# Severe Acute Maternal Morbidity: An indicator of Obstetric Care

## Mamatha K[1], Sushmitha S.C[2]

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### Abstract

*Introduction:* Severe Acute Maternal Morbidity (SAMM) is a tool which is more advantageous compared to maternal mortality as an indicator of obstetric care. The global MMR shows a reduction from 342 to 211 death per 1 lakh live birth from 2007 to 2017 with a 38% over 10 years. Under Millennium development goals (MDG)-5, goal was to reduce maternal mortality by 75% between 1990-2015. By the end of year 2020 MMR in India was 97 per lakh. Now the Sustainable development goal (SDG) is to reach MMR below 70 by 2030.

*Aims and Objectives:*

* To as certain the incidence of maternal near-miss indices

* To as certain the reasons behind maternal mortality

* To as certain the occurrences of near-miss instance

*Materials and Methods:* A retrospective study was conducted at Cheluvamba hospital, Mysore, Karnataka, India during January 2022 to December 2022. Maternal fatalities and near miss incidents are included in the study population. Case definitions were made using the 2009 WHO criteria. Diagnoses of life-threatening illnesses were made, and cases that satisfied WHO 2009 criteria were chosen. Analyses of maternal mortality from the same time frame were also conducted. Anemia and other medical conditions were viewed as secondary causes leading to the mother's near-miss and death, while hemorrhage, hypertension, sepsis, and other conditions were classified as primary causes for patients based on their final diagnosis.

*Results:* In our Institute, 8632 deliveries took place. In this study, the MMR was 251/100,000 live births, while the MNMIR (Maternal Near Miss Incidence Ratio) was 14/1000 live births. The ratio of MNM to MM was 5.7:1. The MI (total mortality) was 14.8%. The ratio of severe maternal outcomes to live births, or SMOR, was 16.8/1000. Hypertensive disorder (42.85%) was the leading cause of maternal mortality, with antepartum eclampsia being the main leading cause in our setup, followed by hemorrhage (19.04%). Among the near miss events, hypertensive disorder was the leading cause with 49.16%, followed by hemorrhage (31.66%), severe anemia, and abortion, which account for approximately 7.5%.

*Conclusion:* Maternal morbidity and mortality can be decreased by recognizing the risk factors, identifying high-risk cases, promptly referring them, and stabilizing the referral system.

**Keywords:** SAMM; Maternal health, Maternal near miss; MMR.

**Author's Affiliation:** [1]Professor, [2]Senior Resident, Department of Obstetrics and Gynecology, Cheluvambha Hospital, Mysore Medical College and Research Institute, Mysore, Karnataka 570001, India.

**Corresponding Author: Mamatha K,** Professor, Department of Obstetrics and Gynecology, Cheluvambha Hospital, Mysore Medical College and Research Institute, Mysore, Karnataka 570001, India.

**E-mail:** Sushmithacvs@gmail.com

## INTRODUCTION

Maternal mortality is a critical indicator to assess the quality of services provided by a health care system. Reducing Maternal mortality and improving existing health care is a prime concern both for the country and worldwide. The global MMR maternal death reduced from 342 to 211 death per I lakh live birth from 2007 to 2017 with reduction of 38% over 10 years[2]. Under Millennium development goals (MDG)-5, goal was reducing maternal mortality by 75% between 1990-2015.[3] Maternal death in India is reduced from 556 per 1 lakh live birth in 1990 to 130 per 1 lakh live birth in 2016. By the end of the 2020 MMR is 97 per lakh (sample registrations system November 2022).[1] As per united nations Sustainable development goal (SDG) target of MMR is below 70 by 2030.[1]

Maternal mortality and Maternal near miss are important indicators of maternal health. Maternal mortality, is often described as "the tip of the iceberg", and maternal morbidity as the base.[4] That is for each maternal death, there are several women who experienced a severe complication, nearly died but survived (near miss).

The goal number five was to improve the maternal health in pregnant women's health status and is not reflected by mortality indicators. Hence the concept of severe acute maternal morbidity (SAMM)[6,7] is superior over maternal death in drawing attention to surviving women's reproductive health and lives and is equally applicable in developing countries as well as developed countries.

In many developed countries, maternal mortality has fallen to single digits whereas near miss cases are more and hence useful in evaluation of the present system. Till recently there were no criteria set for identification of these cases for routine implementation, and wider application of this concept was limited.

In 2009, WHO has come up with clinical, laboratory, and management criteria for the identification of these near miss cases. Maternal near miss case is defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy".[5]

### Need for the study

The frequency of the maternal near miss to death ratio, mortality index, and MNM incidence ratio were the main objectives of our study. Analyzing the causes of near-miss incidents and contrasting them with maternal mortality was our goal. In a single year, we have tracked the pattern of maternal fatalities and near-miss incidents.

## AIMS AND OBJECTIVES

* To as certain the incidence of maternal near miss indices.

* To as certain the reasons behind maternal mortality.

* To as certain the occurrences of near-miss instance.

## METHODS

A retrospective study was conducted at Cheluvamba hospital, Mysore, Karnataka, India during January 2022 to December 2022. Maternal fatalities and near-miss incidents are included in the study population. Case definitions were made using the 2009 WHO criteria.

Diagnoses of life-threatening illnesses were made, and cases that satisfied WHO 2009 criteria were chosen. Analyses of maternal mortality from the same time frame were also conducted.

Anemia and other medical conditions were viewed as secondary causes leading to the mother's near-miss and death, while hemorrhage, hypertension, sepsis, and other conditions were classified as primary causes for patients based on their final diagnosis.

*Following indices were calculated:*

1. Women with Life-threatening Conditions (WLTC) refers to the sum of maternal near-miss and maternal deaths (WLTC=MNM+MD).

2. Severe Maternal Outcome Ratio (sMOR) refers to the number of women with life-threatening conditions (MNM+MD) per 1000 live births (LB). {SMOR=(MNM+MD)/LB}.

3. MNM Ratio (MNMR) refers to the number of maternal near miss cases per 1000 live births (MNMR=MNM/LB).

4. Maternal Near-Miss Mortality Ratio (MNM: MD) refers to the ratio between MNM cases and Maternal Deaths (MD).

5. Mortality Index (MI) refers to the number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage [MI=MD/(MNM+MD)].

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## RESULTS

This is a retrospective study done in department of Obstetrics and Gynecology in Cheluvmaba hospital, Mysore. The study was done during a period from 1st January 2022 to 31st December 2022. During this period 12080 ANC cases were admitted, of which 5279 patients were delivered vaginally, 3353 patients required lower segment caesarean section (LSCS). 120 cases were diagnosed as near miss and 21 maternal deaths during the study period.

Table 2 reveals that whereas 52.3% of maternal deaths and 47.5% of near-miss cases were discovered in the 25–31 age range, respectively.

Primipara are more likely to die and have morbidity. In incidents of maternal death and near misses, the majority of patients were in the third trimester. The majority of cases were referred by people living in rural areas.

The most common medical condition in cases of near misses (7.5%) and maternal deaths (9.52%) in this investigation was very severe anemia.

**Table 1:** Near miss indices

| Indices | Results |
|---|---|
| Total no. of deliveries | 8632 |
| Total no. of live births (LB) | 8347 |
| Number of near miss cases (MNM) | 120 |
| Number of maternal mortality cases (MM) | 21 |
| Maternal near miss incidence ratio (MNM IR=MNM/LB) | 14/1000 live birth (1.43%) |
| Maternal mortality ratio (MMR=MM/LB) | 251/100000 live birth |
| Maternal near miss: Maternal mortality ratio (MNM: MD) | 5.7:1 |
| Mortality index (MD/MNM+MD) | 14.8% |
| Severe maternal outcome ratio (SMOR=MNM+MD/LB) | 16.8/1000 live birth (1.68%) |

The incidence ratio of maternal near misses is 14 per 1000 live births. The ratio of maternal near misses to deaths is 5.7: 1. 14.8% is the mortality index.

**Table 2:** Patient characteristics

| Characteristics | Near Miss Cases N-120 | Percentage % | Maternal Death N-21 | Percentage % |
|---|---|---|---|---|
| **Age** | | | | |
| 18-24 Years | 55 | 45.8 | 8 | 38.1 |
| 25-31 Years | 57 | 47.5 | 11 | 52.3 |
| 32-38 Years | 8 | 6.6 | 2 | 9.5 |
| *Parity* | | | | |
| Primipara | 74 | 61.7 | 13 | 61.9 |
| Multipara | 46 | 38.3 | 8 | 38.1 |
| *Gestational Age* | | | | |
| Upto 12 Weeks | 9 | 7.5 | 1 | 4.7 |
| 13-28 Weeks | 6 | 5 | 1 | 4.7 |
| 28-36 Weeks | 58 | 48.3 | 7 | 33.3 |
| Term | 37 | 30.8 | 8 | 38.1 |
| Postnatal | 10 | 8.3 | 4 | 19.04 |
| *Referral* | | | | |
| Self | 49 | 40.83 | 7 | 33.33 |
| Outside | 71 | 59.16 | 14 | 66.66 |

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**Table 3:** Causes for near miss case and maternal deaths

| Causes | Maternal Near Miss Case N-120 | Percentage % | Maternal Death N-21 | Percentage % | Moratality Index % |
|---|---|---|---|---|---|
| Hemorrhage | 38 | 31.66% | 4 | 19.04% | 9.52 |
| APH | 10 | 26.31 | 1 | 25 | |
| PPH | 27 | 71.05 | 3 | 75 | |
| Ruptured Uterus | 1 | 2.63 | 0 | 0 | |
| Hypertensive Disorder | 59 | 49.16% | 9 | 42.85% | 13.23 |
| Severe PE | 26 | 44.06 | 2 | 22.22 | |
| Antepartum Eclampsia | 25 | 42.37 | 3 | 33.33 | |
| Postpartum Eclampsia | 5 | 8.47 | 2 | 22.22 | |
| Hellp Syndrome | 3 | 5.08 | 2 | 22.22 | |
| Abortion | 9 | 7.50% | 1 | 4.76% | 10 |
| Septic Abortion | 2 | 22.22 | 0 | 0 | |
| Abortion In Shock | 3 | 33.33 | 0 | 0 | |
| Ruptured Ectopic | 4 | 44.44 | 1 | 100 | |
| Severe Anemia | 9 | 7.50% | 1 | 4.76% | 10 |
| Others | 2 | 1.60% | 3 | 14.28% | 60 |
| Cardiac Case | 3 | 2.50% | 0 | 0 | 0 |
| Liver Disorder | 0 | 0 | 2 | 9.52% | 100 |
| AFLP | 0 | 0 | 1 | 50 | |
| Wilson Disease | 0 | 0 | 1 | 50 | |
| Pulmonary Embolism | 0 | 0 | 1 | 4.76% | 100 |

Hypertensive condition accounted for 49.16% of the near-miss occurrences, with hemorrhage coming in second at 31.66%. Severe anemia and abortion accounted for approximately 7.5% of the incidents. In our setup, antepartum eclampsia is the primary cause of maternal mortality, followed by hemorrhage (19.04%), whereas hypertensive disease (42.85%) was the major cause of maternal mortality.

The mortality index was high in our configuration; the largest percentages were seen in cases of liver disease and pulmonary embolism (100%) and DKI, metastatic liver disease owing to ovarian cancer, bronchopneumonia, and epilepsy with metabolic acidosis.

**Table 4:** Intevention

| Intervention | Number of near miss cases |
|---|---|
| ICU admission | 70 |
| Use of cardiotonics/vasopressors | 18 |
| Mechanical ventilation | 15 |
| NIV | 10 |
| Laparotomy including Hysterectomy | 3 |
| Dialysis | 8 |
| Management of ketoacidosis | 2 |
| Drugs to reduce cerebral oedema (mannitol) | 15 |
| Blood transfusions | 50 |
| Balloon tamponade | 19 |

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Over 50% of the patients needed to be admitted to the intensive care unit, and 15% of them needed ventilator support. Patients are often extubated on day two. NIV was needed for ten patients. About fifty patients received several PRBC, platelets, and FFB transfusions.

## DISCUSSION

An indicator of the caliber of maternal care is obstetric fatalities. A few years ago, near miss criteria gained popularity since they were not consistent. The 2009 WHO criteria[8] are distinct in that they take into account laboratory and management based factors in addition to clinical criteria. As a result, it takes into account both Waterston's[10] and Mantel's[9] criterion. The other indices pick up the near miss case if one criterion misses it, lowering the likelihood of missing the case.

The SAMM study conducted in Brazil solely examined ICU settings, but our analysis encompassed ICU and high dependency units, thereby representing all cases of near misses. The findings of our study were similar to those of other developing nations, but the WHO criteria were nottaken into account in these studies.[11]

This study's maternal near miss incidence ratio (MNMR) of 14% is similar to that of Roopa PS et al.'s[12] study from 2012, which found that the MNMR was 14.34/1000 live births. Research indicates a comparable pattern, with variations ranging from 15–40 per 1000 live births in underdeveloped nations.[13-16] Numerous criteria have been included in the studies to identify the cases of near misses. Using the Mantel's and Waterson's criteria, a cross-sectional study conducted in Brazil revealed a variable rate of 86 and 62, respectively.[16]

In our setting, there were 251 maternal deaths for every 100,000 live births. A similar death rate of 260/100000 live newborns was seen in the Brazilian study.[15] The maternal mortality ratios in other emerging nations were 423/100000 live births and 324/100000 live births[17,18], respectively. Hypertensive disorder was the primary cause (42.85%). The majority of the maternal death group patients arrived at our hospital in a fatal condition and passed away in ten to twelve hours.

There was one maternal fatality for every five to six life-threatening diseases, or a near miss to mortality ratio of 5.7: 1. Better care is indicated by higher ratios. A 5.6:1 ratio in Roopa PS et al.[12] supports our findings. A study conducted in Nepal found a ratio of 7.2:1,[17,18] whereas a study conducted in Syria found a ratio of 60:1. The range of 1: 5–12[16] in African countries is comparable to this ratio. According to their research, the ratio is 117–223: 1.[14] Over time, an increase in this percentage indicates progress made in improving obstetric care. Therefore, yearly estimations rather than one-time estimates might aid in increasing the quality of care given.

Hypertensive disorder (49.16%), hemorrhage (31.66%), severe anemia and abortion (7.5%), cardiac cases (2.5%), and DKI (1.6%) are the most common conditions causing maternal near misses. In our investigation, 21 deaths were noted in total. According to Upadhyaya and Chaudhary, Moracs et al., and Huseyin et al., hypertensive disorders during pregnancy are the primary cause of sickness in mother.[19-21]

In our study had incidence of severe preeclampsia in 21.6%, Eclampsia 24.9%, HELLP syndrome 2.5% and in Study by Souza JP et al[22], had incidence of severe pre-eclampsia in 36.3%, Eclampsia 9.7%, HELLP syndrome 5.6%. severe hemorrhage 10.5%, severe sepsis 6.4%.

Our study's mortality index is 14.8%. The majority of the cases submitted to our tertiary referral facility, which serves neighboring regions in and around Mysore, are already in a moribund state. Delays in referrals are a primary cause of illness and mortality among mothers. The creation of tertiary care facilities in each district can reduce this. The study's maternal near misses and deaths may have resulted from insufficient resource utilization, tardy diagnosis making, and delayed transfer to a tertiary center. Improving health awareness and providing health education can also have a significant impact on the quality of obstetric critical care. The high mortality index in our Centre is due to poor antenatal care, delayed referrals, poor transport facilities and lack of knowledge.

One of the main goals of the National Health Mission (NHM) is to lower maternal and newborn morbidity and mortality in order to help India meet the Sustainable Development Goal of having an MMR of fewer than 70 per lakh live births.

With the goal of encouraging institutional delivery, the Janani Suraksha Yojana (JSY) was launched, offering financial incentives. The PMSMA program has been initiated in order to achieve a significant reduction in maternal morbidity, maternal motility, and neonatal morbidity. Pre-eclampsia, eclampsia, hemorrhage, severe anemia, and other high-risk and susceptible cases are more likely to be delivered in an institutional

setting.

All Medical College Hospitals, District Hospitals, First Referral Units (FRU), and Community Health Centers (CHCs) are implementing the LaQshaya program. All expectant mothers and newborns who give birth in public health facilities will benefit from it. Under the LaQshya program, obstetric HDUs at district hospitals and specialized obstetric ICUs at medical colleges hospitals are operationalized to improve critical care in obstetrics.

## CONCLUSION

Maternal fatalities and near-miss incidents share similarities that can be used to illustrate the challenges faced following the commencement of an acute complication.Through early referral or thorough monitoring, the SAMM criteria can be used to reduce maternal mortality and morbidity during obstetric treatment. The introduction of government programs like LaQshya, PMSMA, SUMANA, and other initiatives to strengthen the referral units can reduce maternal morbidity and death by enhancing antenatal care, identifying high risk cases, early referral, and strengthening the referral unit.

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