



Impact of COVID-19 Pandemic on Non-COVID-19 Maternal Mortalities in a Tertiary Health Care Center of North India

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Abstract

Introduction While dealing with the COVID-19-related morbidities and mortalities in general, its adverse impact on non-COVID-19 maternal mortalities was completely forgotten so our aim is to study the adverse consequences of the COVID-19 pandemic on non-COVID-19 hospital births and non-COVID-19 maternal mortalities.

Methodology Retrospective observational study was done in the Department of Obstetrics and Gynecology, Swaroop Rani Hospital, Prayagraj, to compare the non-COVID-19 hospital births, referrals, and non-COVID-19 maternal mortalities during 15 months of pre-pandemic period (March 2018 to May 2019) and 15 months of pandemic period (March 2020 to May 2021 period) and to assess their relation to GRSI using chi-square test, paired *T* test and Pearson's Correlation Coefficient.

Result The total non-COVID-19 hospital births decreased by 4.32% in pandemic period as compared to pre-pandemic period. Monthly hospital births decreased drastically, to 32.7% during the end of the first pandemic wave and to 60.17% during the second wave. 67% increase in the total referral and a significant decrease in the quality of referral leading to significantly higher non-COVID-19 maternal mortality figures (*p* value 0.00003) during the pandemic period. Leading causes of mortalities were uterine rupture (*p* value 0.00001), septic abortion (*p* value 0.0001), primary postpartum hemorrhage (*p* value 0.002) and preeclampsia (*p* value 0.003).

Conclusion While the world is talking only about COVID deaths, increased non-COVID-19 maternal mortalities during the COVID pandemic need equal attention and call for more stringent government guidelines for the care of non-COVID-19 pregnant women as well during the pandemic period.

Keywords Non-COVID-19 hospital births · Non-COVID-19 maternal mortalities · Referral · GRSI score

Introduction

While India was making through the various health goals, year 2020 brought a global disaster in the form of devastating SARS-CoV-2 pandemic that almost collapsed the health-care system and took countless lives across the world, even in the most developed countries. While dealing with the COVID-19-related morbidities and mortalities in general, its adverse impact on non-Covid maternal mortalities was completely forgotten.

Although the guidelines for reproductive, maternal, newborn, child and adolescent health and nutrition (RMNCHA+N) services for COVID-19 positive pregnant patients were released on 24th May 2020, the rate of spread of infection was so high that there was no time to propagate these guidelines among health care providers [1]. Various strategies were implemented to cope up with the changed situations, like lockdown, telecom OPDs, limited visits,

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etc., which had mixed impact on non-COVID-19 health care system.

Government Response Stringency Index (GRSI) is a daily score computed since January 2020 by the Blavatnik School of Government at the University of Oxford as a measure for the strictness of lockdown and restrictions implemented in each country to mitigate SARS-CoV-2 outbreak [2].

Though a lot have been talked about COVID deaths, currently there is a significant gap in understanding the impact of the pandemic and GRSI on the trends of non-COVID-19 maternal morbidities and mortalities. When we think about pandemic, we need to differentiate between the outcome from being infected and from being affected. We all know that in the first and second wave, COVID-19 infection directly took many maternal lives, but indirectly as well pandemic had its adverse impact on non-COVID-19 maternal mortalities throughout the country [3].

So, this study was planned for analyzing the impact of COVID-19 pandemic on non-COVID-19 obstetric outcomes to help government guide their decisions of further planning the policies for upcoming waves of COVID-19.

Aim

- Primary objective:
 - To study the impact of COVID-19 pandemic and GRSI scores on non-COVID-19 maternal mortality rates in a tertiary referral center
- Secondary Objective:
 - To study the impact of COVID-19 pandemic and GRSI scores on non-COVID-19 hospital birth rates.
 - To study the impact of COVID-19 pandemic on number and quality of non-COVID-19 obstetric referrals.

Method

Type of study Retrospective observational study and data were obtained from medical records only and Institutional ethics committee clearance was obtained prior to the conduct of the study.

Place of study Department of Obstetrics and Gynaecology, Swaroop Rani Hospital, MLN Medical College, Prayagraj.

Duration of study 30 months [15 months of prepandemic period (March 2018 to May 2019) and 15 months of pandemic period (March 2020 to May 2021)].

India had its first COVID-19 case on January 27, 2020, in Kerala [4], but Prayagraj had the first case on March 22, 2020, and lockdown was applied from March 23, 2020.

Based on the data from the Johns Hopkin's Resource Centre pandemic period in India was divided into three phases: 'pandemic-wave 1 rising (Mar-Sep 2020)', 'pandemic-wave 1 receding (Oct20-Feb21)' and 'pandemic-wave 2 rising (Mar-May 2021)' [5].

Inclusion criteria All obstetric emergencies in prepandemic period and all non-COVID-19 Obstetric emergencies in pandemic period.

Exclusion criteria COVID-19 infected pregnant patients. All the patients were divided in two groups:

Study group- All non-COVID-19 obstetric emergencies in pandemic period.

Control group- All obstetric emergencies in pre-pandemic period.

Parameters analyzed and compared were:

- Monthly hospital births.
- Obstetric referrals and bad state referrals.

General condition of the patient was assessed using critical, unstable, potentially unstable and stable (CUPS) assessment and critical, unstable, potentially unstable patients were ascertained as the bad state referral while stable patients as average state referral.

- Monthly non-COVID-19 maternal mortalities.
- Causes of maternal mortality:
 - (i) Postpartum hemorrhage (PPH).
 - (ii) Eclampsia.
 - (iii) Pre-eclampsia.
 - (iv) Septic abortion (sepsis following spontaneous or induced abortion).
 - (v) Puerperal infection.
 - (vi) Uterine rupture.
 - (vii) Heart failure in pregnancy or postpartum.
 - (viii) Jaundice with Hepatic Encephalopathy.
 - (ix) Antepartum Hemorrhage (APH).

In cases of multiple co-morbidities, the primary complication was ascertained as main cause of death.

- GRSI score and its impact on hospital births and non-COVID-19 maternal mortalities.

We used the time series data on the Government Response Stringency Index (GRSI) to calculate monthly average GRSI scores for India.

Statistical Analysis

- Chi-square (p value): for statistical significance of differences.
- Pearson's correlation coefficient: for significance of correlation.

- Paired *T* test: statistical significance between two independent variables

Observation

Hospital birth rates decreased by 4.32% in pandemic period as compared to pre-pandemic period. Monthly hospital births started decreasing from July 2021, when Prayagraj started to have the peak of infection rates. Decline continued at varied rates with maximal decline by 32.7% in December 2020, i.e., at the end of first wave. The impact of first wave persisted even after its pace got down with negative balance of birth rates in the month of January and February, 2021 as well. Birth rates started to increase in March and April 2021 but decreased again by 60.17% in May; 2021 during second wave in Prayagraj. (Fig. 1) (Table 1).

There was significant increase; 67% in the total referral received and a significant decrease in the quality of

referred patients especially during both the pandemic waves (*p* value 0.0089–0.00001) (Fig. 2).

Out of the total non-COVID-19 maternal mortality except for one case, all were either referred or unbooked cases. The non-COVID-19 maternal mortality figures were significantly high in comparison with prepandemic period with maximum deaths in October and November; 2020 when the first wave of COVID-19 was settling down, followed by in months March to May; 2021, when Prayagraj was suffering from the second COVID-19 wave (*p* value 0.00003) (Table 2).

In our study even with increase in GRSI score, there was significantly more hospital births (*p* value 0.00001) and less non-COVID-19 maternal mortalities (*p* value < 0.00001), that showed that high stringency had no adverse impact on hospital births and non-COVID-19 maternal mortalities (Table 3).

Leading causes of maternal mortalities were eclampsia and preeclampsia in both pandemic and prepandemic period with a significant rise in the occurrence of uterine rupture (*p* value 0.00001), septic abortion (*p* value 0.0001), primary postpartum hemorrhage (*p* value 0.002) and preeclampsia (*p* value 0.003) in the pandemic period as a cause of maternal mortality (Fig. 3).

Out of Total Hospital Births during 30 months : 3661

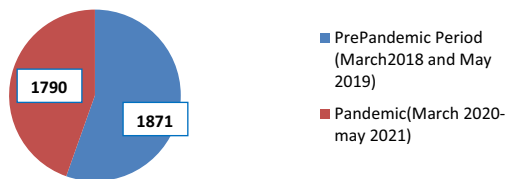


Fig. 1 Number of Hospital Births in Prepandemic and Pandemic Period

Table 1 Monthly hospital births during pre-pandemic and pandemic period

Time	Hospital birth pre-pandemic period (March 2018 to May 2019)	Hospital births Pandemic period (March 2020-May 2021)	Percentage change in births/ month during pandemic and pre-pandemic periods
March	85	119	+40%
April	81	94	+16%
May	87	125	+43.6%
June	123	141	+14.6%
July	154	131	-14.9%
August	178	172	-3.4%
September	149	150	+0.67%
October	149	139	-6.7%
November	163	156	-4.3%
December	162	109	-32.7%
January	123	87	-29.3%
February	107	96	-10.28%
March	104	109	+4.8%
April	93	117	+25.8%
May	113	45	-60.17%
Total	1,871	1790	-4.32%

p Value = 0.03

Fig. 2 Association between quality of referred patients during pre-pandemic and pandemic period

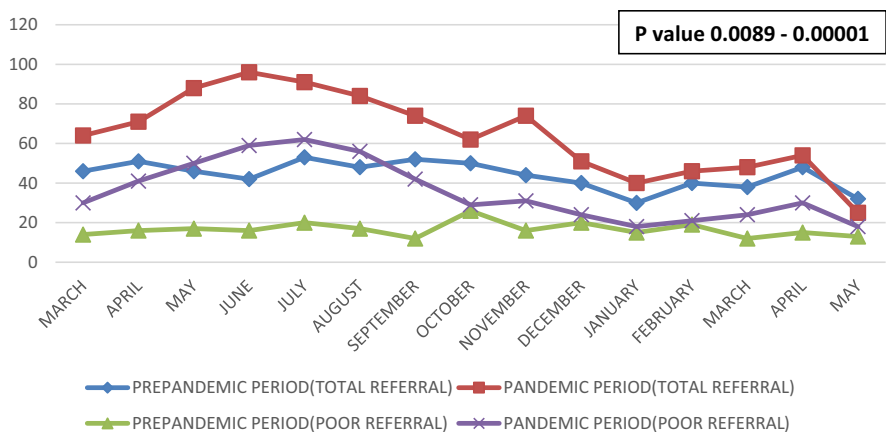


Table 2 Monthly maternal mortality during pre-pandemic and pandemic period

Month	Pre-pandemic Maternal mortality (March 2018-May2019)	Pandemic non-COVID Maternal mortality (March 2020-May 2021)	Percentage change in mortality (Positive denote increase and negative denote decrease)	p value
March	0(0%)	3 (2.5%)	+ 2.5%	< 0.0001
April	2(2.47%)	1(1.06%)	- 1.41%	0.06
May	4(4.49%)	1(0.8%)	- 3.69%	0.0002
June	5 (4.06%)	1(1.16%)	- 2.9%	0.00056
July	4(2.59%)	2(2.28%)	- 0.31%	0.7
August	4(2.24%)	3(3.5%)	+ 1.26%	0.05
September	4(2.68%)	5(5.88%)	+ 3.2%	0.0045
October	3(2.01%)	11(16.17%)	+ 14.16%	0.000023
November	2(1.22%)	8(12.5%)	+ 11.28%	0.00005
December	5(3.08%)	2(2.9%)	- 0.18%	0.9
January	3(2.44%)	5(7.38%)	+ 4.94%	0.0006
February	5(4.67%)	3(4.84%)	+ 0.17%	0.8
March	1(0.96%)	2(3.37%)	+ 2.41%	0.004
April	2(2.15%)	5(7.05%)	+ 4.9%	0.00034
May	3(2.65%)	0	- 2.65%	0.004
Total	47(2.51%)	52(2.9%)	+ 0.395%	

p value 0.00003

Discussion

India has made remarkable progress in health infrastructure with a significant fall in maternal mortality from 178/100,000 in year 2010–2012 to 167/100,000 in year 2011–2013 to 130/1,00,000 live births in year 2014–2016 to 113/1,00,000 live births in year 2016–2018, with the goal of achieving less than 70 by year 2030 [6].

Covid-19 first hit Prayagraj in the end of March, with faster positivity rates in the months of July, August, and September and when graph of COVID-19 positivity was rising, monthly non-COVID-19 hospital births were decreasing, and similar was the case in COVID-19 second

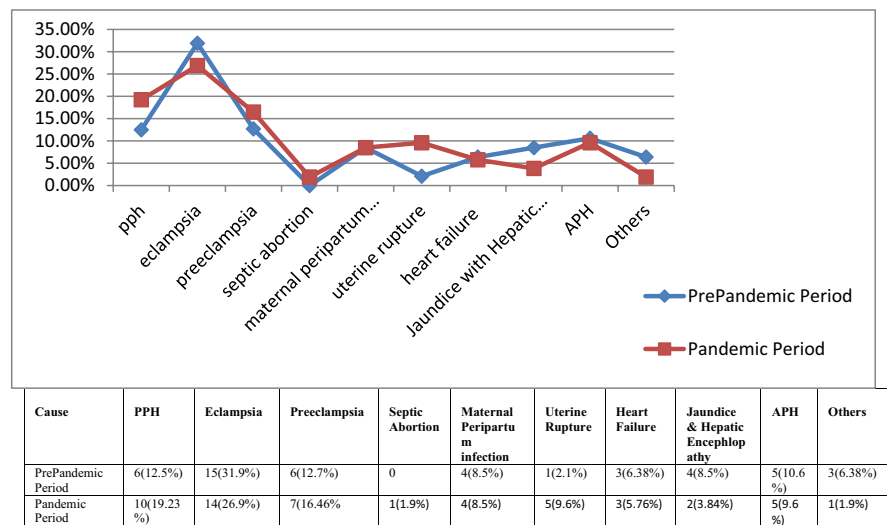
wave and the adverse impact of COVID-19 wave on hospital births persisted even after the cases started decreasing. The reason could be that our hospital was converted to COVID-19 tertiary hospital, and we were the only hospital conducting COVID-19 deliveries for the whole Prayagraj Commissionaire which created fear in them of getting exposed while visiting hospital.

At the same time when non-COVID-19 hospital births were falling during pandemic, a significant increase in number of referrals that to with worsened quality were noted. These late and complicated referrals put a major challenge to save them, and our non-COVID-19 maternal mortality rates increased significantly during pandemic period. Factors contributing these result were analyzed and found that

Table 3 Correlation between GRSI score and percentage change in monthly hospital births and non-COVID-19 mortalities between pandemic and pre-pandemic period

Month	GRSI score	Percentage Change in hospital births per month during pandemic period in comparison with pre-pandemic period	Percentage change in Mortality per month during pandemic period in comparison with pre-pandemic period
March	54.52	+40%	+2.5%
April	98.64	+16%	-1.41%
May	83.32	+43.6%	-3.69%
June	86.24	+14.6%	-2.9%
July	87.5	-14.9%	-0.31%
August	85.65	-3.4%	+1.26%
September	85.03	-0.67%	+3.2%
October	68.08	-6.7%	+14.16%
November	64.04	-4.3%	+11.28%
December	68.98	-32.7%	-0.18%
January	67.72	-29.3%	+4.94%
February	61.9	-10.28%	+0.17%
March	59.3	+4.8%	+2.41%
April	70.896	+25.8%	+4.9%
May	79.52	-60.17%	-2.65%
		<i>p</i> value 0.00001	<i>p</i> value < 0.00001
Pearson's correlation coefficient		0.007	-0.4

Fig. 3 Causes of non-COVID-19 maternal mortality in pre-pandemic and pandemic period



hesitancy of patients to come out of homes, compromised antenatal health checkups, non-identification of high risk cases, significant drop in use of preventive and curative services, dramatic increase in number of unbooked, uninvestigated obstetric emergencies in Government hospitals, reallocated resources to the COVID-19 wards in Government set ups and non-cooperation of private health care sector especially during the first wave were major determining factors to increase non-COVID-19 maternal mortalities. Various other

COVID-19-related social and economic circumstances also played a detrimental role for the maternal health throughout the nation [7, 8]. Among various causes of maternal mortalities, late pre-eclampsia, uterine rupture, septic abortions, PPH caused significant number of non-COVID-19 maternal deaths that could have been prevented with better obstetrics care.

The same observations of reduced hospital births and increased non-COVID-19 mortalities have been observed

in many other national and international studies also. Nair et al. [9] who surveyed 15 hospitals in five Indian states: Assam, Maharashtra, Uttar Pradesh, Himachal Pradesh, and Meghalaya and noticed 30% to 35% decrease in institutional birth during pandemic period. Similarly study by Chiara et al. [10] showed decrease in hospital admissions from February to May 2020 in countries of Africa, South America, Asia, Europe, and Italy. Rita de Cassia et al. [11] showed an increase in non-COVID-19 maternal mortality ratio during the pandemic period in Bahia, Brazil to 78.23/100,000 i.e., 59.46% higher than expected ratio (49.06(95% CI 38.70–59.90)). Similarly, a meta-analysis of 40 studies done by Barbara et al. [12] identified a significant increase in maternal deaths in various countries during pandemic period.

The proportionate relationship between Government Response Stringency Index (GRSI) score and non-COVID-19 hospital births and an inverse correlation between GRSI score and non-COVID-19 maternal mortalities indicate that strictness of lockdown and restrictions had no negative effect on hospital birth rates or non-COVID-19 maternal mortalities in pandemic period.

Conclusion

Our study concluded that non-COVID maternal deaths significantly increased during Covid pandemic period that were more commonly attributed to PPH, rupture uterus, septic abortions in comparison with pre-pandemic period. Though there was overall decrease in non-COVID hospital births during pandemic period, the percentage of referrals, especially in poor state showed a hike. The causes of Maternal mortalities that started declining with ongoing efforts of Governmental and non-governmental health organizations like PPH, rupture uterus, septic abortions, again showed up during the pandemic period most probably because of hesitancy of patients to come out of homes, compromised antenatal health checkups, dramatic increase in number of unbooked obstetric emergencies and non-cooperation of private health care sector.

However, Government Response Stringency Index (GRSI) score which denote strictness of lockdown and restrictions did not show negative effect on hospital birth rates or non-COVID-19 maternal mortalities in pandemic period.

While the world is talking only about the COVID-19 deaths, increased maternal mortalities among non-COVID-19 women are completely ignored. The statistics being presented here might be only the tip of the iceberg. Countless, unseen maternal mortalities may have a devastating impact on society. The result of this study calls for a more stringent guidelines for the care of non-COVID-19

pregnant women throughout their pregnancy and labor during the pandemic period, when all the health care staffs, and the resources are directed towards COVID-19 only. When the government hospital is already bearing the COVID-19 brunt during pandemics, private sectors must also play a vital role in continued obstetric care so that together we can mitigate maternal morbidity and mortality in non-COVID-19 mothers as well during the COVID-19 pandemic.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval The study was in accordance with the ethical standards of institution and national and with the Helsinki Declaration of 1975, as revised in 2008, ethical committee (Reg. no. ECR/922/Inst/UP/2017/RR-22) of institution has given the approval for the study.

Informed Consent It is a retrospective study, data were obtained from medical records only, and consent waiver from Institutional ethics committee of MLN Medical College Prayagraj was obtained prior to the conduct of the study.

References

1. Guidelines on Operationalization of Maternal Health Services during the Covid-19 Pandemic. Maternal Health Division. Ministry of Health & Family Welfare. Government of India. 2021 Sep.
2. Blavatnik School of Government. Coronavirus Government response-tracker. University of oxford. Oxford. <https://www.bsg.ox.ac.uk/research/research-projects/covid-19-governmentresponse-tracker> (accessed in September 2021).
3. Kotlar B, Gerson E, Petrillo S, et al. The impact of the COVID-19 pandemic on maternal and perinatal health: a scoping review. *Reprod Health J.* 2021;18:10.
4. Andrews MA, Areekal B, Rajesh KR, et al. First confirmed case of COVID-19 in India: a case report. *Indian J Med Res.* 2020;151(5):490–2.
5. Johns Hopkins University of Medicine. Coronavirus Resource Centre. <https://coronavirus.jhu.edu/region/India>, (accessed in September 2021).
6. Meh C, Sharma A, Ram U, et al. Trends in maternal mortality in India over two decades in nationally representative surveys. *BJOG.* 2022;129(4):550–61.
7. Calvert C, John J, Nzvere FP, et al. Maternal Mortality in Covid-19 pandemic: findings from a rapid systematic review. *Glob Health Action.* 2021;14(Suppl):1974677.
8. Kumari V, Mehta K, Choudhary R, COVID-19 outbreak and decreased hospitalization of pregnant women in labour. *Lancet Glob Health.* 2020;8(9):e1116–7.
9. Nair M, Reproductive health crisis during waves one and two of the COVID19 pandemic in India incidence and deaths from severe maternal complications in More than 202000 Hospital. *J Eclin Med.* 2021;39: 101063.
10. Dell'Utri C, et al. Effects of SARS Cov-2 epidemic on the obstetrical and gynecological emergency service accesses. What

happened and what shall we expect now? *Eur J Obstet Gynecol Reprod Biol.* 2020;254:64–8.

11. de Carvalho-Sauer RC, et al. Impact of COVID-19 pandemic on time series of maternal mortality ratio in Bahia, Brazil: Analysis of period 2011–2020. *J BMC Pregnancy Childbirth.* 2021;21:423.
12. Chmielewska B, Barratt I, Townsend R, et al. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. *J Lancet Glob Health.* 2021;9(6):e759–72.

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