Section: Obstetrics & Gynecology

Original Research Article

# TREND OF MATERNAL MORTALITY RATIO AT GOVERNMENT TERTIARY CENTRE, INDORE OVER LAST DECADE- ARE WE ACTUALY REACHING TO EACH AND EVERY WOMAN TO PROVIDE HER BETTER HEALTH SERVICES

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***Received*** *: 17/07/2024*
***Received in revised form*** *: 12/09/2024*
***Accepted*** *: 28/09/2024*

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**DOI:** 10.70034/ijmedph.2024.3.177

**Source of Support:** Nil,
**Conflict of Interest:** None declared

**Int J Med Pub Health**
2024; 14 (3); 985-990

ABSTRACT

**Background:** Maternal mortality remains a critical issue, reflecting the effectiveness of obstetric care and healthcare systems. This study aims to analyze maternal mortality trends, causes, and contributing factors over a 11-year period at MGM and MTH Hospital, Indore.

**Materials and Methods:** A retrospective analysis was performed on hospital records and death summaries for all maternal deaths at MGM and MTH Hospital from January 2013 to December 2023. Data collected included maternal age, parity, booking status, delivery status, residence, referral history, socioeconomic class, admission-to-death interval, and cause of death. Maternal deaths were classified according to the WHO's International Classification of Diseases, 10th Revision (ICD-10), into direct and indirect obstetric causes.

**Results:** Out of 1,75,128 deliveries, there were 1194 maternal deaths, yielding a Maternal Mortality Ratio (MMR) ranging from 1917.3 to 602, with an average of 960.5 per 100,000 live births. The majority of deaths (59.9%) were referred from peripheral health centers, often arriving with severe complications. The causes of death included direct obstetric causes (64.8%), such as hypertensive disorders, obstetric hemorrhage, and thromboembolism, and indirect causes (27.3%), including severe anemia, jaundice, and heart disease. The most frequent deaths occurred during the postnatal period (517 cases), with significant mortality linked to medical interventions and complications.

**Conclusion:** The study highlights critical areas for improvement in maternal care, including the need for timely referrals, enhanced critical care facilities, and better management of anemia and safe abortion services. Addressing these issues could significantly reduce maternal mortality and improve outcomes for pregnant women.

**Keywords:** Maternal mortality rate (MMR), Indore, Referral cases, Hypertensive disorders, Obstetric hemorrhage, Direct and indirect causes.

## INTRODUCTION

Maternal mortality has long been a significant concern in India, and improving maternal health while reducing the Maternal Mortality Ratio (MMR) has been a persistent goal.[1] Maternal mortality reflects the quality of care provided to women during childbirth and is often a tragic indicator of

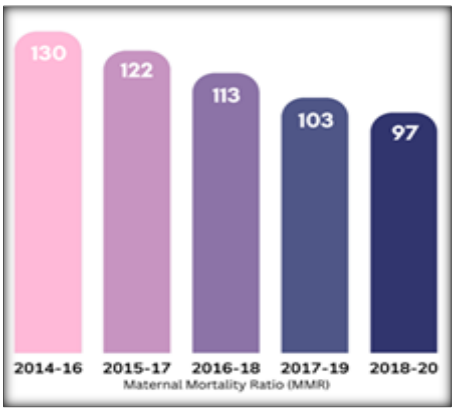
preventable deaths. Many maternal deaths occur during what is typically a natural process, affecting young and otherwise healthy women. In India, a maternal death is reported approximately every 10 minutes.[2]

Maternal death was defined and classified according to the World Health Organization's International Classification of Diseases, 10th Revision (ICD-10). According to this definition, maternal death refers to the death of a woman while pregnant or within 42 days of the termination of pregnancy, regardless of the duration or site of the pregnancy. This includes deaths resulting from any cause related to or aggravated by the pregnancy or its management but excludes accidental or incidental causes. Maternal deaths were categorized into direct, indirect, or fortuitous. The Maternal Mortality Ratio (MMR) is calculated as the number of direct and indirect maternal deaths per 100,000 live births up to 42 days after the termination of pregnancy.[3]

This metric reflects the reproductive health of women in a given region. A high maternal mortality rate indicates a higher incidence of deaths among women of reproductive age due to complications arising during or after pregnancy, childbirth, or abortion.

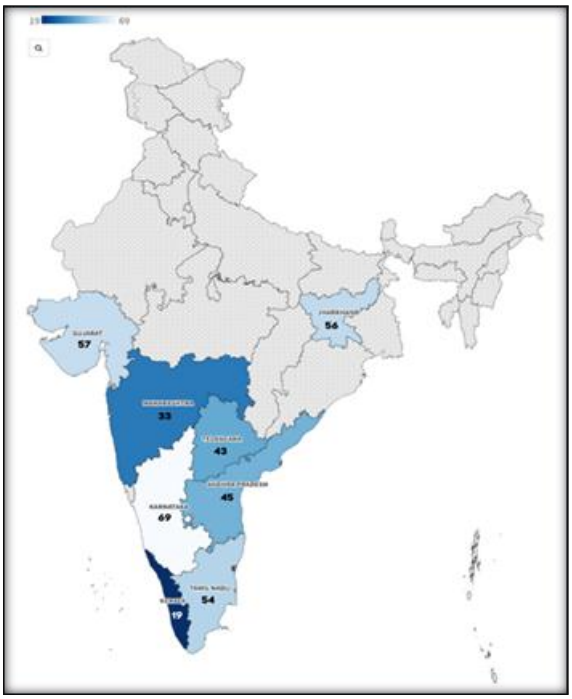
In recent years, maternal mortality trends in developing countries have gained increased attention, particularly in light of the United Nations Millennium Declaration. The fifth Millennium Development Goal (MDG) aimed to reduce the Maternal Mortality Ratio (MMR) by 75% by 2015.[4]

In 1990, India had a high Maternal Mortality Ratio (MMR) of 556 per 100,000 live births, leading to approximately 138,000 maternal deaths annually, far exceeding the global MMR of 385 at the time.[5] The National Health Policy (NHP) 2017 set a target to lower the MMR to below 100 by 2020. By 2018-2020, India achieved an MMR of 97, surpassing this goal.[6] Targeted interventions over the past eight years led to a steady decrease in MMR, from 130 in 2014-2016 to 113 in 2016-2018, and further to 103 by 2017-2019, compared to a global MMR of 211 during the same period.




**Maternal Mortality Rate in India from 2014 to 2020**

The Sustainable Development Goal (SDG) 3.1, set by the United Nations in 2015, targets reducing the global Maternal Mortality Ratio (MMR) to below 70 per 100,000 live births by 2030. India is progressing towards this goal, with several states already meeting or exceeding this target. Notable examples include Kerala (19), Maharashtra (33), Telangana (43), Andhra Pradesh (45), Tamil Nadu (54), Jharkhand (56), Gujarat (57), and Karnataka (69). The Indian Government's approach focuses on improving maternal and child health through comprehensive care throughout pregnancy and the postpartum period, encompassing routine testing, regular check-ups, delivery services, and postnatal care.




**Indian States which have achieved MMR SDG target**

India has launched several key initiatives to improve maternal and newborn health. The Pradhan Mantri Surakshit Matritva Abhiyan provides enhanced free antenatal care, while POSHAN Abhiyaan focuses on better nutrition for pregnant women. The Pradhan Mantri Matru Vandana Yojana offers cash benefits to offset pregnancy-related expenses. SUMAN ensures dignified and respectful healthcare at public facilities, and LaQshya improves care quality during childbirth. These programs have increased institutional deliveries from 79% in 2015-16 to 89% in 2019-20. Additional measures include improving infrastructure at delivery points, establishing Maternal and Child Health Wings, creating Birth Waiting Homes, and addressing anemia through the Anemia Mukt Bharat strategy. [7,8]

The Maternal Mortality Ratio (MMR) in Madhya Pradesh (MP) is 163 per 100,000 live births for the period 2017-2019, representing a decrease of 10 points from the 2016-2018 period, according to the

Special Bulletin on Maternal Mortality in India. Despite this improvement, MP remains among the states with the highest MMR, ranking third worst, with only Uttar Pradesh (167) and Assam (205) having higher ratios.

Current epidemiological data on improvements in Maternal Mortality Ratio (MMR) in Madhya Pradesh, particularly in Indore, is limited. This study seeks to fill this gap by reviewing maternal deaths at our institution in Indore. The objectives are to analyze the causes of these deaths, identify preventable factors, and determine necessary healthcare improvements. Ultimately, the study aims to develop effective strategies to prevent maternal deaths and enhance overall maternal health in the region.

## MATERIALS AND METHODS

A retrospective study was conducted to review hospital records and death summaries of all maternal deaths at MGM and MTH Hospital, Indore, over a 11-year period from January 2013 to December 2023. The study involved a detailed examination of each maternal death, focusing on factors such as maternal age, parity, booking status, delivery status, residence, referral, socioeconomic class, admission-to-death interval, and the cause of death.

Maternal death was defined and classified according to the World Health Organization's International Classification of Diseases, 10th Revision (ICD-10). The causes of death were classified into direct and indirect obstetric causes. Direct obstetric deaths are those resulting from complications of pregnancy, delivery, or postpartum periods, including issues arising from interventions, omissions, incorrect treatments, or a chain of events related to these factors. Indirect obstetric deaths are those caused by pre-existing conditions or diseases that developed during pregnancy, which were exacerbated by the physiological effects of pregnancy but not directly caused by obstetric complications. Data was collected using a prescribed proforma from the hospital records.

## RESULTS

There were a total of 1,75,128 deliveries at MGM & MTH hospital from January 2013 to December 2023. There were 1194 deaths, MMR ranged from 1917.3 to 602 with an average of 960.5

Of the 1194 maternal deaths reviewed, 59.9% (716) were referred from peripheral health centers. These cases typically arrived at a late stage with severe complications, resulting in deaths within 24 hours (44.7% or 534 cases) and within 48 hours (18.3% or 218 cases) of admission. Most referrals came from Badwani, Khandwa, Khargone, Ratlam, Ujjain, Dewas, and Dhar. The high Maternal Mortality Ratio (MMR) reflects the difficulties faced at our tertiary referral center, MYH and MTH Indore, which handles a large volume of complex cases from these regions. Contributing factors include delayed referrals, delays in seeking healthcare, lack of awareness, illiteracy, and poverty.

Among the 1194 maternal deaths reviewed, 64.8% (774) were attributed to direct obstetric causes, 27.3% (327) to indirect causes, and 4.1% (41) were brought in dead (with 38 of these cases occurring during the COVID-19 pandemic).

The most prevalent direct obstetric causes included hypertensive disorders, such as eclampsia and severe preeclampsia, followed by obstetric hemorrhage (including postpartum hemorrhage, antepartum hemorrhage, ruptured uterus, uterine inversion, and retained placenta), thromboembolism, and post-abortion complications. [Table 2]

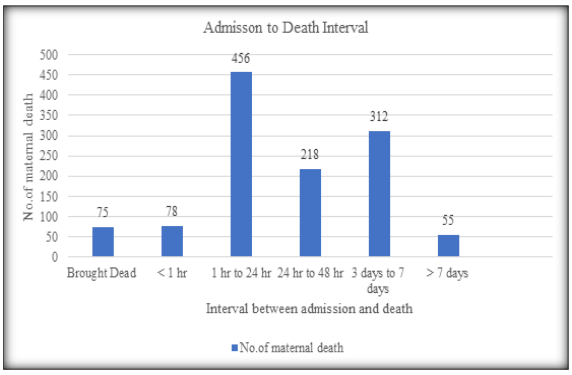



**Figure 1: Admission to Death Interval**

Out of 1194 maternal deaths, 375 occurred during antenatal care, 218 post-Cesarean section, and 517 during postnatal care. Additionally, 26 deaths followed obstetric hysterectomy, 17 after laparotomy for ruptured uterus or ectopic pregnancy, and 40 were post-abortal, mostly during the COVID-19 pandemic. There was one death due to hydatidiform mole. The data highlights a high number of deaths during the postnatal period and reveals significant mortality associated with various medical interventions and complications. [Table 4]

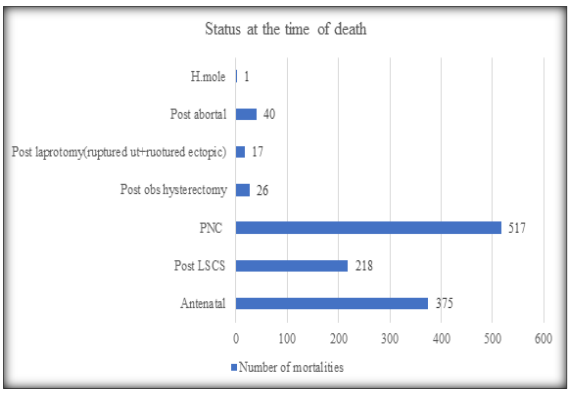



**Figure 2: Status at the time of death**

**Table 1: Maternal Mortality Ratio (MMR) from January 2013 to December 2023**

| Years | Total maternal admission | Live birth | Total deaths | MMR |
|---|---|---|---|---|
| 2013 | 14816 | 9966 | 60 | 602 |
| 2014 | 15577 | 10830 | 70 | 646 |
| 2015 | 15684 | 11360 | 73 | 642 |
| 2016 | 14882 | 12325 | 89 (2 brought dead) | 722 |
| 2017 | 18281 | 12356 | 76 | 615 |
| 2018 | 18352 | 12308 | 101 | 820.6 |
| 2019 | 18484 | 12358 | 106 | 857 |
| 2020 | 12317 | 8886 | 159 (27 brought dead) | 1789 |
| 2021 | 11345 | 9284 | 178 (11 brought dead) | 1917.3 |
| 2022 | 15751 | 12102 | 143 | 1181.6 |
| 2023 | 19639 | 12535 | 139 | 1108.6 |
| **2013-2023** | **175128** | **124310** | **1194** | **960.5** |

**Table 2: Referral cases from January 2012 to December 2021**

| | Number of mortalities | Referral | % of referred cases |
|---|---|---|---|
| 2013 | 60 | 24 | 40% |
| 2014 | 70 | 28 | 40% |
| 2015 | 73 | 29 | 39.8% |
| 2016 | 89 | 54 | 60.8% |
| 2017 | 76 | 59 | 77.6% |
| 2018 | 101 | 58 | 52.7% |
| 2019 | 106 | 65 | 61.3% |
| 2020 | 159 | 103 | 64.8% |
| 2021 | 178 | 105 | 59% |
| 2022 | 143 | 98 | 68% |
| 2023 | 139 | 93 | 66.9% |
| **2013-2023** | **1194** | **716** | **59.9%** |

**Table 3: Direct Cause of deaths**

| Causes | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2013 -2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Eclampsia** | 08 | 13 | 19 | 23 | 25 | 31 | 28 | 38 | 33 | 05 | 32 | **255** |
| **Preclampsia** | 10 | 11 | 05 | 22 | 14 | 21 | 15 | 20 | 11 | 37 | 08 | **174** |
| **PPH** | 14 | 11 | 12 | 13 | 10 | 18 | 15 | 23 | 27 | 25 | 08 | **176** |
| **APH** | 02 | 05 | 04 | 08 | 06 | 03 | 04 | 15 | 13 | 05 | 12 | **77** |
| **Ruptured uterus** | 04 | 02 | 02 | 01 | 03 | 02 | 01 | 03 | 01 | 02 | 02 | **23** |
| **Retained placenta** | - | - | 03 | - | 01 | - | - | - | - | - | | **04** |
| **Uterine inversion** | - | - | 02 | 02 | 04 | - | - | 01 | 01 | 01 | 02 | **13** |
| **Ectopic pregnancy** | 01 | 01 | - | - | 01 | - | | - | - | - | - | **03** |
| **Abortion** | 02 | 01 | 01 | - | 01 | 01 | 01 | 01 | - | - | - | **08** |
| **h.Mole** | - | 01 | - | - | - | - | - | - | - | - | - | **02** |
| **thromboembolism** | 02 | 03 | 02 | 01 | 01 | 04 | 10 | 06 | 08 | - | 03 | **39** |
| **TOTAL** | 43 | 48 | 50 | 70 | 66 | 80 | 74 | 107 | 94 | **75** | **67** | **774** |

**Table 4: Indirect Cause of deaths**

| Causes | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2013 -2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Severe anemia** | 03 | 04 | 05 | 06 | 02 | 06 | 05 | 02 | 07 | 03 | 01 | **44** |
| **Jaundice** | 05 | 06 | 04 | 03 | 01 | 04 | 08 | 02 | 04 | 05 | 06 | **48** |
| **heart disease** | - | 01 | 02 | - | 03 | 01 | 03 | 06 | 05 | 03 | 04 | **28** |
| **ARDS** | 01 | 03 | 03 | 02 | 01 | 04 | 07 | 04 | 12 | 11 | 11 | **59** |
| **Hepatic encephalopathy** | 06 | 03 | 05 | 02 | 01 | 04 | 05 | 06 | 05 | 00 | 07 | **44** |
| **Sickle cell crisis** | - | - | 01 | 01 | 01 | - | -- | - | | 02 | 07 | **12** |
| **others** | 02 | 04 | 03 | 05 | 01 | 02 | 04 | 05 | 12 | 11 | 13 | **62** |
| **covid-19** | - | - | - | - | - | - | - | 03 | 27 | | | **30** |
| **Total** | **17** | **21** | **23** | **19** | **10** | **21** | **32** | **28** | **72** | 35 | 49 | **327** |

## DISCUSSION

Evidence indicates that infants whose mothers die are significantly more likely to die before their second birthday compared to those whose mothers survive. Furthermore, for every maternal death, approximately 20 women experience serious complications. Alarmingly, 98% of these deaths occur in developing countries.[9] Maternal mortality serves as a critical indicator not only of women's reproductive health but also of the effectiveness and accessibility of maternal health services under national programs. According to the United Nations, the risk of maternal mortality in India is 1 in 190 women, compared to 1 in 170 in Pakistan and 1 in 1400 in Sri Lanka.[2]

UNICEF estimates that around 80% of maternal deaths could be prevented with access to essential maternity and basic health-care services.[10] The United Nations Human Rights Office highlights that the majority of these deaths could have been avoided with equal treatment and access to basic

care known for over 60 years. Each preventable death underscores a systemic failure, reflecting inadequacies in the healthcare system.

Maternal deaths often result from three types of delays: the first delay involves the decision to seek care for obstetric complications, typically occurring at the household level; the second delay pertains to the transportation of the patient to a health facility; and the third delay occurs at the healthcare facility, reflecting the quality and urgency of emergency obstetric care.

This study, conducted at MYH & MTH Hospital, a tertiary care centre affiliated with MGM Medical College and Research Institute in Indore, Madhya Pradesh, provides insights into maternal mortality in the region. Mysore, with a population of approximately 3,276,697 has a high rate of institutional deliveries (98.7%). MYH & MTH Hospital handles referrals from nearby Primary Health Centers and Community Health Centers across various districts of Madhya Pradesh mainly Badwani, Khandwa, Khargone, Ratlam, Ujjain, Dewas, and Dhar.

In the present study, the Maternal Mortality Ratio (MMR) ranged from 1917.3 to 602 with an average of 960.5. Comparatively, studies from various locations in India report differing MMRs: Ashrafi A M et al,[1] reported a range of 262 to 190 at Cheluvamba Hospital, Mysore; Saini V et al,[11] reported a range of 471 to 225 at Hindu Rao Hospital, Delhi; Tayade S et al,[12] found an MMR of 242 in Wadgaon, Maharashtra; Shivakumar HC et al,[13] reported an MMR of 974 at VIMS, Bellary, South India; and Jadhav CA et al,[14] noted an MMR of 395 at a tertiary care center in Solapur, India. The high Maternal Mortality Ratio (MMR) reflects the difficulties faced at our tertiary referral center, MYH and MTH Indore, which handles a large volume of complex cases from these regions. Contributing factors include delayed referrals, delays in seeking healthcare, lack of awareness, illiteracy, and poverty.

In our study, women who were referred during labor and delivery experienced more adverse birth outcomes. The postnatal period emerged as particularly critical, as most maternal deaths i.e., 517 (43.3%) occurred during this time due to factors such as inadequate antenatal care, delayed diagnosis, and poor management of pregnancy complications. This underscores the need for improved prenatal care and timely interventions to address complications early and enhance maternal survival.

Table 5 illustrates Maternal Mortality Ratio (MMR) trends across different studies. Traditionally, in developing countries like India, hemorrhage has been the leading cause of maternal deaths. However, our study reveals a shift in this trend, with hypertensive disorders now being the predominant cause of death, similar to patterns observed in developed nations. This shift underscores the need for increased emphasis on the early identification and treatment of hypertensive disorders, including the use of appropriate medications, regular antenatal care, prevention of eclampsia, and timely referrals to improve maternal health outcomes. [Table 5]

In our study, the majority of maternal deaths occurred either within the first 6 hours of admission or after 48 hours. This pattern underscores the urgent need for improved early referral systems and enhanced critical care facilities, including increasing staff and optimizing workloads at tertiary centers. Anemia continues to be a major indirect cause of mortality, highlighting the need for better periconceptional anemia management and improved antenatal care. Ensuring a reliable supply of blood and blood products is also essential. Furthermore, abortion-related deaths in 08 patients emphasize the importance of strengthening safe abortion services to prevent such fatalities.

**Table 5: Review of literature**

| Authors | MMR | Hemorrhage % | Toxemia % | Sepsis % | Anaemia % |
|---|---|---|---|---|---|
| Ashrafi A M et al. [1] (2008-2013) | 215.6 | 24.8 | 30.4 | 6.3 | 14.8 |
| Vidyadhare et al. [15] (2006-10) | 302.6 | 21.5 | 10.52 | 7.89 | 2.63 |
| Verma A et al. [16] (1995-2005) | 345.9 | 21.8 | 20.0 | 21.6 | 15.4 |
| Mukherjee S et al. [17] (1996-2006) | 518.7 | 12.7 | 22.97 | 9.45 | 25.40 |
| Pal A et al. [18] (2005) | 625 | 9.22 | 50.56 | 18.17 | 4.8 |
| Puri A et al. [19] (2003-06) | 690 | 12 | 18 | 24 | 13 |

## CONCLUSION

In conclusion, addressing maternal mortality requires a multifaceted approach. Identifying high-risk cases during antenatal care (ANC) visits and ensuring regular follow-ups with routine screenings are essential for effective management. To mitigate maternal deaths, there must be a focus on early referrals, accessible transport, and ongoing skill-based training for healthcare providers. Special attention should be given to training Accredited Social Health Activists (ASHA) and Auxiliary Nurse Midwives (ANM) at the grassroots level, alongside strengthening referral facilities. Continuous education for medical officers at primary health centers (PHCs) and sub-district hospitals is crucial for the timely recognition and referral of high-risk women. Additionally, providing multidisciplinary management at tertiary centers and ensuring that all health facilities are effectively reaching and serving every mother is imperative for reducing maternal mortality and improving overall maternal health outcomes.

**Financial Support and Sponsorship:** Nil
**Conflicts of Interest:** There are no conflicts of interest.

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