

AN ANALYSIS OF MATERNAL NEAR MISS CASES IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Maternal Near Miss (MNM) cases are important indicators of the quality of maternal health care services. Studying these cases helps in identifying preventable medical conditions, delays in management, and systemic gaps that contribute to severe maternal morbidity and mortality, thereby providing opportunities to improve maternal health outcomes and strengthen healthcare delivery systems. This study is aimed to determine the incidence and major causes of maternal near miss cases in a tertiary care hospital and to assess the avoidable factors and delays contributing to these life-threatening events. **Materials and Methods:** A prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Silchar Medical College and Hospital over a period of one year. All women who fulfilled the WHO 2009 Near Miss Criteria were included in the study. Information regarding the sociodemographic characteristics, obstetric history, clinical presentation, laboratory findings, and delays in receiving treatment was collected. Data were compiled and analyzed using Microsoft Excel and SPSS. **Result:** Out of 103 participants, the mean age was 28.38 ± 5.59 years. The Maternal Near Miss Ratio was 48.5 per 1,000 live births and the Maternal Mortality Ratio was 145.6 per 100,000 live births. Eclampsia, severe anemia, sepsis, and hemorrhage were the leading causes, with most cases occurring during the third trimester. Delay in reaching the healthcare facilities was the most common delay observed. **Conclusion:** Hypertensive disorders, hemorrhage, and sepsis remains the predominant causes of maternal near miss. Strengthening referral systems, ensuring early diagnosis, and providing timely and effective management can substantially reduce maternal morbidity and mortality.

INTRODUCTION

Maternal Near Miss (MNM) has emerged as an important indicator for evaluating the quality of maternal healthcare services worldwide. Unlike maternal mortality, which records deaths due to pregnancy-related causes, MNM focuses on women who experience severe life-threatening complications during pregnancy, childbirth, or within 42 days of termination of pregnancy but survive. According to the World Health Organization (WHO), MNM refers to a woman who nearly died but survived a complication occurring during pregnancy or the postpartum period.^[1] Studying such cases provides broader insights into maternal health challenges and reflects how effectively healthcare systems respond to obstetric emergencies. MNM cases highlight both the severity of maternal complications and the capacity of health facilities to provide timely and effective treatment.

These cases serve as important indicators for assessing hospital infrastructure, clinical decision-making, and emergency response systems.^[2] In settings where maternal deaths are relatively low, MNM offers a more sensitive measure for evaluating maternal health services. Monitoring MNM also supports global initiatives such as Sustainable Development Goal 3.1, which aims to reduce maternal mortality and improve maternal health outcomes. Furthermore, MNM surveillance encourages respectful, patient-centred maternity care and helps identify hidden risks during pregnancy that require early monitoring and intervention.^[3]

Analysis of MNM cases provides valuable insights into the functioning of maternal healthcare systems. These cases act as “sentinel events,” helping clinicians and policymakers identify preventable factors that contribute to severe maternal complications. Survivor experiences often reveal

important information regarding delays in recognizing complications, referral barriers, and availability of skilled healthcare personnel.^[3] MNM reviews also promote a culture of learning and accountability by highlighting successful life-saving interventions alongside clinical shortcomings. Regular audits based on MNM cases enable healthcare facilities to refine referral pathways, improve triage systems, and strengthen clinical decision-making processes. Compared with maternal death reviews, MNM audits generally create a less punitive environment, encouraging open discussion and multidisciplinary learning.^[4] In addition, the analysis of MNM cases frequently reveal the influence of the “Three-Delay Model,” which includes delays in seeking care, reaching healthcare facilities, and receiving appropriate treatment. Addressing these delays through community awareness, improved transportation systems, and strengthened health facilities can significantly reduce maternal morbidity and mortality.^[5,6]

Globally, the burden of MNM varies considerably between high-income countries (HICs) and low- and middle-income countries (LMICs). In high-income settings, well-developed healthcare infrastructure, skilled birth attendants, and efficient emergency obstetric services contribute to lower MNM rates, often below 10 cases per 1,000 live births.^[7] In contrast, many LMICs report MNM rates exceeding 50 per 1,000 live births due to systemic challenges such as limited resources, delayed care-seeking, poor transportation, and inadequate referral systems. Socioeconomic factors, geographic isolation, and cultural barriers further restrict access to timely maternal healthcare, particularly among rural and marginalized populations.^[8,9] In India, despite improvements in institutional deliveries through government initiatives such as Janani Suraksha Yojana and Pradhan Mantri Surakshit Matritva Abhiyan, systematic surveillance of MNM cases remains inconsistent.^[10] Strengthening standardized reporting systems, adopting WHO near-miss criteria, and integrating MNM audits into hospital practices are essential for improving maternal health monitoring and ensuring equitable healthcare access.^[11,12]

This study aims to evaluate maternal near miss cases in a tertiary care hospital, focusing on incidence, risk factors, clinical management, and outcomes. It applies WHO’s MNM criteria to systematically assess severe maternal morbidity. By identifying gaps in emergency response, referral delays and care quality, the study intends to offer actionable insights for health system strengthening. It also explores socio-demographic patterns and common complications among survivors. Findings will improve clinical practices, hospital protocols, and policy interventions at both institutional and governmental levels. Ultimately, this research contributes to improving maternal survival and achieving equity in healthcare.

MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Obstetrics and Gynaecology Silchar Medical college and hospital Silchar, Assam from December 2024 to November 2025. Ethical approval was obtained from the Ethical Approval Committee of Silchar Medical college and hospital Silchar, Assam.

Study Population: The study population included pregnant women, women in labour, or those within 42 days of delivery or abortion admitted to the Department of Obstetrics and Gynaecology at SMCH who fulfilled the WHO Near-Miss Criteria (2009). Women presenting with clinical, laboratory or management indicators of organ dysfunction were included, while those with non-pregnancy related conditions or unwilling to provide consent were excluded. Consecutive sampling was applied, enrolling every eligible case during the study period.

Data Analysis: Data were compiled, managed, and analyzed to generate conclusions. Information from paper proformas was entered into Microsoft Excel and verified through cross-checking of 10% of entries to minimize errors. Descriptive statistics summarized categorical variables as frequencies and percentages, while continuous variables were tested for normality and expressed as mean $\pm$ standard deviation. Associations between categorical variables were examined using the chi-square test with $p < 0.05$ considered significant and WHO health indicators were calculated.

RESULTS

The study conducted at Silchar Medical College and Hospital (SMCH) to analyze maternal near miss cases during the study period. The findings were systematically organized to evaluate the sociodemographic profile, obstetric characteristics, referral patterns, clinical presentation, laboratory investigations, organ dysfunction according to WHO 2009 criteria, management interventions, and maternal and fetal outcomes. The study population had a mean age of 28.38 ± 5.59 years, with most women belonging to lower and lower-middle socioeconomic groups and predominantly residing in rural areas of Assam and nearby regions. The majority of cases were referred from district hospitals, primary health centres, and community health centres, while some patients were self-referred or came from private clinics. Most near miss events occurred during the third trimester, with a mean gestational age of 24.58 ± 12.8 weeks and booking status was nearly equal between booked and unbooked women. Analysis of delays using the three-delay model revealed that delay in reaching the healthcare facility was the most common. Clinically, women presented with symptoms such as convulsions, postpartum hemorrhage, severe abdominal pain, shock, and fever. A high

prevalence of anemia was observed among the participants. Vital signs indicated moderate physiological compromise, and examination findings suggested uterine atony, retained products, and cervical abnormalities in several cases. Laboratory investigations showed generally stable

platelet counts and renal parameters but revealed abnormalities in liver function tests and elevated lactate dehydrogenase levels in a considerable proportion of patients, reflecting systemic involvement associated with severe maternal morbidity.

Table 1: Classification of study population according to WHO Maternal Near Miss Criteria (2009)

Sr. No	Parameter	Value
1	Maternal Near Miss Criteria (WHO 2009 Clinical/Lab/Management), n (%)	
	Clinical: eclampsia	24 (23.3)
	Clinical: shock	13 (12.62)
	Laboratory: LDH > 600 U/L	26 (25.24)
	Management: ICU admission	13 (12.62)
	Management: PRBC ≥ 5 units	25 (24.28)

Among the study population classified by the World Health Organization Maternal Near Miss Criteria (2009), the most common indicators were laboratory LDH >600 U/L (25.24%) and PRBC transfusion ≥5 units (24.28%), followed by clinical eclampsia (23.3%), while shock and ICU admission were each reported in 12.62% of cases. Overall, both laboratory and management-based criteria accounted for the majority of maternal near-miss events.

The management of maternal near miss cases in the study population involved a combination of medical and surgical interventions. The mean number of blood transfusion units administered was 2.30 ± 1.53 . Operative procedures were frequently required, with emergency lower segment cesarean section being the most common intervention, followed by exploratory laparotomy with

salpingectomy, check dilation and evacuation, subtotal hysterectomy, and repair of ruptured uterus. A few cases required procedures such as B-Lynch sutures, manual removal of placenta or peripartum hysterectomy, while some patients were managed conservatively or with uterotonics alone. Medical management included the use of oxytocin for prevention or treatment of postpartum hemorrhage in most cases, magnesium sulfate for eclampsia management, corticosteroids for fetal lung maturation in preterm pregnancies, and antibiotics for sepsis treatment or cesarean prophylaxis. Almost all patients required admission to the High Dependency Unit, and a substantial proportion needed intensive care unit support, reflecting the severity of complications and the need for advanced monitoring and multidisciplinary management.

Table 2: Record of Maternal & Foetal Outcomes in the study population

Sr. No	Parameter	Value
1	Maternal Outcome, n (%)	
	Near Miss	100 (97.09)
	Death	3 (2.91)
2	Complications (PPH/Sepsis/Eclampsia/Rupture/Anemia/Other), n (%)	
	Anemia	20(19.4)
	Cardiomyopathy	2 (1.94)
	Eclampsia	24 (23.3)
	PPH	18 (17.46)
	Ruptured ectopic	12 (11.65)
	Sepsis	22 (21.4)
	Uterine rupture	5(4.85)
3	Type of Dysfunction, n (%)	
	Cardiology	6 (5.8)
	Coagulation	17 (16.5)
	Coagulation/Uterine	23 (22.33)
	Hepatic	1 (0.97)
	Neuro	28 (27.18)
	Neuro/Coagulation	5 (4.85)
	Neuro/Coagulation/Renal	1 (0.97)
	Neuro/Renal	16 (15.53)
	Renal	1 (0.97)
	Respiratory	2 (1.94)
	Uterine	3 (2.91)
4	Foetal Outcome (Live birth/Stillbirth), n (%)	
	Live birth	70
	Stillbirth	2

In the study population, maternal near miss cases constituted 97.09% while maternal deaths accounted for 2.91%. The most frequent complications were

eclampsia (23.3%), sepsis (21.4%), and anemia (19.4%), with neurological dysfunction being the

most common organ dysfunction (27.18%); fetal

outcomes included 70 live births and 2 stillbirths.

Table 3: Timing, Trimester, and Parity Distribution of Maternal Near-Miss Cases

Parameter	Category	n (%)
Timing of Near-Miss Events	Antenatal	34 (33.0)
	Intrapartum	23 (22.3)
	Post-operative	27 (26.21)
	Postpartum	19 (18.44)
Trimester of Event	1st Trimester	32 (31.0)
	2nd Trimester	13 (12.62)
	3rd Trimester	58 (56.31)
Gravida / Parity	G1	10 (13.51)
	G2	8 (10.8)
	G3	22 (29.73)
	G4	16 (21.62)
	G5	18 (24.32)

Timing, trimester, and parity distribution of maternal near-miss cases showed that most events occurred during the antenatal period (33.0%), followed by post-operative (26.21%), intrapartum (22.3%), and postpartum (18.44%). The majority occurred in the third trimester (56.31%), and were most common among multigravida women, particularly G3 (29.73%), followed by G5 (24.32%) and G4 (21.62%).

Organ dysfunction among maternal near-miss cases was most commonly neurological (27.18%), followed by combined coagulation/uterine dysfunction (22.33%), coagulation (16.5%), and neuro-renal involvement (15.53%). Other less frequent dysfunctions included cardiology (5.8%), uterine (2.91%), respiratory (1.94%), and isolated hepatic or renal dysfunction (0.97% each).

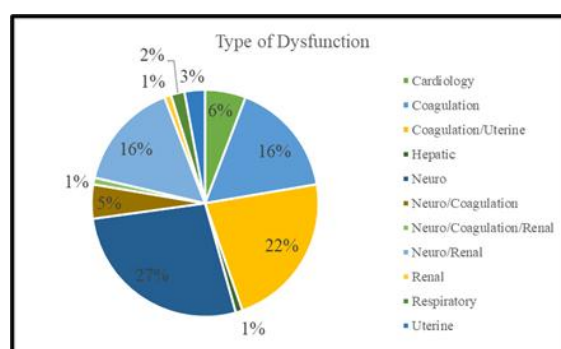


Figure 1: Organ Dysfunction distribution and Causes of Maternal Near Miss.

Table 4: Referral Source, Booking Status, Fetal Outcome, and Level of Delay Distribution

Parameter	Category	n (%)
Referral Source	ASHAs/PHC	13 (12.62)
	CHC	20 (19.42)
	District Hospital	35 (33.98)
	Private Clinic	10 (9.70)
	Referred from Other District	8 (7.76)
	Self	17 (16.50)
Booking Status	Booked	53 (51.5)
	Unbooked	50 (48.5)
Fetal Outcome	Live birth	70 (97.22)
	Stillbirth	2 (2.77)
Level of Delay	Level 1 – Seeking	31 (28)
	Level 2 – Reaching	43 (40)
	Level 3 – Receiving	29 (26)

Referral and care-related factors showed that most cases were referred from district hospitals (33.98%) and CHCs (19.42%), while 16.5% were self-referred; booking status was nearly equal with 51.5% booked and 48.5% unbooked. Most fetal outcomes were live births (97.22%), and the commonest delay was level-2 (reaching health facility) at 40%, followed by level-1 (28%) and level-3 (26%).

Analysis of organ dysfunction with critical care support showed that neurological dysfunction (27.18%) and coagulation/uterine dysfunction (22.33%) were the most common, with many cases requiring HDU and ICU admission. Nearly all dysfunction types, particularly neuro, coagulation,

and combined dysfunctions, required ICU care, indicating the severity of maternal near-miss conditions.

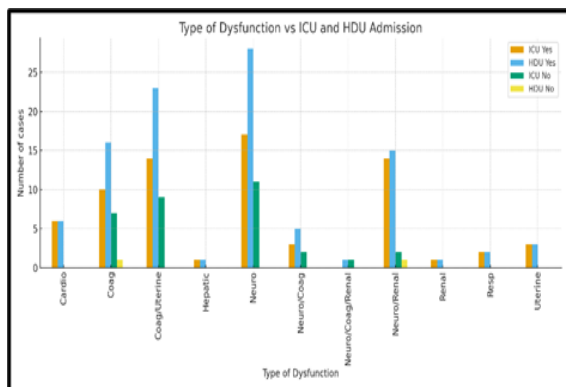


Figure 2: Type of dysfunction and ICU /HDU Admission.

Table 5: Chi square evaluation

Parameter	χ^2 value	p-value	df	Significance
Type of Dysfunction	13.2322	0.211	10	NS
Delay Level	5.3191	0.07	2	NS
Gestational Age	10.5714	0.3919	10	NS
Foetal Outcome	0	1	1	NS
HDU Admission	0.0351	0.8515	1	NS
Blood Transfusion	0.0002	0.9898	1	NS
Referral Source	6.5858	0.2533	5	NS

Chi-square analysis showed no statistically significant association between maternal outcomes and variables such as type of dysfunction, delay level, gestational age, fetal outcome, HDU

admission, blood transfusion, and referral source (all $p > 0.05$). This indicates that none of the studied factors demonstrated a significant relationship with maternal outcomes in the study population.

Table 6: Maternal Health Indicators

Sr. No	Indicator	Value
1	Maternal Mortality Ratio (MMR) (per 100,000 live births)	145.6
2	Maternal Near-Miss Ratio (MNMR) (per 1,000 live births)	48.5
3	Severe Maternal Outcome Ratio (SMOR) (per 1,000 live births)	50.0
4	MNMR : Mortality Ratio	33.3
5	Mortality Index (%)	2.9

Maternal health indicators showed a maternal mortality ratio of 145.6 per 100,000 live births, with a maternal near-miss ratio of 48.5 and severe maternal outcome ratio of 50.0 per 1,000 live births. The MNMR to mortality ratio was 33.3, and the mortality index was low at 2.9%, indicating relatively better survival among severe maternal cases.

DISCUSSION

Maternal near miss (MNM) has become an important indicator for evaluating the quality of maternal healthcare, especially in low- and middle-income countries where maternal mortality continues to be a major public health concern. MNM refers to women who experience severe life-threatening complications during pregnancy, childbirth, or within 42 days of termination of pregnancy but survive. Because these women often share similar risk factors and clinical characteristics with those who die from maternal complications, studying MNM cases provides valuable insights into the functioning of healthcare systems. Unlike maternal death reviews, MNM analysis allows

evaluation of emergency obstetric services, referral mechanisms, and the effectiveness of timely interventions without the ethical and medico-legal challenges associated with maternal fatalities.^[13] The World Health Organization (WHO) has developed standardized criteria based on clinical, laboratory, and management indicators for identifying MNM cases, enabling consistent monitoring and comparison across healthcare settings.^[14] In countries like India, where disparities in healthcare access, socioeconomic conditions and institutional preparedness persist, MNM surveillance plays a critical role in identifying gaps in maternal healthcare delivery, particularly in tertiary care hospitals that receive complicated and referred cases.^[15]

Mohamed MH, et. al; 2025, provided insights into the “three-delay model,” which includes delays in seeking care, reaching healthcare facilities and receiving appropriate treatment after arrival. Identifying these delays helps healthcare providers recognize preventable causes of severe maternal morbidity and improve referral networks, emergency preparedness, and clinical protocols. Systematic evaluation of MNM cases contributes to

improved maternal health outcomes by promoting early recognition of obstetric complications and ensuring timely, evidence-based interventions.^[16]

Sunanda N, et. al; 2023, studies the sociodemographic profile of MNM cases showed a mean maternal age of 28.38 ± 5.59 years, with most women belonging to lower or lower-middle socioeconomic groups. The majority were rural residents and a considerable proportion were referred from peripheral health facilities. About half of the women were booked for antenatal care while the remainder were unbooked, reflecting variations in healthcare access. Most MNM events occurred in the third trimester, consistent with findings from other tertiary care studies in India where severe maternal complications are commonly reported in late pregnancy.^[17] Age distribution also showed that the majority of cases occurred among women aged 21–30 years, highlighting that severe maternal morbidity primarily affects women in the peak reproductive age group.^[18]

Referral patterns and delay analysis revealed that women were referred from primary health centres, community health centres, district hospitals, private clinics, and occasionally from outside the state. Delay in reaching healthcare facilities was the most frequent delay observed, followed by delays at the referral and tertiary-care levels. Kulkarni R, et. al; 2023, reported in other Indian studies, where delays in seeking and reaching care significantly contribute to maternal near-miss events.^[19]

Clinical presentations in MNM cases commonly included severe anemia, hemorrhage, breathlessness and hemodynamic instability. A large proportion of women were anemic, and many presented with tachycardia and reduced oxygen saturation, reflecting severe physiological stress. These patterns correspond with other tertiary-centre studies where anemia and obstetric hemorrhage are leading contributors to severe maternal morbidity.^[18] Nelissen E, et. al; 2013, investigated in the study also revealed hematologic abnormalities, elevated liver enzymes, and raised lactate dehydrogenase levels, suggesting systemic involvement such as hemolysis, hepatic dysfunction or hypertensive disorders like HELLP syndrome.^[20]

Based on WHO near-miss criteria, major contributors to MNM included eclampsia, severe hemorrhage requiring blood transfusion, shock and ICU admission. Management often required intensive obstetric interventions such as blood transfusion, emergency caesarean section, hysterectomy and laparotomy. High rates of HDU and ICU admissions reflected the severity of cases and the referral bias associated with tertiary care centres.^[17]

Regarding outcomes, most women survived severe complications, with only a small proportion resulting in maternal deaths. Neurological dysfunction was the most common organ system involvement in this study, followed by coagulation and renal dysfunction. Agarwal N, et. al; 2022,

studies where coagulation or cardiovascular dysfunction predominated, suggesting variation in case-mix and referral patterns across different centres.^[21] Fetal outcomes in the study were generally favourable, with a high proportion of live births and a relatively low stillbirth rate compared with other tertiary hospital studies.^[22]

Maternal health indicators calculated from the study demonstrated a Maternal Mortality Ratio (MMR) of 145.6 per 100,000 live births and a Maternal Near-Miss Ratio (MNMR) of 48.5 per 1,000 live births. Although the near-miss ratio was higher compared with several other studies, the mortality index was relatively low, indicating better survival among women experiencing life-threatening complications. Singh V & Barik A. 2021, suggested that while the hospital manages a high burden of severe obstetric cases, timely and effective management contributes to improved maternal survival. Overall, MNM analysis provided a valuable information for strengthening maternal healthcare systems, improving referral mechanisms, and enhancing the quality of emergency obstetric care.^[22,23]

CONCLUSION

This prospective study of maternal near-miss (MNM) cases in a tertiary care hospital in Assam highlights the significant burden of severe maternal morbidity and the systemic challenges affecting maternal healthcare. Hypertensive disorders, particularly eclampsia, along with sepsis, hemorrhage and ruptured ectopic pregnancy were identified as the major causes of near-miss events. Severe anemia was present in more than 80% of cases, increasing vulnerability to complications. Nearly half of the women were unbooked, indicating gaps in antenatal care. Delay in reaching healthcare facilities was the most common barrier, while delays in seeking and receiving care also contributed substantially. The high MNM ratio reflects a heavy burden of life-threatening complications.

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