Shadow of Pandemic: An Analysis of Maternal and Neonatal Outcomes before, during, and after the First and Second COVID-19 Waves

Swati Angadrao Badgire[1], Shrinivas Gadappa[2], Sonali Deshpande[3]

Abstract

Objective: India reported its first case of coronavirus in Kerala on 30th January, 2020. On March 24, 2020, the Government of India announced the first complete lockdown of the entire nation for 21 days for the containment of the virus. The immediate effect of the lockdown was that the cases and COVID-19-related deaths were significantly controlled. Besides the direct effects, the indirect impact of the pandemic and pandemic-control policies on healthcare services, communities, and the global economy may also affect vulnerable groups like pregnant women. The objective is to explore trends in maternal or neonatal outcomes during this pandemic by comparing the same in pre-pandemic, pandemic, and post-pandemic phases.

Materials and Methods: This was a retrospective analysis of maternal and neonatal outcomes over the period from January 2020 to August 2021. The monthly statistics from the pre-pandemic period (2018 and 2019) were combined and then analyzed against the statistics from 2020 and 2021 using the Fisher's exact test or Chi-squared analysis as appropriate.

Results: There was positive correlation between the monthly number of COVID-19-related deaths with the monthly number of stillbirths ($p = 0.153$). The diagnosis of antenatal complications such as hypertension in pregnancy occurred at the same rate pre-pandemic as in the months during the pandemic. There was a strong positive correlation between maternal mortality and the number of COVID-19-related deaths ($p = 0.016$).

Conclusion: Women's healthcare is often adversely affected in humanitarian disasters, and our study highlights the importance of planning for powerfully built maternal services in any emergency services.

Keywords: COVID, Maternal outcome, Pandemic.

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Introduction

India reported the first confirmed case of a novel coronavirus in the Southern state of Kerala on 30th January, 2020. On 24th March, 2020, the Government of India announced a complete lockdown nationwide for 21 days to contain the spread of the COVID-19 virus. In this complete lockdown, the Government of India mandated the closure of all nonessential businesses, restricted nonessential journeys, and directed isolation of at-risk individuals. The strategy followed by the Government of India was in harmony with global strategies endorsed by the World Health Organization. After the first lockdown phase, the Government of India called 3 more lockdown phases consecutively. After the peak waves, to restart the Indian economy, unlock phases have also been announced.

As expected, the immediate effects of these lockdown phases were that the mortality rate of COVID-19 and its cases were dramatically controlled. But there were various indirect effects of lockdown on maternity services, maternal, and neonatal outcomes.

While analysis of gender-disaggregated data on COVID-19 mortality suggests that COVID-19 infection poses more severe health outcomes in women than in men, there are concerns that the infection could burden women in the social and economic sense. Also, there are more concerns about whether pregnancy makes women more susceptible to COVID-19 infection or COVID-19 infected pregnant women may have more severe outcomes. Besides the direct effects of COVID-19 infection, the pandemic and pandemic-related control policies have an indirect

[1–3]Department of Obstetrics and Gynecology, Government Medical College, Aurangabad, Maharashtra, India

Corresponding Author: Swati Angadrao Badgire, Department of Obstetrics and Gynecology, Government Medical College, Aurangabad, Maharashtra, India, Phone: +91 7448220988, e-mail: drswatibadgire@gmail.com

effect on healthcare services, communities, and the global economy, which may affect maternal health. The unique population of pregnant women postnatal women may be vulnerable to various issues such as domestic violence with particular mental and physical healthcare needs. The indirect impact of the global pandemic may be revealed only as a significant time passes, and the analysis done and published during or immediately after the pandemic control policies implemented may not reveal all the outcomes. The aim of this review article is to generate the literature on both direct and indirect effects of pandemic and pandemic-related policies on pregnant women, new mothers, and antenatal services. So, this is the time to explore the effects on maternal and

Table 1: Monthly maternity statistics (January 2020–August 2021)

	January–April (2020)	May–August (2020)	September–December (2020)	January–April (2021)	May–August (2021)	p-value	Remarks
ANC visits	6543	2556	6332	6852	7753	0.778	Not significant
Preterm births (%)	11.65	13.57	13.44	10.22	10.20	0.570	
Stillbirth (%)	9.5	10.43	12.28	9.2	9.23	0.002941	Significant
NICU (%)	12.92	14.06	15.06	13.92	14.81	0.09	Not significant

ANC, antenatal care

neonatal outcomes during the defined time period by comparing the various outcome in the pre-pandemic, pandemic, and post-pandemic periods.

MATERIALS AND METHODS

This was a retrospective analysis conducted over the period from January 2020 to August 2021 in one of the major tertiary care centers in the Marathwada region. The Government Medical College, Aurangabad, is a referral center catering to nearby districts and subdistricts with approximately 20,000 deliveries annually. All maternity and neonatal data in the hospital is recorded online on the Health Management Information System (HMIS) which is used for the generation of an annual report. This time period encompasses the time from the pre-pandemic phase, through the peak incidence of COVID-19 cases in the first and second wave in India, to the period where national lockdown measures were eased following successful containment of the virus. The time period from January 2020 to April 2020 indicates the pre-pandemic phase. From May 2020 to August 2020, a rising curve of COVID-19 deaths was noted with a peak noted in September 2020. The period from January 2021 to April 2021 shows a flattened curve after the first COVID-19 wave, while the peak of second wave was noted from May 2021 to August 2021. So, we tabulated the data in four-monthly time frames to represent pre-pandemic, peaks of first and second waves with a flattened curve in between. The monthly birth statistics were correlated with the monthly number of COVID deaths in India (Pearson's correlation coefficient) to analyze any relation with the progress and resolution of the pandemic. The severity of the pandemic was assessed by the number of COVID-related deaths in the review period. The number of COVID deaths rather than COVID-19 infection rate was used as a disease marker as it is a more reliable measure, being unaffected by testing availability, inaccuracies, delayed reporting, and missing asymptomatic individuals. Statistical analysis was done using the Fisher's exact test or Chi-squared analysis as appropriate. Approval was obtained from the Institutional Ethics Committee.

The primary objective of this study was to analyze the impact of the COVID-19 pandemic on healthcare services and to assess any statistically significant trends in maternal and neonatal outcomes during this period.

RESULTS

Monthly birth statistics for the obstetrics and gynecology department at the Government Medical College, Aurangabad, of the year January 2020–August 2021 are presented in Table 1.

Figure 1 shows the rate of preterm births and stillbirth rate from January 2020 to August 2021, contrasted with a total number of COVID-19-related deaths in the review period.
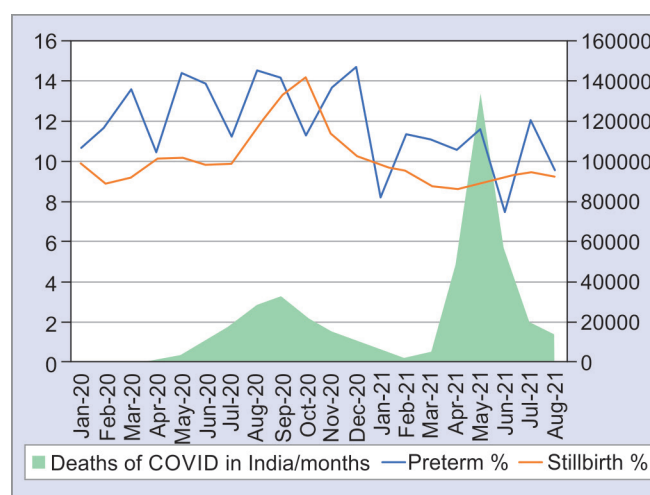

Fig. 1: Preterm delivery rate and stillbirth in GMC, Aurangabad, vs COVID-19-related deaths from January 2020 to August 2021

There was no statistically significant correlation between the monthly number of preterm births (<37 weeks) and the monthly number of COVID deaths ($p = 0.570$). There was a positive correlation between stillbirth percentage and COVID deaths ($p = 0.002941$), with the highest stillbirth rate noted from May 2020 to December 2020.

The mode of delivery (Table 2 and Fig. 2) did not show any significant correlations, but April 2021 month had the lowest total delivery rate. The detection rate of antenatal complications such as hypertensive disorders of pregnancy (Table 2) was observed at the same rate before the pandemic as in the months during the pandemic. The incidence of eclampsia was not remarkably different from that in the pre-pandemic period ($p = 0.693$).
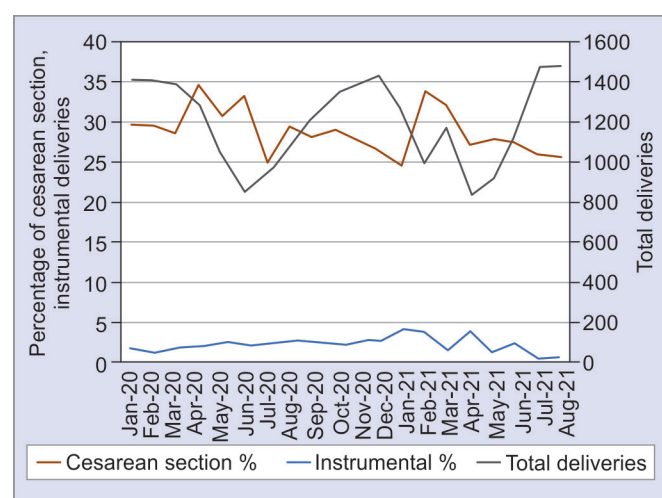
No statistical difference was noted in the rate of intra- or post-partum complications (Table 3) such as abruption ($p = 0.610$) and postpartum hemorrhage ($p = 0.544$). No correlation was seen between the near-miss ratio and the number of COVID-related deaths ($p = 0.428$). However, there was a strong positive correlation between maternal mortality and the number of COVID-related deaths ($p = 0.016$) (Fig. 3). A total of 126 maternal deaths were noted from January 2020 to August 2021. The leading cause of maternal death was due to obstetric hemorrhage (37.30%), followed by hypertension in pregnancy (19.84%), and COVID deaths (11.11%). The majority of cases (71.84%) were referred from outside, while 28.15% of cases were self-referred.

DISCUSSION

In the last year, many articles published the gendered nature of catastrophic disasters, as the COVID pandemic questioned the

Table 2: Deliveries, cesarean sections, instrumental deliveries, and antenatal complications

	January–April (2020)	May–August (2020)	September–December (2020)	January–April (2021)	May–August (2021)	p-value	Remarks
Total deliveries	5510	3891	5372	4258	5173	0.064	Not significant
Cesarean rate (%)	30.61	29.64	27.92	29.50	26.65	0.270	
Instrumental deliveries (%)	1.75	2.50	2.51	3.29	1.91	0.620	
Eclampsia (%)	1.32	3.59	1.85	1.02	1.68	0.693	
Pre-eclampsia (%)	4.69	8.50	5.84	5.63	5.19	0.924	

Fig. 2: Total deliveries, LSCS, and instrumental delivery (January 2020–August 2021)

current healthcare system. Disturbances in healthcare services combined with an imbalance in access to health services, handicap at-risk groups, particularly pregnant women and girls.[1]

Past global experiences from the Zika[2] epidemics suggest that resources were redirected from routine healthcare services, including antenatal and postnatal healthcare and contraceptive services on efforts to contain the epidemics. This exacerbated already limited access to maternal, sexual, and reproductive health services for women and girls.

Although, it is hypothesized regarding possible unforeseen adverse effects of the global pandemic on delivery of maternity services and its sequelae on maternal and neonatal outcomes, it is not yet proven by statistical data and needed analysis. This retrospective study using our hospital data compares monthly birth statistics with COVID deaths which represents the severity of the pandemic outcomes and relates them with the severity of the pandemic.

In a study by McDonnell et al. at Dublin,[3] a reduction in preterm deliveries as compared to the pre-pandemic period in the year 2018 and 2019 was noted, and no difference was no difference was noted in stillbirth rate. However, in our study, it was observed that the stillbirth rate was significantly higher compared to the pre-pandemic rate. On comparison of birth trends in pre-pandemic and pandemic periods in the London unit, Khalil et al. noted a statistically significant increase in the stillbirth rate.[4] The increase in stillbirths in our study may have resulted from indirect effects of lockdown such as hesitance to go to the hospital when needed (for example, reduced fetal movements, prolonged history of leaking per vaginum) and fear of contracting COVID-19 infection. Changes in routine antenatal services may have contributed secondary to staff shortages (routine staff diverted to COVID wards) or decreased antenatal contacts, reduced screening of high-risk cases, and routine ultrasound.

In a meta-analysis on the effects of the COVID-19 pandemic on maternal and perinatal outcomes by Townsend et al.,[5] it was noted that there was no significant difference in the rate of vaginal deliveries, cesarean section rate, and rate of instrumental vaginal deliveries was noted during vs before the pandemic. Similar results in vaginal delivery rate, cesarean rate, and instrumental vaginal delivery rate were noted in our study.

In a study by McDonnell et al. at Dublin,[3] the rate of complications such as abruption placenta and postpartum hemorrhage did not differ significantly in pre- and post-pandemic period. Similar results were noted in our study.

In a study by Lumbreras-Marquez et al.,[6] it was noted that the actual maternal death (MMR) for the year 2020 was 42.4 much more than the anticipated MMR in 2020 in Mexico (29.5 per lakh), with COVID-19 as the leading cause. Data from the MBRRACE-UK rapid report[7] show that, in the first wave of the pandemic (March–May, 2020), there were 16 maternal deaths (10 associated with SARS-CoV-2) of an estimated 162,344 births, corresponding to a maternal mortality rate of 9.9 per 100,000, 51 compared with a pre-pandemic rate of 9.7 per 100,000 in 2016–2018. Our observations are particularly worrisome because still, the major contributor to maternal is hemorrhage, followed by hypertensive disorders. However, COVID deaths contributed to 11.11% of total maternal deaths. One suggested mechanism for the increased adverse maternal outcomes could be linked to reduced access to healthcare.[8–11] This reduction could be driven by concern about the risk of acquiring COVID-19 infection in hospitals, government guidelines to stay at home, or reduced public transport during the lockdown. Though, in our institute, we quickly restructured and provided routine healthcare services in remote areas using teleconsultation, as ours is a tertiary referral center, the majority of women arriving in labor are referred and not booked with us.

STRENGTHS AND LIMITATIONS

The major strength of this study includes the relatively larger number of sample size and our ability to describe the maternal and neonatal outcomes in consecutive 20 months periods, including the first and second wave of COVID-19, compared to the pre-pandemic period. The main limitation of the study is that it's a retrospective study. Also, we postulated that at least in part, COVID-19 lockdown and decreased access to healthcare are the main reason for an increase in maternal mortality, but there might

Table 3: Intra- and postpartum complications, near-miss ratio, and maternal mortality

	January–April (2020)	May–August (2020)	September–December (2020)	January–April (2021)	May–August (2021)	p-value	Remarks
Abruption (%)	1.15	2.05	1.78	1.86	1.68	0.610	Not significant
PPH (%)	4.16	5.39	4.08	4.17	3.68	0.544	
HDU admission (%)	3.76	4.68	5.23	5.50	5.55		
Near-miss ratio	17.30	54.25	41.60	22.76	32.22	0.428	
MMR	11	18	26	34	37	0.016	Strong positive correlation

HDU, high dependency unit; MMR, maternal death; PPH, postpartum hemorrhage
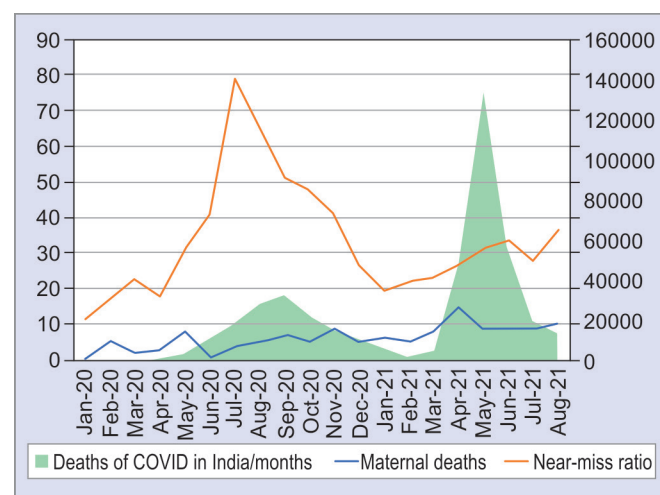

Fig. 3: Maternal mortality and near-miss ratio correlated with COVID deaths

be other explanations such as redeployment of maternal staff to support critical care and medical teams, reducing the trained staff available for obstetric care.

CONCLUSION

In our study, stillbirth rate and maternal mortality rate in the pandemic phase were significantly higher as compared to the pre-pandemic phase. It is obvious that pregnant women are the most affected by the pandemic, and the liability is on the academic institutes, healthcare professionals, and policymakers to learn from it. Women's healthcare is often adversely affected in humanitarian disasters and our study highlights the importance of planning for powerfully built maternal services in any disaster. Healthcare professionals intending for service provision in the ongoing pandemic must observe how to establish robust antenatal care that carefully reaches out to vulnerable women.

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