. Neonatal outcomes remained largely favorable. These findings highlight the need for vigilance and timely management of severe maternal COVID-19 infection.

Keywords: Georgetown Public Hospital Corporation, Guyana, COVID-19 in pregnancy, SARS-CoV-2, maternal mortality, neonatal mortality, Developing countries, pregnancy

INTRODUCTION

Coronaviruses are a group of related viruses that infect both animals and humans; however, several coronaviruses that infect

animals are not transmitted to humans. The first human coronavirus was first detected in the mid-1960s, and since then, multiple strains have been discovered, including the highly pathogenic viruses responsible for major outbreaks in the 21st century. [1] Over the past two decades, the world has experienced significant public health impacts from three highly contagious coronaviruses: Severe Acute Respiratory Syndrome (SARS-CoV-1) in 2003, Middle East Respiratory Syndrome (MERS-CoV) in 2012, and most recently, severe acute respiratory syndrome (SARS-CoV-2). [2] Both SARS-CoV-1 and MERS-CoV have been associated with unfavorable pregnancy outcomes.

In 2019, SARS-COV-2 emerged in Wuhan, China, and it was declared the 6th public health emergency of national concern on Jan 30 2020. On Mar 11 2020, the SARS-COV-2 infection was declared the first global pandemic of the 21st century by the WHO. [3,4] The International Committee on Taxonomy of Viruses (ICTV) later renamed it Severe Acute Respiratory Syndrome Coronavirus-2.[4]

Research has shown that due to the immunologic and physiological changes that occur in pregnancy, pregnant patients are more susceptible to respiratory illnesses and intolerance to hypoxia and, therefore, require more surveillance.

Early in the COVID-19 pandemic, approximately 2.5 million infections and 169,000 deaths had been reported globally. A WHO-China joint mission concluded that pregnant patients were not at a higher risk for developing the severe disease due to COVID-19; the report, however, did not examine neonatal outcomes. [5] Up to that time, there were no reported maternal deaths associated with COVID-19 until a multi-institution case series in Iran found seven maternal deaths from COVID-19 infection.[6]

Subsequent larger studies challenged these early assumptions. A multinational cohort study involving 43 institutions from 18 countries found that pregnant patients with COVID-19 were 22 times more likely to experience an adverse pregnancy outcome compared to their counterparts, with a maternal mortality rate of 1.6%.[7] Similarly, a study from Brazil reported 20 maternal deaths within 45 days, with asthma identified as the most common comorbidity. [8]

Conversely, a retrospective study conducted at Georgetown Public Hospital Corporation (GPHC), Guyana, between August 2020 and April 2021 found no significant impact of COVID-19 on maternal or neonatal outcomes.[9] These contrasting findings suggest that outcomes may vary by geographic region, population characteristics and health care system capacity.

Given these inconsistencies, further local data are needed. Therefore, this study aims to describe the maternal and immediate neonatal morbidity and mortality associated with COVID-19 infection among pregnant patients delivering at GPHC, the national referral hospital of Guyana.

MATERIALS & METHODS

This retrospective cohort study was conducted at the Obstetrics and Gynecology Department of GPHC, and included all pregnant patients admitted and delivered with a diagnosis of COVID-19, and their neonates between Mar 11 2020 and Mar 31 2022. The primary objectives were to assess maternal morbidity and mortality associated with COVID-19 infection and to determine whether comorbidities were associated with worsening maternal outcomes. The Secondary objectives included describing clinical features of COVID-19 in pregnancy and examining whether the severity of maternal infection influenced neonatal outcomes.

All pregnant patients with a laboratory-confirmed diagnosis of COVID-19 (molecular or rapid antigen), irrespective of gestational age at the time of diagnosis, who were admitted and subsequently delivered or aborted at GPHC, as well as the newborns, were included. Pregnant patients

diagnosed with COVID-19 in the postpartum period and those diagnosed during pregnancy but who delivered outside of GPHC were excluded.

Eligible charts were identified from the institutional COVID-19 maternity database using consecutive sampling to minimize selection bias. Data collection was carried out from June 2023 to December 2023.

The primary exposure was laboratory-confirmed SARS-CoV-2 infection, categorized by severity according to WHO Criteria (mild, moderate, severe or critical). Primary outcomes were maternal morbidity (including respiratory failure, hypertensive complications, and ICU admission) and maternal mortality. Variables collected included maternal age, parity, administrative region, comorbidities, clinical presentation, gestational age at delivery, mode of delivery, and maternal complications. Neonatal variables included gestational age, birthweight, Apgar scores, NICU admissions, neonatal COVID-19 status, and neonatal complications. Comorbidities assessed included asthma, hypertension (chronic or pregnancy-related), diabetes, obesity, and other preexisting medical disorders documented in the charts.

Statistical analyses

Data were extracted from medical records using a standardized form by two independent reviewers, with discrepancies resolved by consensus. Missing data were recorded as "not documented" and handled on a variable-by-variable basis without imputation. Misclassification bias was minimized by using laboratory-confirmed COVID-19 results, and including all consecutively identified cases reduced selection bias. The study size reflected all eligible patients identified during the study period; therefore, no a priori sample size calculation was performed. Quantitative variables, such as maternal age and birthweight were analyzed as continuous measures; birthweight was also categorized according to the WHO low birthweight thresholds when appropriate.

STATISTICAL ANALYSIS

A total of 686 charts were identified in the COVID-19 database, and 301 met the inclusion criteria. Data were entered into Microsoft Excel and analyzed using SPSS version 23. Measures of frequency (counts and percentages), central tendency (mean), and dispersion (range and standard deviation) were calculated. Categorical variables were compared using chi-square tests, and continuous variables were compared using t-tests or Mann-Whitney U tests, depending on distribution. Confounding was assessed using stratified analyses. A p-value <0.05 was considered statistically significant. All data were stored on a password-protected computer with restricted access.

RESULT

A total of 301 patients met the inclusion criteria for this study. **Table 1** presents their demographic characteristics. Maternal age ranged from 13 to 43 years, with a mean age of 24.9 years. Amerindians were the most frequently affected ethnic group, accounting for 27.0% (n=81), while East Indians constituted 13.6% (n=41). Most patients were from Administrative Region $ (44.2%, n=133), followed by region 1 (21.0%, n=63). Regions 2,5, and 9 had the lowest case numbers.

COVID-19-related maternal complications occurred in 2.9% (n=9) of patients (**Table 2**). Of these, 56% (n=5 out of 9) resulted in maternal death, corresponding to an overall case fatality rate of 1.6% (n=5 out of 301). Four of the five deaths occurred at gestational ages <37 weeks, and one patient died with an intrauterine fetus at 20 weeks. One patient underwent a perimortem cesarean delivery but did not survive. Among the women who developed complications, eight presented with multiple symptoms, while one was asymptomatic. ICU admission and intubation were required for 1.9% (n=6) of the cohort, and all maternal deaths occurred among patients who were admitted to the ICU and intubated.

Regarding comorbidities, 76.7% (n=231) had none,21.3% (n=63) had one and 2.3% (n=7) had two comorbidities. Pregnancy-induced hypertension was the most common comorbidity (11.7%, n=35). Asthma and chronic hypertension were also observed, but less frequently. Among patients who developed COVID-19 complications,55.6% (n=5 out of 9) had no comorbidities. Asthma was present in 22.2% (n=2 out of 9) (p=0.005), and diabetes with pregnancy-induced hypertension was present in another 22.2% (n=2 out of 9) (p=0.001). Among the maternal deaths, 40% (n=2 out of 5) had both diabetes and PIH, 40% (n=2 out of 5) had asthma, and one death occurred in the absence of any comorbidity (**table 3**).

Most patients (71.0%, n=214) experienced one symptom, while 22.0% (n=66) were asymptomatic. Smaller proportions experienced two (3.9%, n=12) or three symptoms (2.9%, n=9). Fever was the most common symptom (65.1%, n=196). Among the patients with COVID-19-related complications, shortness of breath was the most frequent presenting symptom (n=4 out of 9) (P=0.0004), followed by dry cough (n=2 out of 9) (**table 3**). As shown in **graph 1**, patients with comorbidities were slightly more likely to be symptomatic than those without (77.5% vs 72.5%), although this difference was not statistically significant (p=0.498).

Most deliveries occurred at term (37-40 weeks). Vaginal delivery accounted for 65.7% (n=197) of births. Among cesarean deliveries, the most common indication was fetal distress (39.2%, n=40) (**graph 2**). More than half of the patients were admitted for 1-3 days (51.3%, n=154), and 83.0% (n=250) had an estimated blood loss <500mls (**table 1**)

Table 4 summarizes neonatal outcomes. Among the neonates born to mothers with COVID-19- related complications, 11.1% (n=1 out of 9) developed hyperbilirubinemia, and 11.1% (n=1 out of 9) had presumed sepsis. Neonatal mortality was higher among mothers with complications (22.2%, n=2 out of 9) compared with those without complications (1.3%). One fetus died in utero at 20 weeks due to the maternal death. Of the five neonatal deaths overall, 40% (n=2 out of 5) occurred among mothers with COVID-19-related complications. Chi-square analysis showed no statistically significant association between maternal and neonatal complications across the categories assessed.

Table 1. Demographic Characteristics and their relation to COVID complications

			COVID Complications			Chi-square
	Frequency	**Percentage**	**Absent**	**Present**	**Death****	
Grand Total	**300**	**100%**	**292**	**8**	**4**	
Age						**0.128**
< 15	6	2.0%	6	-	-	
15 – 19	61	20.3%	61	-	-	
20 – 25	108	36.0%	107	1	-	
26 – 35	95	31.7%	90	5	3	
> 35	29	9.7%	28	1	1	
Not stated	1	0.3%	1	-	-	
Ethnicity						**0.10**
African	69	23.0%	69	-	-	
East Indian	40	13.3%	38	2	1	
Amerindian	81	27.0%	80	1	-	
Mixed	72	24.0%	69	3	1	
Not stated	38	12.7%	36	2	2	
Parity						**0.05**
Nulliparous	130	43.3%	127	3	1	
Low multiparous	135	45.0%	132	3	2	
Gran Multiparous	31	10.3%	31	-	-	
Great Gran Multiparous	4	1.3%	-	2	1	
Mode of Delivery						**0.60**

Vaginal delivery	197	65.7%	193	4 (50.0%)	1	
Caesarean section	102	34.0%	99	3 (37.5%)	2	
Not delivered	1	0.3%	-	1 (12.5%)	1**	
Blood loss						**0.35**
Not Stated	12	4.0	11	1 (12.5%)	1*	
< 500 ml	249	83.0	242	7 (87.5%)	3	
500 – 1000 ml	34	11.3	34	-	-	
> 1000 – 1500 ml	2	0.7	2	-	-	
> 1500 ml	3	1.0	3	-	-	
Blood Transfusion	15	5.0	14	1 (12.5%)	**1**	**0.88**
Administrative Region						**0.73**
Region 1	**63**	21%	63	-	**-**	
Region 2	3	1.0%	3	-	**-**	
Region 3	24	8%	23	1	**-**	
Region 4	132	44%	127	5	**3**	
Region 5	3	1%	3	-	**-**	
Region 6	25	8.3%	24	1	**1**	
Region 7	16	5.3%	15	1	**-**	
Region 8	16	5.3%	16	-	**-**	
Region 9	3	1%	3	-	**-**	
Region 10	14	4.7%	14	-	**-**	

**** Died with fetus in utero. *Undocumented**

Table 2: Incidence of Maternal Complications

Maternal Complications	**Frequency**	**Percentage**
Grand Total	**300**	**100.00%**
No Complications	239	79.7%
Obstetric Complications	52	17.3%
Cardiac Arrest from High Spinal Anesthesia	1	0.3%
COVID Complications	8	2.7%
ARDS & Pneumonia	2	**25%**
Pneumonia	1	**12.5%**
Pneumonia & PE	1	**12.5%**
Pneumonia_ ARDS_ Death	4	**50%**

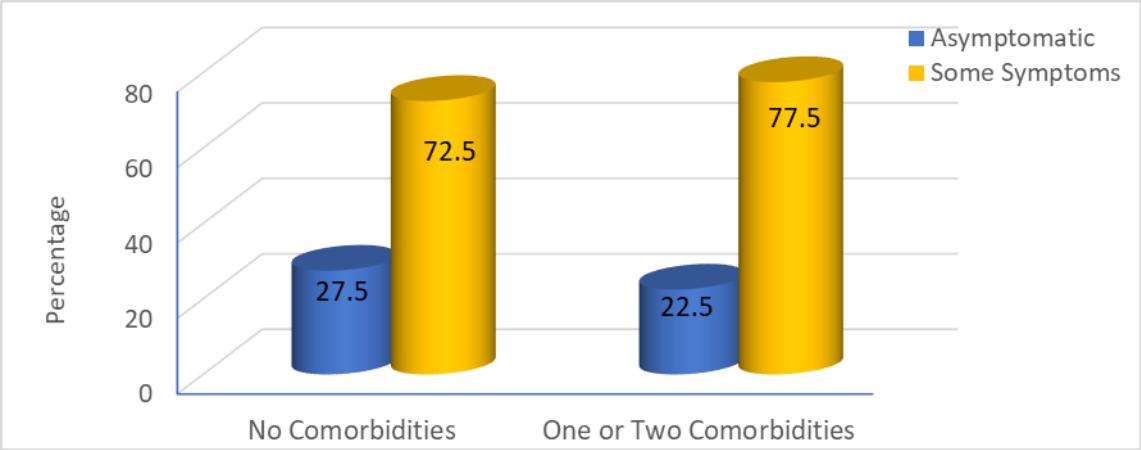
ARDS- acute respiratory distress syndrome PE-pulmonary embolism

Table 3: Comorbidities & Main Symptoms and their relation to COVID complications

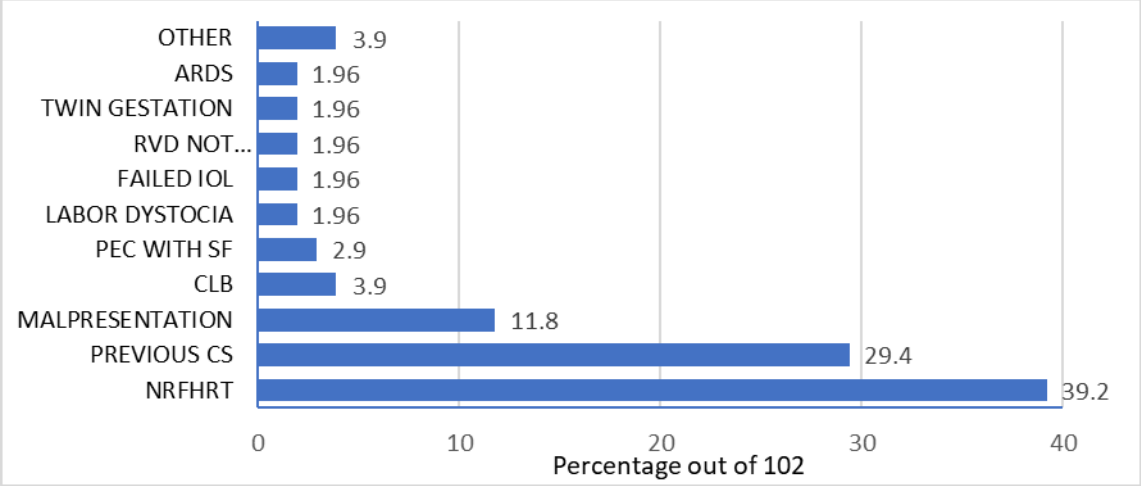
				COVID Complications			**Chi-square**
		Frequency	**Percentage**	**Absent**	**Present**	**Death**	
Comorbidities	**Grand total**	**300**	**100%**	**292**	**8**	**4**	
	No comorbidities	**230**	**76.7%**	**226**	**4 (50.0%)**	**-**	
	PIH	29	9.7%	29	-	-	
	Asthma	16	5.3%	14	2 (25.0%)	2	**0.005**
	CHTN	11	3.6%	11	-	-	
	DM	1	0.3%	1	-	-	
	RVD	6	2.0%	6	-	-	
	DM + PIH	3	1.0%	1	2 (25.0%)	2	**0.001**
	CHTN + SIP	1	0.3%	1	-	-	
	CHTN + RVD	1	0.3%	1	-	-	
	Obesity + PIH	2	0.7%	2	-	-	
		Frequency	**Percent**	**Absent**	**Present**	**Death**	
Main Symptoms on Admission	Asymptomatic	66	22.0	65	1	1	
	Fever	195	65.0	**195**	**-**	**-**	
	Dry Cough	9	3.7	7	**2**	**2**	**0.000**
	Vomit & diarrhea	7	2.3	7	-	-	

	Loss of Taste/Smell	4	2.3	3	1	-	**0.000**
	Shortness of Breath	11	3.7	7	4	-	**0.000**
	Headache	5	1.7	5	-	-	
	Chest pain	3	1.0	3	-	1	

PIH – Pregnancy-induced hypertension, CHTN – Chronic Hypertension, SIP- superimposed preeclampsia, DM – Diabetes Mellitus, RV D – Retroviral disease



Graph 1: Correlation of Comorbidities and Symptom Presence



Graph 2: Indication for Cesarean Section

Table 4: Neonatal variables/ Neonatal Complications related to Maternal Complications

	Frequency	**Percentage**	**Covid Complications**	**Maternal deaths**	**P value**
Grand Total	**300**	**100 %**	**8**	**4**	
Gestational age (weeks)					**0.00**
< 28	3	1.0 %	1	1*	
28 – 36.6	55	18.3 %	3	2	
37 - 40	179	59.7 %	3	1	
40.1 – 41.6	53	17.7 %	-	-	
42 or More	2	0.7 %	-	-	
Not stated/seen	8	2.7 %	1	-	
Birthweight (grams)					**0.146**
< 2500	36	12.0 %	2	-	
2500 - 3999	224	74.7 %	3	1	
≥ 4000	8	2.7 %	-	-	
Not documented	32	10.7 %	3	3	

Days Admitted					**0.10**
1 - 3	138	46.0 %	4	-	
4 - 6	45	15.0 %	-	-	
≥ 7	29	9.7 %	1	1	
Not Documented	88	3.3 %	3	3	
Newborn COVID-19 Test					**0.058**
Negative	31	10.3 %	-	-	
Not done	191	63.7 %	5	1	
Not documented	78	26.0 %	3	3	
Neonatal Complications					**0.164**
No Complications	**255**	85 %	5 (62.5 %)	2	
Obstetric Complications	2	0.7 %	0	-	
Hyperbilirubinemia	11	3.7 %	1 (12.5 %)	-	
RDS	4	1.3 %	0	-	
Presumed Sepsis	16	5.3 %	1 (12.5 %)	1	
Others	7	2.3 %	0	-	
Death	5	1.7 %	1 (12.5 %)	1	
Grand Total	**300**		**8** (100 %)		

*** Died before delivering, GA 20 weeks (1)**

DISCUSSION

This retrospective cohort study assessed the maternal & neonatal morbidity and mortality associated with COVID-19 at GPHC over a two-year period. The overall maternal complication rate was low (2.9%), and the maternal case fatality rate was 1.6 %, findings comparable to the INTERCOVID multinational cohort study, which reported a maternal case fatality rate of 1.67,these results differ from the earlier study conducted at GPHC, which included only 79 patients over a 9 month period and occurred during the early pandemic when testing capacity and clinical protocols differed substantially.[9] In the present study, half of the patients with COVID-19-related complications died from Acute Respiratory failure from COVID-19 pneumonia, all of whom were in the ICU prior to their demise; these findings are similar to a multinational Latin-American study, where approximately 90% of maternal deaths were attributed to acute respiratory failure secondary to COVID-19 pneumonia.[10]

As expected, comorbidities significantly increase the risk of mortality. The combination of Diabetes with PIH and Asthma were the most common comorbidities observed among maternal deaths. These findings, however, contrast with a study conducted in Iran, which reported 9 cases of maternal COVID-19 infection, 7 of which resulted in deaths despite none of the patients having comorbidities.[6] On the other hand, a study done in Brazil found that at least one comorbidity or risk factor was present in 11 cases out of 20 maternal deaths, with asthma being the most common risk factor.[8] Differences in population characteristics, variant circulation and accessibility of critical care may account for this variation.

Most patients in this cohort (96.4 %) were diagnosed in the third trimester, and more than half were multiparous (56.6%). One-third underwent caesarean delivery, most commonly for fetal distress or previous cesarean section, findings similar to other published reports.[11] Late-trimester diagnosis may reflect the increased physiological vulnerability to respiratory infections due to reduced lung capacity, diaphragm elevation and immune modulation. However, emerging research suggests placental inflammation and vasculitis associated with SARS-CoV-2 infection, potentially leading to fetal distress, preterm birth, and growth restriction.[12] Placental histopathology was not routinely performed in this cohort, limiting further interpretation.

Neonatal COVID-19 testing was performed in only done in 10.3% of neonates, and all results were negative. A Systematic review found no evidence of vertical transmission

or COVID-19-positive tests among neonates who died.[13] On the contrary, the INTERCOVID study found that 12.1 % of neonates born to COVID-19-positive pregnant patients also tested positive, and this rate was higher in the cesarean section group.[7] The low neonatal testing rate in our cohort precludes any reliable estimation of vertical transmission; thus, the actual neonatal impact remains uncertain.

Several significant limitations must be considered when interpreting these findings. First, missing, incomplete, or illegible handwritten documentation was common, and 93 charts were not located, potentially introducing selection bias. The direction of this bias is likely toward an underestimation of morbidity, as patients with mild or asymptomatic illness, particularly in early pregnancy, were less likely to be tested or admitted.COVID-19 testing during the study period was limited to pregnant patients at 28 weeks of gestation or more who were admitted through the maternity triage area; those presenting earlier in pregnancy or through the emergency department were tested only if symptomatic. As a result, early pregnancy infections were likely under-captured, and the burden of COVID-19 in the first and second trimesters remains unknown. Neonatal testing was infrequent, limiting assessment of vertical transmission or early neonatal morbidity.

Despite these limitations, the results align with international data showing elevated risks linked to comorbidities and severe respiratory failure as the primary cause of maternal death. These findings have practical implications for clinical care, including the need for improved documentation and testing procedures, prioritizing of respiratory support and early ICU referral for patients with severe disease, and increased surveillance for pregnant patients with comorbidities.

Regarding generalizability, the findings may be most applicable to tertiary referral centers in low-resource or middle-resource settings with similar testing policies, patient demographics, and health system constraints. Differences in health care infrastructure, ICU capacity, and vaccination coverage across countries should be considered when extrapolating these results to other settings.

In conclusion, this study adds to the growing body of evidence on the maternal and neonatal consequences of COVID-19 in pregnancy. It highlights the heightened risk of mortality among pregnant patients with comorbidities. Improved documentation. Standardized testing and enhanced surveillance, particularly in early pregnancy, may strengthen future assessments of the COVID-19's impact on maternal and neonatal outcomes.

CONCLUSION

This study found a maternal case fatality rate of 1.6 % associated with COVID-19 at GPHC. However, COVID-19-related complications were relatively rare, affecting only 2.9% of the population. PIH was the most frequent comorbidity, and the presence of Diabetes with PIH or asthma was associated with higher maternal mortality. Shortness of breath and a dry cough were the most common symptoms among patients who experienced severe outcomes.

Most neonates had favorable outcomes; however, those born to mothers with COVID-19-related complications had higher rates of neonatal complications, including sepsis and death, although these associations were not statistically significant.

Overall, these findings suggest that while COVID-19 posed some risk to maternal and neonatal health, severe complications were relatively uncommon. These results contribute valuable local evidence for clinical decision-making and highlight the importance of optimizing care for pregnant patients with underlying comorbidities.

Declaration by Authors

Ethical Approval: Approved

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