

Causes of maternal mortality- Experience of a Critical care unit in a Medical College.

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Abstract

Introduction: Maternal mortality is considered a key health indicator of any nation and the direct causes of maternal deaths are well known and largely preventable and treatable.⁽¹⁾ Our medical college provides all facilities and expertise required to treat critically ill pregnant patients through critical care unit and acts as a referral centre for the entire Marathwada region.

Aim and Objectives: The aim of this study was to assess the causes of maternal mortality and calculate the Maternal Mortality Ratio (MMR), and see whether there is a shift in the causes that contributed majorly to the maternal mortality in a health care setup with the availability of critical care unit.

Materials and Methods: A retrospective study was carried out using medical records, and Maternal Mortality Ratio (MMR) calculated as it is a hospital based study, and the causes of maternal mortality were analysed over a period of 9 years.

Conclusion: Overall, 70 cases of maternal mortality were studied through record forms. The average MMR (Maternal mortality ratio) calculated over a period of 9 years was 382/1,00,000 live births. There was a drastic shift in the trends of causes of maternal mortality with a rise in the cases due to heart diseases, renal diseases, indirect causes and SARS-CoV-2.

Keywords

Maternal mortality, Antepartum and postpartum haemorrhage, Hypertensive disorders of pregnancy, Direct and indirect causes of maternal mortality, Maternal mortality ratio, COVID-19.

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I. Introduction:

WHO defines maternal mortality as “The death of a woman while pregnant or within 42 days of terminating a pregnancy, irrespective of the site and duration of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes”⁽²⁾ The 3 major causes of maternal mortality according to worldwide statistics are severe bleeding, indirect causes and puerperal infections, in that order.

Causes of maternal mortality in 2022 worldwide⁽²⁾

Causes	% maternal mortality
Severe Bleeding (Antepartum and Postpartum Haemorrhage)	25%
Indirect causes (Dengue, Multi-system diseases (CVS, CNS, RS, Vascular systems, renal diseases), Viral hepatitis, Covid infection)	20%
Infection (Puerperal infections)	15%
Unsafe abortion	13%
Eclampsia	12%
Obstructed Labor	8%
Other direct causes (Ectopic pregnancy, Embolism, Anaesthesia-Related, Ruptured uterus)	8%

The maternal mortality is expressed in terms of two indices namely maternal mortality rate and maternal mortality ratio.⁽²⁾

Maternal Mortality Rate⁽³⁾:

Number of Maternal deaths during a given time period*1,00,000
Total number of women in the reproductive age group

Maternal Mortality Ratio (MMR)⁽³⁾:

Number of maternal deaths * 1,00,000
Total Live births

In 2022, the worldwide maternal mortality ratio was 152/1,00,000 live births, and that of India was 97/1,00,000 live births.⁽⁴⁾

Global Improvement in MMR from 342 in 2000 to 211 in 2017 was attributed to fewer maternal deaths in developing countries such as India.⁽⁵⁾

In this study, we calculated the MMR for different years from the year 2013 to 2021 and assessed the percentages of deaths due to each individual cause of maternal mortality in a critical care unit of a medical college to see whether there is a change in the trends.

Aim and Objectives:

The aim of this study was to assess the causes of maternal mortality and see whether there is a shift in the causes that contributed majorly to the maternal mortality in a health care setup with availability of critical care unit.

The main objectives of this study were:

- To know Maternal mortality ratio.
- To evaluate the frequency of causes every year.
- To assess the trends and compare them with standard causes prevalent worldwide.

II. Materials and Methodology:

We used a retrospective study design where all the cases of maternal mortality were assessed in a tertiary care medical college from the year 2013 to 2021 with the help of records available.

Yearly maternal mortality ratio was calculated and compared with the maternal mortality ratio of India for that year. Percentage of each cause leading to maternal mortality was then calculated for each year, and the trend assessed over a time period of 9 years. Finally, each cause was then individually compared with the percentage of deaths due to that specific cause worldwide.

A total of 70 cases of maternal mortality were evaluated.

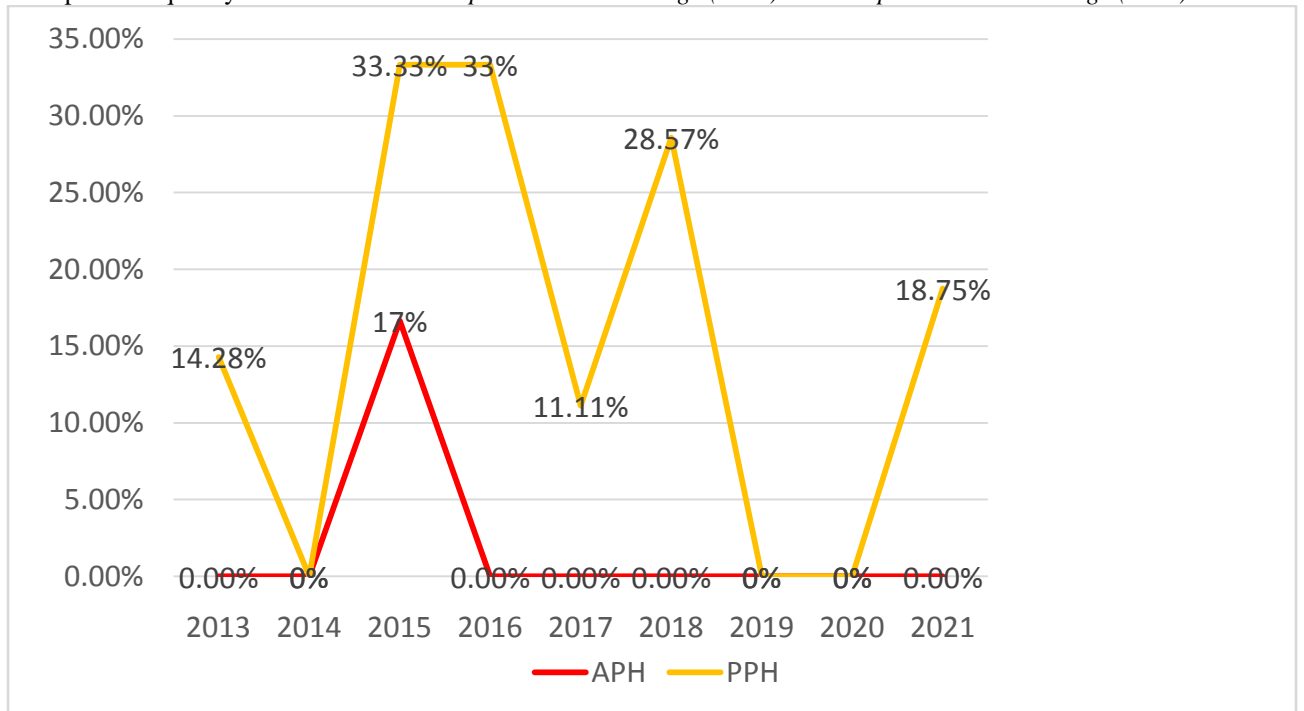
III. Observation:

Table 01: Number of live births and maternal deaths in each year and Comparison of Maternal mortality ratio for each year in India versus Our Centre

Year	Number of live births	Number of maternal deaths (N= 70)	Maternal mortality ratio	
			India ⁽⁴⁾	Our Centre
2013	2065	7	167	338
2014	2288	7	130	305
2015	2208	6	130	271
2016	2381	3	122	125
2017	2612	9	113	344
2018	2784	7	113	251
2019	2824	6	103	212
2020	1440	9	99	625
2021	1656	16	103	966

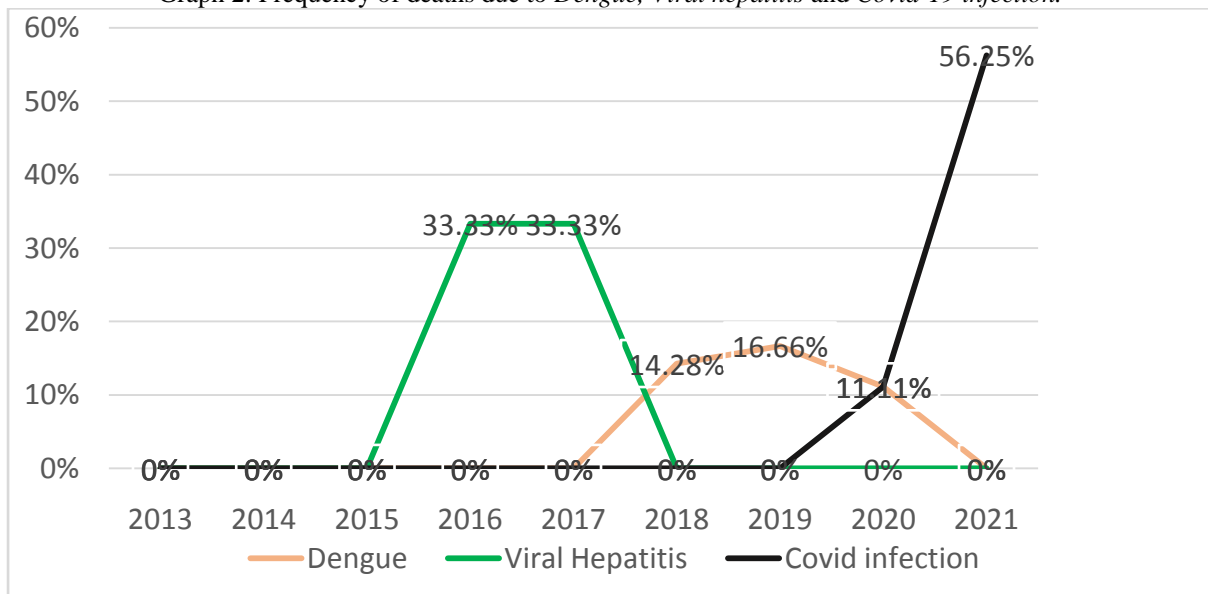
Causes of Death:

Graph 1: Frequency of deaths due to *Antepartum Haemorrhage (APH)* and *Postpartum Haemorrhage (PPH)*.



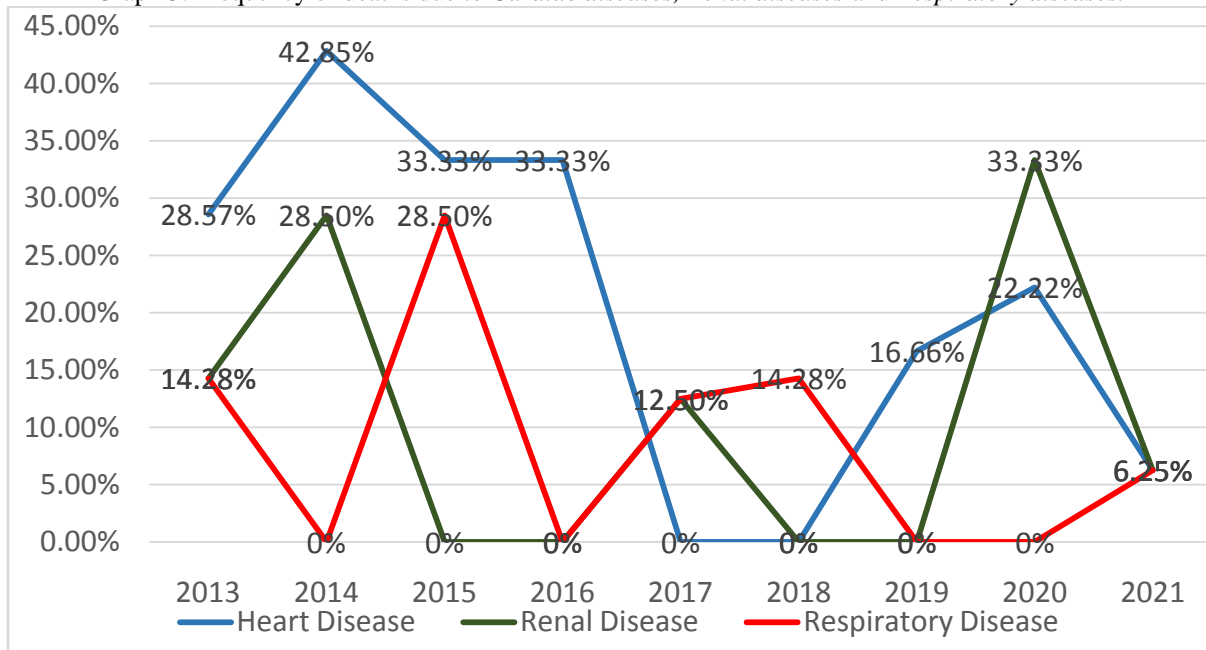
The average number of deaths due to severe bleeding was 17.33% (APH- 1.88%, PPH- 15.44%)

Graph 2: Frequency of deaths due to *Dengue*, *Viral hepatitis* and *Covid-19 infection*.



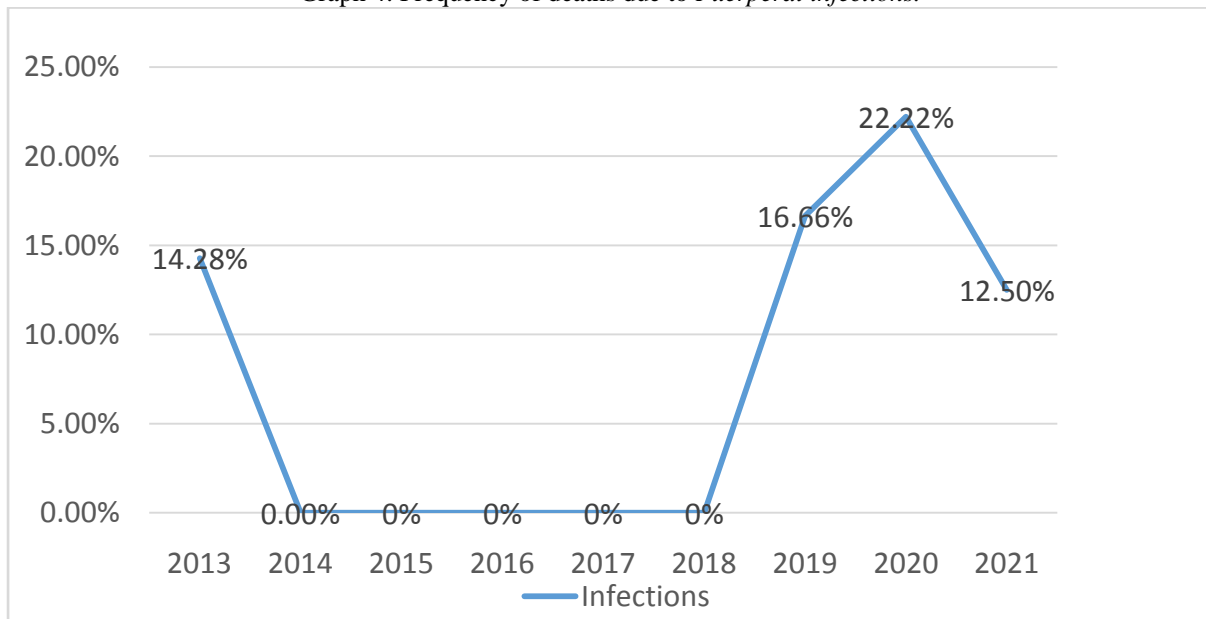
The average maternal mortality being Dengue- 4.67%, Viral Hepatitis- 7.4%, SARS-CoV-2- 22.45%.

Graph 3: Frequency of deaths due to *Cardiac diseases, Renal diseases and Respiratory diseases.*



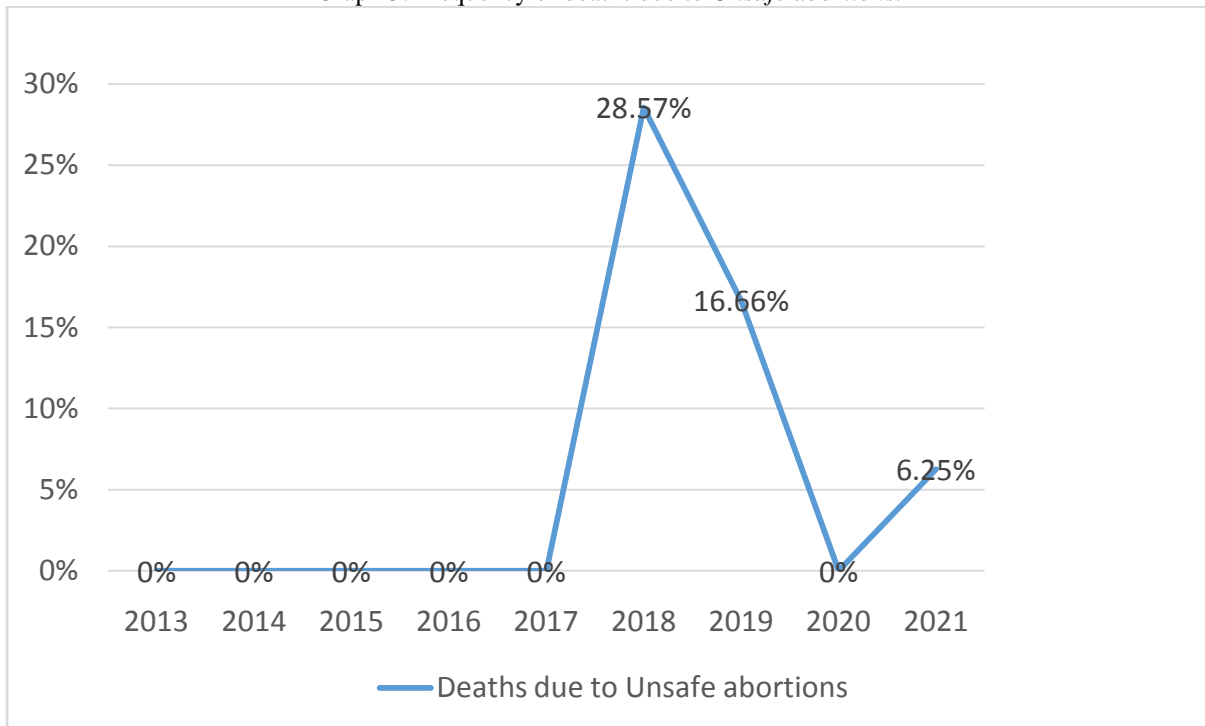
The average maternal mortality being, Heart disease- 20.35%, Renal Diseases- 10.45%, Respiratory disease- 12%

Graph 4: Frequency of deaths due to *Puerperal infections.*



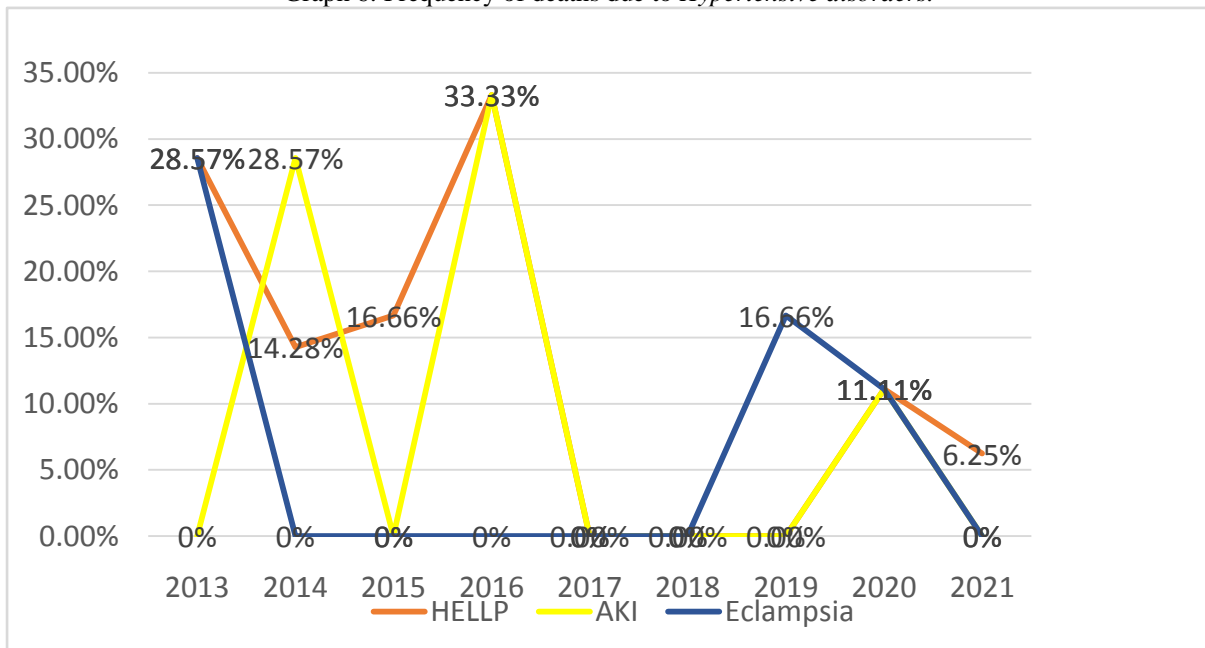
The average maternal mortality due to Puerperal infections being 7%

Graph 5: Frequency of deaths due to *Unsafe abortions*.



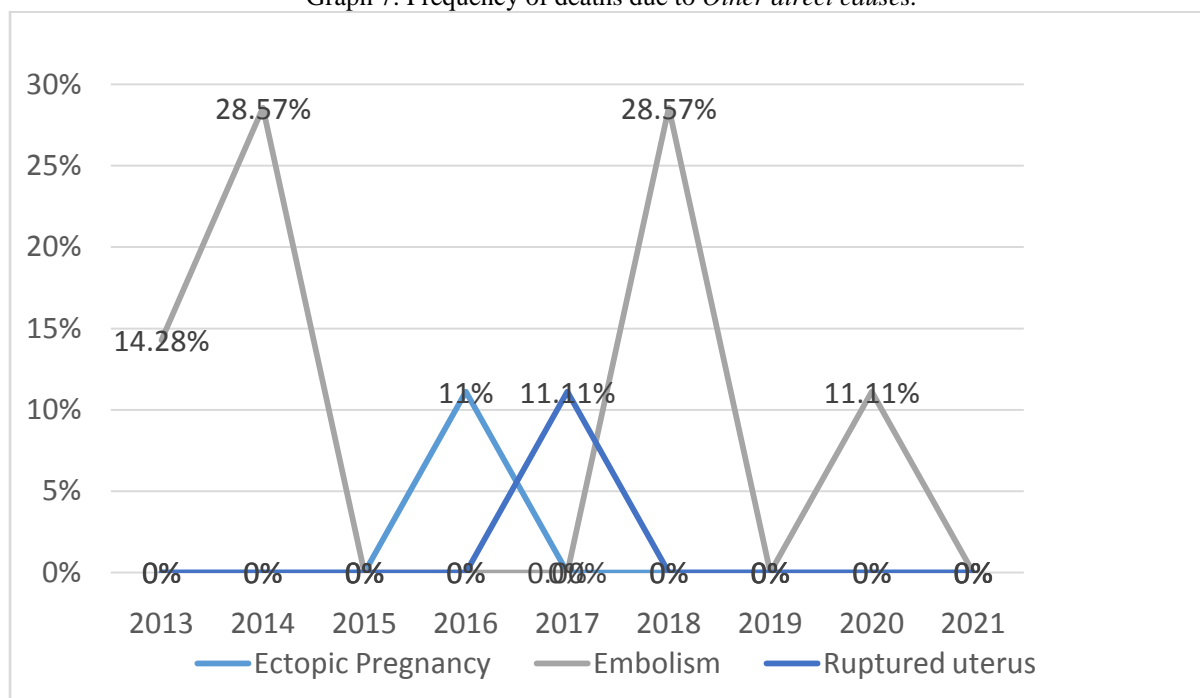
The average maternal deaths due to Unsafe abortion being 5.7%.

Graph 6: Frequency of deaths due to *Hypertensive disorders*.



The average maternal mortality being, Eclampsia- 6.26%, HELLP- 12.24%, AKI- 6.24%

Graph 7: Frequency of deaths due to *Other direct causes*.



The average mortality being 11.63%.

Table 2: Comparison of percentage of maternal mortality due to various causes: *Worldwide* versus *our study*

Cause	Worldwide	Tertiary healthcare setup	Trend
PPH	25%	17.33%	↓
Dengue	6.6%-21.7%	4.67%	↓
Viral Hepatitis	20%	7.4%	↓
SARS-CoV-2	1.6%	22.45%	↑
Heart diseases	0.496%	20.35%	↑
Renal diseases	6.4%	10.45%	↑
ARDS (Non- Covid)	25%	12%	↓
Puerperal Infections	15%	7%	↓
Unsafe abortions	13%	5.7%	↓
Eclampsia	12%	6.26%	↓
Eclampsia with HELLP	0-24%	12.24%	↓
Eclampsia with AKI	6.24%	8.11%	↓
Indirect causes	8%	11.63%	↑
Obstructed labor	8%	0.00%	↓

IV. Discussion:

In our study, the average MMR calculated over a period of 9 years came out to be 382/ 1,00,000 live births. Being a referral centre for the entire Marathwada region, MMR is more as compared to the National MMR.

In this study, average number of deaths due to severe bleeding was 17.33% which is lower than that worldwide (25%). There was no uniform trend of increase or decrease observed. This trend is observed probably due to the monitoring and availability of blood and blood products at our centre. The majority of cases of mortality due to PPH were late referrals, with patient already in a state of shock.

The frequency of deaths due to indirect causes was studied under the headings of *Dengue, Viral Hepatitis, COVID-19, Cardiac diseases, Renal diseases and respiratory diseases*.

In this study maternal mortality due to dengue is 4.67% . There is also a trend of decrease in maternal deaths due to Dengue which can be attributed to timely diagnosis and multidisciplinary approach for treating a mother diagnosed with dengue. Studies suggest that dengue during pregnancy tripled the risk of maternal death from 0.1% to 0.3% with an ODD's ratio of 3. The percentage of deaths among pregnant women with dengue varies from 6.6% in Sri Lanka to as high as 21.7% in South Sudan.⁽⁶⁾

In this study, Viral hepatitis led to 7.4% of maternal mortality. Similar to dengue, a trend of decrease in the cases of maternal mortality due to viral hepatitis is observed over the years. Viral Hepatitis is associated with very high maternal mortality rates (20%) and needs special attention especially in endemic areas.⁽⁷⁾

In this study, the COVID 19 maternal mortality was 22.45% over a span of three years which showed a steep rise in the year 2021, the reason being that our centre was a dedicated COVID referral centre. SARS-CoV-2 was discovered in the late December'2019 and led to significant morbidity and mortality worldwide with many studies aimed at assessing its impact on pregnant females and pregnancy outcomes. An INTERCOVID multinational cohort study carried from March to October 2020, involving 43 institutions in 18 countries concluded that maternal mortality and morbidity were significantly increased with COVID 19 with the risk of maternal mortality being 1.6%.⁽⁸⁾

On an average, in this study, heart diseases led to an average of 20.35%. Over the years, we do observe a non-uniform trend towards decrease in cases of maternal mortality due to cardiac diseases. The major heart diseases responsible for maternal mortality were rheumatic heart disease (RHD) (2 cases) and arrhythmias (2 cases), followed by congenital heart diseases (1 case) and Cardiomyopathy of pregnancy (1 case). The MMR worldwide according to global data varies from 1 to 496/1,00,000 live births.⁽⁹⁾ Despite the potential for significant maternal morbidity, a satisfactory response can be expected with careful antenatal, Intrapartum and postpartum management.^(10,11,12,13)

In this study, the average maternal mortality due to renal diseases came out to be 10.45% which is high, mainly because of the availability of dialysis facilities in our centre and hence, many referrals. The renal diseases included here are mainly acute renal insufficiency (sequelae of pre-eclampsia-eclampsia, HELLP, Septic abortion), and patients with chronic renal insufficiency. No uniform trend of increase or decrease is observed. Grunfeld and Pertuiset reviewed 57 patients that presented over a 22-year period and calculated the maternal mortality rate to be 12% due to all causes of renal diseases.⁽¹⁴⁾ Maternal mortality due to pregnancy related acute kidney injury in India has observed a decreasing trend from 20% to 6.4% from 1992-2002.⁽¹⁵⁾

In this study the average of maternal mortality due to Non-COVID ARDS came out to be 12% which is significantly lower than the rates observed in cases of severe ARDS. A study carried out by K G Perry Jr et al. on pregnancy related ARDS reviewed all the cases of pregnant patients diagnosed with ARDS over a period of 14 years. They calculated the maternal mortality rate to be as high as 25%.⁽¹⁶⁾

In our study the average maternal mortality due to puerperal infections came out to be 7% which is significantly lower than the percentage worldwide (15%)⁽²⁾. This can be attributed to the strict aseptic precautions observed and vigilant post-natal monitoring of the patients.

In this study, the average maternal mortality due to unsafe abortions was 5.7%. Unsafe abortions are the 4th highest leading cause of maternal mortality worldwide with a maternal mortality rate of 13%.⁽²⁾ Majority of these in countries like India are due to the consumption of over the counter MTP pills without medical supervision that lead to complications like severe bleeding and sepsis.

In this study the average maternal mortality due to eclampsia came out to be 6.26%. There is a decrease in the maternal mortality due to eclampsia with 0% maternal mortality in the year 2021 which could be attributed to the 0 hour LSCS in cases of eclampsia with salvageable fetuses. Maternal mortality rate due to eclampsia is 12% worldwide making it the 5th leading cause of maternal mortality worldwide.⁽²⁾ The average maternal mortality in cases of pre-eclampsia complicated with HELLP syndrome was 12.24%. A trend of decrease in mortality is evident. The mortality rate due to HELLP syndrome ranges from 0-24%.⁽¹⁷⁾ Maternal mortality in these cases appears to be due to renal failure, consumption coagulopathy, abruption placenta, lung and brain edema's, liver hematoma and hypovolemic shock. Furthermore, maternal mortality due to cases of pre-eclampsia with AKI came out to be 8.11% as compared to 6.24% prevalent in India.

In this study, the average maternal mortality due to other direct causes came out to be 11.63%. The leading cause of maternal mortality was pulmonary embolism which lead to 9.17% of maternal mortality followed by ruptured uterus (1.23%) in a referred case of MTP and ectopic pregnancy (1.22%). Other direct causes of maternal mortality contribute to 8% maternal mortality worldwide.⁽²⁾

In this study, there were zero reported cases of maternal mortality due to obstructed labor which is in stark contrast to the 8% of maternal mortality reported due to obstructed labor worldwide due to protocol based monitoring in our labor room.⁽²⁾

V. Conclusion:

In this study, what is evident is that there is a shift in the causes of maternal mortality in a critical care unit catering to high risk pregnancies requiring ICU, CCU, dialysis and ventilatory support. As a result of preventive measures adopted in a critical care setup, the obvious causes of MMR do not contribute significantly to maternal mortality. The rise in percentage of maternal mortality contributed by causes such as SARS-CoV-2, heart diseases, renal diseases and other direct causes should alert the Obstetrician. This significant rise in part may be due to the increase in life expectancy of females with congenital heart diseases and chronic renal diseases and them being able to attempt pregnancy. A multidisciplinary, holistic and joint effort towards early diagnosis, timely referral and management of these rising factors of maternal mortality will therefore, lead to a drastic decrease in Maternal mortality.

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