

Maternal Mortality Ratio and COVID Pandemic Impact: A Retrospective Analytic study in a tertiary care institute

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Abstract

Background: The ongoing coronavirus disease (COVID-19) pandemic has challenged the resilience of even the most effective health systems of the world. It has emerged as a threat to global public health.

Owing to the pandemic, healthcare workers, equipment, and facilities have been transposed to other areas to cope with the rising number of patients suffering from COVID-19.

Aim: To study the trends in the Maternal Mortality Ratio (MMR) in the last five years and to compare them with the COVID year ratios. We also wanted to study the direct and indirect causes of the maternal deaths in COVID times (March 2020-June 2021) and the attributable risk factors, in detail, and analyse the possible levels of delay.

Methodology: The maternal mortality data was studied for a period of 5 years 6 months from Jan 2016 to June 2021. Detailed analysis of maternal deaths in COVID pandemic (March 2020 - June 2021) was done with COVID status, possible aetiology, diagnosis and delay as per WHO model. We also looked into the Case Fatality Rate (CFR) for Covid-positive women and assessed if pregnancy is a risk factor for COVID deaths.

Results: Maternal Mortality Ratio was highest just before the pandemic and was not increased in COVID period. Every case in the pandemic period had experienced some delay in healthcare. Our study showed a lower CFR in pregnant women as compared to non-pregnant women with COVID.

Conclusion: Despite the challenges of the pandemic, our study showed that overall there was no increase in MMR. Pregnant women had a lower CFR than a non-pregnant women during this time. Restructuring available healthcare infrastructure is essential in pandemic situations.

Keywords: Maternal Mortality, COVID positive, case fatality rate, MMR

Introduction

The ongoing coronavirus disease (COVID-19) pandemic has challenged the resilience of the even most effective health systems of the world. It has emerged as a threat to global public health.

Owing to the pandemic, healthcare workers, equipment, and facilities have been transposed to other areas to cope with the rising number of patients suffering from COVID-19.

Although mortality rates for COVID-19 appear to be low in children and women of reproductive age, these groups might be affected out of proportions due to disarranged routine health services, particularly in low-income and middle-income countries (LMICs) like India^[1].

Maternal Mortality Ratio is defined as number of maternal deaths during a given time period per 1 lac live birth during the same period. It quantifies the risk of maternal death relative to the number of live births.

Maternal Mortality Rate is defined as number of maternal deaths in given period per population of women who are of reproductive age. It captures both, the risk of maternal death per pregnancy or per birth and the level of fertility in the population.

In epidemiology, a **case fatality rate (CFR)**, sometimes also called case fatality risk or case fatality ratio is the proportion of deaths from a certain disease

compared to the total number of people diagnosed with the disease for a particular period.

Case fatality refers to the propensity of a disease to kill and is simply the ratio of deaths to cases. The case fatality rate for the same disease may vary in different epidemics because of changes in the agent, host and environmental factors. It is closely related to virulence of the causative organism.^[2]

The aims and objectives of the study were as follows

1. To study the trends in the Maternal Mortality Ratio (MMR) in the last five years and to compare them with the COVID year ratios.
2. To study the direct and indirect causes of the maternal deaths in COVID times (March 2020-June 2021) and the attributable risk factors, in detail.
3. To analyse the possible levels of delay with possible suggestions for further reduction.
4. To look into the Case Fatality Rate for COVID-positive women and compare with pregnancy COVID deaths.

Materials and Methods

A Retrospective Analytical study was carried out in tertiary care institute in Mumbai, India. Our institute keeps data of all maternal deaths, live births and submits it annually to state board. Various parameters during the COVID pandemic period including demographics, aetiology and possible delays were analysed in details (March 2020 till June 2021). From this, the maternal mortality data was studied for a period of 5 years 6 months from Jan 2016 to June 2021. The formula used for Case Fatality Rate is:

$$\text{Case Fatality Rate (CFR)} = \frac{\text{Total number of deaths due to a particular disease}}{\text{Total number of cases due to the same disease}} \times 100$$

Since it would be difficult to trace women in the reproductive age group, we decided to use Maternal

Mortality Ratio as a parameter to evaluate the healthcare system.

Type of study: Retrospective Analytical study.

Duration: The maternal mortality data was studied for a period of 5 years 6 months from Jan 2016 to June 2021. Detailed analysis of maternal deaths in COVID pandemic (March 2020 - June 2021) was done with COVID status, possible aetiology, diagnosis and delay as per WHO model.

Results

Maternal Mortality Ratio was highest just before the pandemic and was not increased in COVID period. (See Figure No. 1)

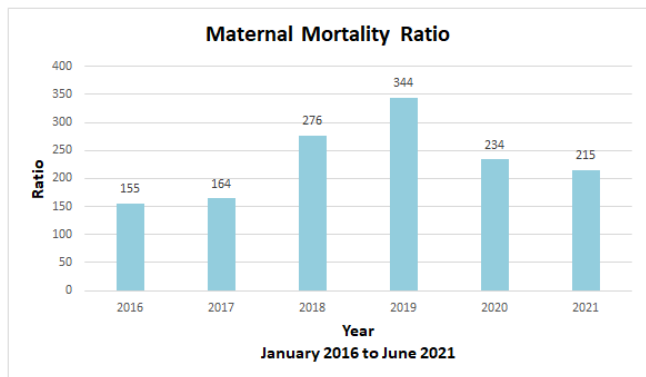
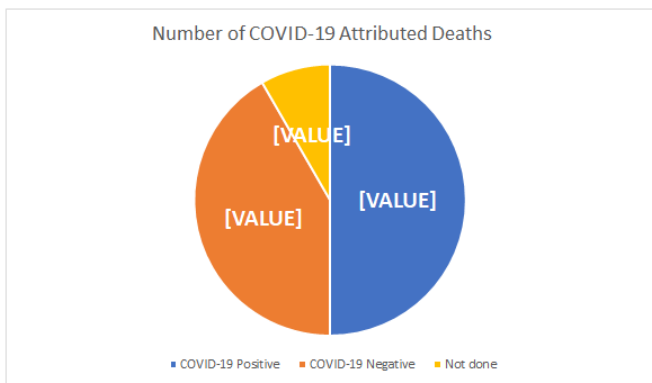
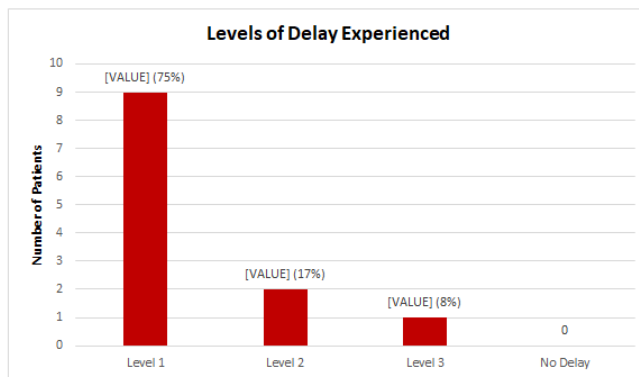


Figure 2: COVID status of maternal deaths



We found 50% (6 cases) were documented to be COVID positive, one happened before testing was available, and 5 were negative. (See Figure 2)

We assessed the levels of delay identified by audit of maternal deaths in our institute. (See Figure 3)



1 patient had delays at 2 levels, and another had delays at all 3 levels. Every case in the pandemic period had experienced some delay in healthcare, irrespective of COVID status.

	COVID Positive	COVID Negative	COVID Not Done
Delay +	6	4	1
Delay -	0	0	0

Table 1: Level of delay and COVID status

We also report all COVID admissions and deaths to centralised surveillance system. From this data, we have calculated the CFR for women with COVID admitted in our institute (See Figure 4) and compared this with CFR for pregnant women (See Table 2).

Month	Female COVID Case Fatality Rate %	Maternal COVID Case Fatality Rate %
April 20	10.85	0
May 20	13.99	0.625
June 20	10.63	0
July 20	10.04	2.29
August 20	5.10	0
September 20	15.08	0
October 20	14.94	8
November 20	13.89	0
December 20	4.96	0

January 21	5.06	0
February 21	6.25	0
March 21	6.29	0
April 21	43.18	0
May 21	23.32	6.66
June 21	7.93	0

Table 2: COVID CFR in women (overall) and in pregnant women

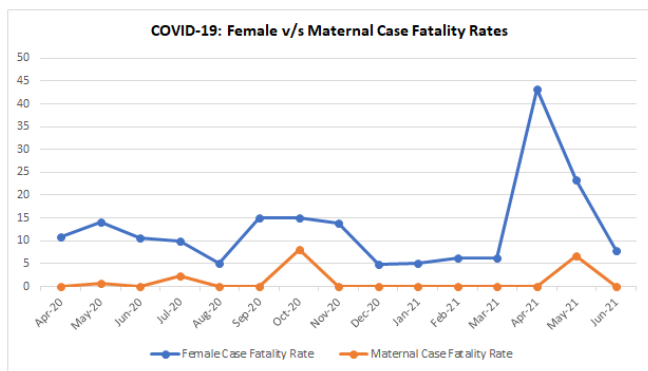


Figure 4: Comparison of COVID CFR in women (overall) and in pregnant women

Our study showed a lower CFR in pregnant women as compared to non-pregnant women with COVID. An interesting finding is a sudden rise in CFR during the second wave of COVID in 2021. This could be due to virus variants, but we do not have genotyping data available currently.

Discussion

Maternal mortality occurs when a woman, during pregnancy, delivery, or after delivery dies due to childbirth. Over the past two years, the vast majority of maternal mortalities have occurred in low-resource settings.^[3] When women die due to complications during or after their pregnancy, unfortunately majority of these are preventable or treatable. The causes of roughly 75% of all maternal deaths are severe bleeding, infections, high blood pressure during pregnancy, complications from delivery, and unsafe abortions.^[4]

MMR reduction is a priority in the SDGs, with the broad objective to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030^[4] Maternal and child healthcare services are of paramount importance for public healthcare delivery systems, especially in low- and middle-income countries. Understanding the effects of the measures taken to curb a pandemic on maternal and child health and ensuring that essential health services are maintained while containing the pandemic, is the real challenge emanating from this situation.

Current maternal mortality ratio (MMR) in India is 113 per 100000 live births whereas in Maharashtra is 46.^[5] The MMR in our institute seems to be higher (see fig 1), but this is attributable to many factors, primarily that we are a referral point for high-risk cases which often reach us in a moribund state, and although the denominator is live births in our institute, the births from the several centres that have referred these cases cannot be added in our calculation. If we consider only the cases who had registered with us for antenatal care in advance, the MMR would be much lower. We found that two cases were patients registered in our institute in 2021, hence the corrected MMR for our institute would be 143 for the period from January to June 2021. Conversely, in the year 2020 we found that all the maternal deaths were referred patients and none were primarily registered in our hospital and corrected MMR would be zero. A previous study in Mumbai by one of us was carried out to calculate the maternal mortality ratio (MMR) in a tertiary care hospital and to correlate final cause of death with the clinical diagnosis. An audit of maternal autopsies was carried out to evaluate current practices, identify fallacies and suggest corrective measures to rectify them. There were 158 maternal deaths and 13940 live births in this five-year

period. Maternal mortality rate was found to be very high (1133/ 100000 live births) in that institution with a high number of complicated referral cases (68/89 cases, 76%). Of the 89 autopsies, acute fulminant viral hepatitis was the commonest cause of indirect maternal deaths (37 cases, 41.5%) possibly due to association with an infectious disease centre. This was followed by direct causes like pregnancy-induced hypertension (12 cases, 13.4%) and puerperal sepsis (10 cases, 11.2%). They found that being a tertiary care centre, MMR was higher in that hospital than the national average in view of large number of complicated referral cases received. Low socioeconomic status, absence of emergency obstetric care in peripheral smaller centres, delays in referral of complicated cases and poor utilization of available obstetric facilities are contributory factors. The authors suggested that healthcare providers at peripheral centres should be trained on a regular basis to recognize early signs of obstetric and medical complications and refer cases promptly. ^[6]

Worldwide maternal and foetal outcomes have worsened during the COVID19 pandemic, with an increase in maternal deaths, ruptured ectopic pregnancies, stillbirth rates and maternal depression. However, some outcomes show considerable disparity between high resource and low resource settings. There is therefore an urgent need to prioritise safe, equitable and accessible care of mothers within this pandemic and in future health crises. The observed increase in maternal death is based only on data from LMICs. However, our findings are particularly concerning because these areas already carry the majority of global burden of maternal mortality. These findings are supported by National data registry from Kenya. Therefore, further investigation of maternal mortality as a matter of urgency.

Data from MBRRACE-UK showed that during the first wave of the pandemic (March-May2020), there were 16 maternal deaths (10 associated with SARS-CoV-2) of an estimated 162344 births, corresponding to the maternal mortality rate of 9.9 per 100000, compared with the pre-pandemic rate of 9.7 per 100000 in 2016-2018. ^[7]

Our study also showed no increase in MMR during pandemic period. (see Fig 1)

During the peak prevalence of COVID19 pandemic, maternity staff has been redeployed to support critical care and medical teams reducing the staffing available for maternity care. Following the first wave in UK, RCOG argued strongly for excluding maternity staff from redeployment, wherever possible. ^[8] This is also happening in our institute. Although maternal anxiety was shown consistently increased during the pandemic, healthcare providers around the world have reported reduced attendance for routine and unscheduled pregnancy care. ⁽¹⁾

One proposed explanation for the increase in adverse pregnancy outcomes is that such outcomes could be linked to reduced access to care. According to the WHO, The Three Delays Model and Integrated Approach has been used. ^[3]

This approach has been used globally, to address each of the issues that women face when trying to access safe childbirth. This is based on the Three Delays Model which identifies three groups of factors which may stop women and girls accessing the maternal health care they need:

1: Delay in decision to seek care due to

The low status of women, Poor understanding of complications and risk factors in pregnancy and when to seek medical help, Previous poor experience of

health care, Acceptance of maternal death, Financial implications.

2: Delay in reaching care due to

Distance to health centres and hospitals, Availability of and cost of transportation, Poor roads and infrastructure, Geography e.g. mountainous terrain, rivers.

3: Delay in receiving adequate health care due to

Poor facilities and lack of medical supplies inadequately trained and poorly motivated medical staff and inadequate referral systems.

Our data (Fig 3) showed Level 1 Delay in 75% of cases, perhaps due to the pandemic situation along with other factors. Despite being in a major city, there was a 17% delay in access to health-care.

In India, the case fatality rate for COVID-19 is lower than that observed in high-income countries, such as the USA^[8] This difference might be due to the age structure of the Indian population, which has a larger proportion of younger individuals than the US population^[9]

Our study showed a lower CFR in pregnant women as compared to non-pregnant women with COVID (See Figure 4).

It is clear that pregnant individuals and babies have been subjected to harm during the pandemic, and the responsibility lies on, health-care providers, and policy-makers of the country and the world to learn from it.

We can thus prioritise safe and easily accessible maternity services during the pandemic and the lessons of this pandemic for the future to reduce preterm birth, stillbirth, and maternal mortality worldwide.

Conclusion

Despite the challenges of the pandemic, our study showed that overall there was no increase in MMR. Pregnant women had a lower CFR than non-pregnant

women during this time. Delays in access to safe childbirth were identified in all cases of maternal deaths in the pandemic period. Thus, our findings highlight the importance of planning for maternity services in any emergency response for the COVID 19 pandemic.

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