TITLE: EVALUATING MATERNAL NEAR-MISS INCIDENCE AND CARE QUALITY IN BIHAR, INDIA: A CROSS-SECTIONAL STUDY

ABSTRACT:

Background:
Maternal near-miss (MNM) cases—where women experience life-threatening obstetric complications but survive—offer critical insights into the quality of maternal healthcare. Despite declining maternal mortality rates globally, near-miss evaluations remain underutilized in low-resource settings like Bihar, India.

Objective:
To estimate the proportion of maternal near-miss cases and evaluate the quality of care using WHO near-miss criteria at a secondary-level hospital in Bihar.

Methods:
A cross-sectional audit of 5012 medical records from the labour room at Duncan Hospital, Bihar, was conducted for the year 2023. WHO near-miss criteria were applied to identify cases. Descriptive statistics were used to analyse complications, interventions, and outcomes.

Results:
A total of 227 near-miss cases were identified, yielding a near-miss incidence of 4.5%. Severe pre-eclampsia (37.4%), eclampsia (36.5%), and postpartum hemorrhage (20.2%) were the most common complications. ICU admission (25.5%), blood transfusion (24.6%), and laparotomy were the primary interventions. While 99.14% of near-miss women survived, 20% experienced stillbirths. The hospital demonstrated good adherence to WHO management protocols.

Conclusion:
Maternal near-miss cases provide a valuable lens to assess and improve obstetric care. This study highlights both strengths and gaps in managing severe maternal outcomes at the secondary care level. Strengthening antenatal surveillance and enhancing emergency readiness can further reduce maternal and perinatal morbidity in similar low-resource settings.

Keywords: Maternal near-miss, obstetric complications, WHO criteria, Bihar, maternal health, secondary hospital, quality of care

INTRODUCTION:

Maternal health is a fundamental component of public health, directly impacting the well-being of women and their communities. Maternal health refers to the health of women during pregnancy, childbirth and postnatal period. The most common indicator used to estimate the status of maternal health in an area is the maternal mortality rate(1). Maternal mortality remains unacceptably high despite all the important progress in the last two decades (about 287 000 women died during and following pregnancy and child birth in 2020 all over the world) The global MMR in 2020 was 223 per 100 000 live births (2). The most common indicator used to estimate the status of maternal health in an area is the maternal mortality rate. Despite global efforts to enhance maternal health, maternal mortality rates remain unacceptably high, particularly in low- and middle-income countries like India. In estimating the maternal mortality and other mortality

related index, we often ignore the maternal morbidity and other cause of severe maternal outcomes which are equally important in estimating maternal health in an area.

The term maternal near-miss is a relatively new term and according to WHO it can be defined as a women who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy. In practical terms women are considered near-miss cases when they survive a life-threatening condition during pregnancy and childbirth(3).

In any setting, women who develop severe acute complications during pregnancy share many pathological and circumstantial factors. While some of these women die, a proportion of them narrowly escape death. Maternal near miss share many characteristics with the maternal death, can directly give us information regarding obstacle that needs to be overcome (especially after onset of an acute complication) and it is potentially more useful in assessing the care and service provided in the health facility(4).

The maternal near miss audits gives us an opportunity to study the cases which were almost like to those where a maternal death happened. Here the mother being alive, gives us a chance to have that detailed information of what happened. According to NCBI, near-miss audits will allow the care of critically ill women to be analysed, deficiencies in the provision of care to be identified, and comparison within and between institutions and, ultimately, improve the quality of obstetric care and further reduce maternal morbidity and mortality. By evaluating these cases where the women narrowly escapes death, much can be learnt about the processes in place (or lack of them) for the care of pregnant women(3) (5).

This study aims to conduct a study in Bihar, India, to explore the incidence of maternal near-miss cases.

NEED FOR THE STUDY:

This study is based on 'WHO near-miss approach' which is a standardised method all over the world. Data for the assessment is extracted from appropriate patient records. For each woman, data are collected on the occurrence of selected severe pregnancy-related complications and severe maternal outcomes, use of critical/key interventions, and admission to intensive care unit. As a result of this assessment, among others, local rates and patterns of maternal mortality and morbidity, strengths and weaknesses in the referral system, and use of clinical and other health-care interventions are known. This approach is helpful for healthcare workers, program managers and policy makers who are responsible for the maternal healthcare within a health facility or organization. While other assessment tools like the three-delay model focus on delays in care-seeking, reaching care, and receiving care, the WHO near-miss approach offers a standardized, facility-based method to assess the quality of maternal care using objective clinical criteria. This makes it especially useful in hospital settings to audit life-threatening obstetric complications, evaluate system-level responsiveness, and compare outcomes across institutions and regions. It also enables timely identification of gaps in emergency obstetric care delivery and supports targeted improvements in clinical protocols.

A disproportionately high proportion of maternal mortality (99 percent) occur in low- and middle-income countries (LMICs), of which 90 per cent is contributed by Sub-Saharan Africa and South Asia. Most of the maternal deaths (80-85%) in developing nations including India can be attributed to direct obstetric causes (haemorrhage, sepsis, complications of abortion, hypertensive disorders)

(6). Timely treatment and management of pregnancy complications is the key to prevent maternal mortality and reduce the gap in maternal deaths between developed and developing countries. Delay in seeking healthcare at the time of any acute complication forms one of the major underlying reason for maternal near-miss and mortality(7).

In a study done in Kerala using the three-delay model for near misses, the maternal near miss incidence was 9.27/ 1000 live births(8). In another study done in North India on the factors associated with near- misses, the prevalence of maternal near- miss was almost 10% of all the deliveries(9). Studies on maternal near-misses and outcomes for the near-miss is still rare all across the globe. More such studies are required to establish the relationship between occurrence of a near-miss cases particularly in an Indian setting.

OBJECTIVES:

1. To estimate the proportion of pregnant women who had maternal near-miss outcome in past one year.

2. To look at the adherence of hospital to the WHO protocol among women who had severe maternal outcomes.

3. To document outcomes among women who had severe maternal outcomes.

REVIEW OF LITERATURE:

 Magnitude and Determinants of Maternal Mortality and Morbidity

Maternal mortality remains one of the starkest indicators of global health inequality. According to the World Health Organization (2023), approximately 287,000 women died globally from pregnancy-related causes in 2020. 94% of these deaths occurred in low- and middle-income countries (LMICs), primarily in Sub-Saharan Africa and South Asia(10). Every day, around 800 women lose their lives due to complications of pregnancy and childbirth, most of which are preventable with timely and quality maternal healthcare(10).

The main direct causes of maternal death include postpartum hemorrhage, hypertensive disorders of pregnancy (pre-eclampsia and eclampsia), infections (especially puerperal sepsis), unsafe abortions, and obstructed labour (11). In many LMICs, indirect causes such as anemia, malaria, and cardiac conditions also contribute significantly due to their interaction with pregnancy-related physiological changes(12).

Social and systemic determinants exacerbate these risks. These include low literacy levels, gender inequality, poor transportation infrastructure, inadequate health-seeking behavior, and limited access to skilled birth attendants(13). In states like Bihar, where the maternal mortality ratio (MMR) remains high at 165 per 100,000 live births, structural barriers such as poor institutional delivery rates (63.8%) and weak referral systems further increase maternal vulnerability(14).

Notably, maternal deaths represent only the "tip of the iceberg." For every maternal death, 20 to 30 women experience severe morbidity, often leading to long-term health complications such as infertility, chronic pelvic pain, or mental health disorders(15). This broader category, referred to as

maternal morbidity, includes conditions ranging from non-life-threatening but disabling complications to life-threatening obstetric events classified as "maternal near-miss"(16).

The near-miss to maternal mortality ratio is a valuable indicator of the quality of care in a health system. In developing countries, this ratio ranges between 5:1 and 12:1, reflecting variability in health system capacity and access to emergency obstetric care(17). The maternal near-miss incidence in such contexts varies widely, from 7 to 40 per 1,000 live births, with higher rates observed in facilities managing more complicated cases (18).

Despite decades of policy efforts and interventions through programs like India's Janani Suraksha Yojana and Pradhan Mantri Surakshit Matritva Abhiyan, maternal mortality and morbidity remain significant public health concerns. Addressing this issue requires multi-sectoral efforts focusing on improving antenatal care, ensuring timely referrals, increasing access to emergency obstetric care, and addressing underlying social determinants.

Maternal Near-Miss and Its Determinants

The concept of maternal near-miss (MNM)—defined by the World Health Organization (WHO) as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy"—has emerged as a valuable tool in evaluating maternal health care quality (19). Near-miss cases share the same underlying causes as maternal deaths, such as hemorrhage, hypertensive disorders, and sepsis, but differ in outcome due to timely intervention or better access to care.

A systematic review by Say et al. (2014) highlighted regional variations in the causes of maternal death: hemorrhage was responsible for 33.9% of maternal deaths in Africa and 30.8% in Asia, while hypertensive disorders were the leading cause in Latin America and the Caribbean (25%). Anemia also played a significant role in Asia (12.8%) but was nearly negligible in high-income countries(11). These same complications—when managed in time—frequently lead to near-miss situations rather than deaths, underscoring the importance of strong health systems.

In India, about 20–30% of pregnancies are considered high-risk, and these account for approximately 75% of perinatal morbidity and mortality(20). Common high-risk complications include gestational hypertension, hemorrhage, gestational diabetes, preterm labor, sepsis, and eclampsia. A study conducted in South India found a maternal near-miss ratio (MNMR) of 8.46 per 1,000 live births, while a North Indian tertiary center reported an MNMR of 22.5 per 1,000 live births, reflecting the higher complexity of cases handled in referral hospitals(21) (22). International literature shows that the MNMR ranges from 15 to 40 per 1,000 live births depending on the criteria used and the level of care available(17).

The wide variation in identification criteria—ranging from disease-specific indicators to organ-dysfunction-based definitions—has made it challenging to estimate global MNM prevalence consistently. A WHO systematic review noted that near-miss prevalence ranged from 0.8% to 8.2% using disease-specific criteria and 0.38% to 1.09% using organ-system-based criteria(16).

Beyond identifying clinical causes, sociodemographic factors—such as type of family, religion, education level, and the presence of danger signs during pregnancy—also influence MNM risk. For

instance, poor awareness, cultural beliefs, and delays in seeking emergency obstetric care increase the risk of complications progressing to near-miss levels(23).

In Bihar, maternal health indicators remain poor. A study using District Level Household Survey (DLHS-3) data revealed that while 37% of pregnant women received iron and folic acid (IFA) tablets, only 24% consumed them for the recommended 90 days or more, contributing to the state's high prevalence of anemia in pregnancy (about 60%)(24). These deficiencies directly affect maternal outcomes and elevate the risk of near-miss conditions.

Near-miss audits offer a critical opportunity to examine systemic gaps in care and identify preventable factors. As noted by WHO and researchers, these audits allow clinicians and institutions to analyze the management of critical cases, evaluate adherence to protocols, and foster continuous quality improvement in obstetric care (19)(25). By capturing both the clinical and systemic aspects of maternal health, the MNM approach strengthens evidence-based decision-making and policy formulation in maternal health systems.

Post-Partum Hemorrhage (PPH):

Postpartum haemorrhage (PPH) is one of the leading causes of maternal mortality globally. According to the WHO, severe PPH is defined as blood loss of ≥1000 ml within 24 hours after birth, or any amount of bleeding that causes hemodynamic instability or requires blood transfusion(18).It is estimated that approximately 14 million women experience PPH annually, and it accounts for about 25% of all maternal deaths worldwide(11). In India, PPH is responsible for 30–38% of maternal deaths, as per various estimates by the Sample Registration System (SRS) and ICMR studies(. Uterine atony, the failure of the uterus to contract effectively after childbirth, accounts for about 50% of PPH cases(26). Despite being preventable and treatable, PPH remains a "quick killer," capable of causing maternal death within two hours if not promptly managed(27).

Severe Pre-Eclampsia

Severe pre-eclampsia, as defined by WHO, is characterized by blood pressure ≥160/110 mmHg, significant proteinuria, oliguria, and the presence of HELLP syndrome (Hemolysis, Elevated Liver enzymes, and Low Platelet count)(18). Globally, hypertensive disorders of pregnancy affect around 10% of all pregnancies, and pre-eclampsia affects 3–5%(28). In India, the prevalence ranges between 8–10%, with regional studies reporting up to 5.4% incidence among pregnant women(29). HELLP syndrome, which may be a severe variant of pre-eclampsia or a separate entity, significantly increases the risk of maternal and perinatal morbidity and mortality. Risk factors include maternal age >34 years, multiparity, and previous hypertension(30).

Eclampsia:

Eclampsia, a life-threatening complication of pre-eclampsia, is characterized by generalized seizures or coma in women without a prior history of epilepsy(18). Most seizures occur during labour or within 48 hours postpartum. Eclampsia accounts for approximately 12% of maternal deaths in low- and middle-income countries(31). In India, population-based data reported an incidence of 3.2% for eclampsia in a representative sample(32). This condition contributes significantly to both maternal and perinatal mortality due to sudden onset and rapid progression.

Uterine Rupture:

Uterine rupture is the spontaneous tearing of the uterine wall during pregnancy or labour, often resulting in the fetus being expelled into the abdominal cavity(18). It remains one of the most severe obstetric emergencies. In a retrospective study in Muzaffarpur, Bihar, the incidence was 2.5 per 2000 deliveries, with scar rupture accounting for almost half the cases(33). The key risk factors include prior caesarean section, grand multiparity, obstructed labour, and malpresentations, which together contribute to over 90% of cases(34). Despite modern surgical techniques and antenatal monitoring, uterine rupture continues to pose a risk due to delays in diagnosis or referral.

Sepsis

Maternal sepsis is the third most common direct cause of maternal death globally, accounting for approximately 11% of maternal deaths(35). WHO defines it as a life-threatening organ dysfunction caused by infection, commonly associated with endometritis, chorioamnionitis, septic abortion, and pneumonia(18). In India and other LMICs, poor hygiene during delivery, unsafe abortion practices, and delayed diagnosis contribute to higher sepsis rates. The Global Maternal Sepsis Study (GLOSS) emphasized that early detection and appropriate antibiotic use could prevent most sepsis-related maternal deaths(36).

Antepartum Haemorrhage (APH)

Antepartum haemorrhage (APH) refers to bleeding from the genital tract after 24 weeks of gestation but before the delivery of the baby. It complicates 3–5% of pregnancies and is a major cause of perinatal and maternal morbidity and mortality(37). The main causes include placenta previa, placental abruption, and local genital tract lesions, with the first two responsible for up to 50% of APH cases(38). Timely diagnosis and delivery planning are key to preventing complications from APH.

Serious Complications of Abortion

Although abortion is legal in India, unsafe abortion remains a significant contributor to maternal mortality, particularly among socioeconomically vulnerable populations. Serious complications include uterine perforation, haemorrhage, septic abortion, disseminated intravascular coagulation (DIC), and damage to nearby organs like the bladder or bowel(39). Lack of access to safe abortion services, stigma, and delay in seeking care contribute to a high burden of morbidity and mortality, especially in rural regions(40).

METHODOLOGY:

Study setting:

This cross-sectional study was conducted in Duncan Hospital of East Champaran district in Bihar, India. Medical records from January 2023 to December 2023 were meticulously audited using the WHO near-miss criteria. Near-miss cases were identified using the WHO near-miss tool and set apart.

Study Design and Duration:

The study spanned six months from July 2024 to December 2024. It adopted a cross-sectional design to examine the occurrence of near-miss cases among women admitted to the labour room in 2023.

Sample Size Calculation:

The sample size calculation was based on estimating the proportion of pregnant women who experienced a maternal near-miss outcome in Duncan Hospital in a year. Assuming a conservative near-miss rate of 10%, a confidence level of 95%, and a margin of error of 5%, the minimum required sample size was calculated using the formula for estimating proportions:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

where:

- **n** = required sample size

- **Z** = Z-score corresponding to the desired confidence level (1.96 for a confidence level of 95%)

- **p** = estimated proportion of pregnant women experiencing a maternal near-miss outcome (0.10)

- **E** = margin of error (0.05)

Plugging in the values:

$$n = \frac{(1.96)^2 \times 0.10 \times (1-0.10)}{(0.05)^2}$$
$$n \approx 290$$

Therefore, a sample size of approximately 300 pregnant women was required for this study.

Sampling Strategy:

A systematic random sampling technique was employed to select medical records for review from the designated time frame.

Participant Recruitment:

 Participants were recruited from Duncan Hospital and selected blocks of East Champaran district based on eligibility criteria. Pregnant women who experienced severe maternal outcomes during the study period were identified through medical records.

Severe maternal complications are defined as "potentially life-threatening conditions." This extensive category of clinical conditions includes diseases that can threaten a woman's life during pregnancy and labour and after termination of pregnancy. A summary list of potentially life-threatening conditions was produced by the WHO Working Group on Maternal Deaths and Morbidity Classifications (41).

In the present guide, five potentially life-threatening conditions were used as part of the inclusion criteria set: Severe postpartum haemorrhage, severe pre-eclampsia, eclampsia, sepsis/severe systemic infection, and ruptured uterus (41).

Inclusion Criteria:

- Pregnant women who experienced severe maternal outcomes during the study period (January 2023 to December 2023).
- Women who were admitted to Duncan Hospital and residing in the selected blocks (Adapur, Raxaul, and Ramgharwa) of East Champaran district in Bihar, India during their pregnancy and after childbirth.
- Women who survived severe pregnancy-related complications or conditions meeting the WHO near-miss criteria (41).

The following WHO criteria will be used to identify severe maternal outcomes and near-miss cases (41):

Severe Maternal Complications:

- Severe postpartum hemorrhage
- Severe pre-eclampsia
- Eclampsia
- Sepsis or severe systemic infection
- Ruptured uterus
- Severe complications of abortion

Critical Interventions or Intensive Care Unit Use:

- Admission to intensive care unit (ICU)
- Interventional radiology
- Laparotomy (including hysterectomy, excludes caesarean section)
- Use of blood products

Life-Threatening Conditions (Near-Miss Criteria):

1. **Cardiovascular Dysfunction:**
   - Shock, cardiac arrest (absence of pulse/heart beat and loss of consciousness)
   - Use of continuous vasoactive drugs
   - Cardiopulmonary resuscitation
   - Severe hypoperfusion (lactate >5 mmol/L or >45 mg/dL)
   - Severe acidosis (pH <7.1)
2. **Respiratory Dysfunction:**
   - Acute cyanosis, gasping
   - Severe tachypnea (respiratory rate >40 breaths per minute)
   - Severe bradypnea (respiratory rate <6 breaths per minute)
   - Intubation and ventilation not related to anesthesia
   - Severe hypoxemia (O2 saturation <90% for ≥60 minutes or PAO2/FiO2 <200)
3. **Renal Dysfunction:**
   - Oliguria non-responsive to fluids or diuretics
   - Dialysis for acute renal failure
   - Severe acute azotemia (creatinine ≥300 μmol/mL or ≥3.5 mg/dL)
4. **Coagulation/Haematological Dysfunction:**

- o Failure to form clots
- o Massive transfusion of blood or red cells (≥5 units)
- o Severe acute thrombocytopenia (<50,000 platelets/mL)
5. **Hepatic Dysfunction:**
   - o Jaundice in the presence of pre-eclampsia
   - o Severe acute hyperbilirubinemia (bilirubin >100 μmol/L or >6.0 mg/dL)
6. **Neurological Dysfunction:**
   - o Prolonged unconsciousness (lasting ≥12 hours)
   - o Coma (including metabolic coma)
   - o Stroke
   - o Uncontrollable fits/status epilepticus
   - o Total paralysis
7. **Uterine Dysfunction:**
   - o Uterine hemorrhage or infection leading to hysterectomy

Maternal Vital Status:

- Maternal death

Definitions of the criteria (41):

Severe maternal complications are defined as "potentially life-threatening conditions". This is an extensive category of clinical conditions, including diseases that can threaten a woman's life during pregnancy and labour and after termination of pregnancy. A summary list of potentially life-threatening conditions has been produced by the WHO Working Group on Maternal Deaths and Morbidity Classifications

Critical interventions are those that are required in the management of life-threatening and potentially life-threatening conditions. In this guide, blood transfusion, interventional radiology and laparotomy (including hysterectomy and other emergency surgical interventions in the abdominal cavity, but excluding caesarean section) fall into this category.

Admission to intensive care unit is defined as admission to a unit that provides 24-hour medical supervision and is able to provide mechanical ventilation and continuous vasoactive drug support.

Maternal death is defined as death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

Exclusion Criteria:

1. Pregnant women who did not experience severe maternal outcomes during the study period.
2. Women who did not seek any form of medical care during their pregnancy and childbirth.
3. Women who delivered outside the designated study area and were not admitted to Duncan Hospital.

Study Tool:

- WHO near-miss tool for auditing medical records (41).

Confidentiality of the Participants:

Confidentiality of participant information was strictly maintained throughout the study, with data anonymized and stored securely.
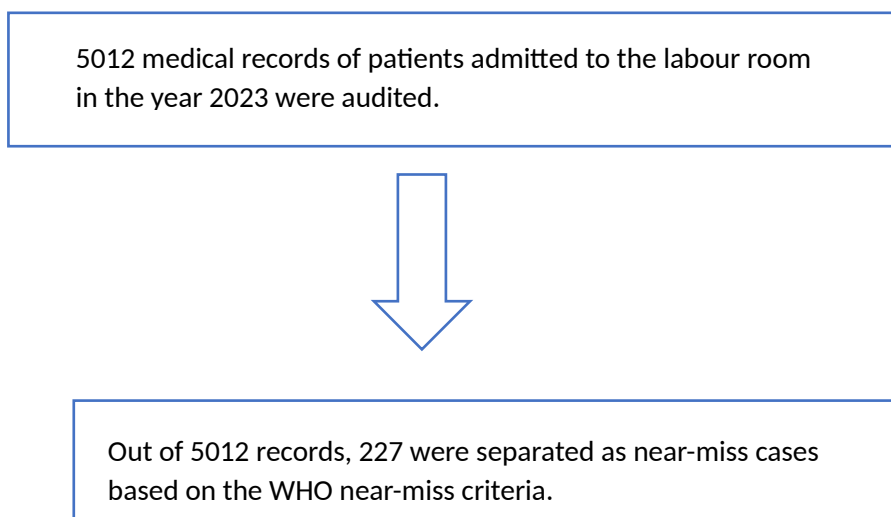
Data Collection Procedure:

Trained healthcare professionals and research assistants conducted the data collection process under supervision. Medical record audits involved extracting relevant information using the WHO near-miss tool. To ensure data accuracy and reliability, a standardized data collection protocol was followed and regular quality checks were conducted.

Data Entry and Analysis:

Data entry was conducted using Microsoft Excel, while analysis was performed using SPSS version 30. Descriptive statistics were employed to present and interpret the findings.

Statistical Methods:

Descriptive statistics were used to summarize the characteristics of the study population. The proportion of pregnant women who experienced a maternal near-miss outcome was calculated.

Flowchart for Methodology

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5012 medical records of patients admitted to the labour room
in the year 2023 were audited.
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Out of 5012 records, 227 were separated as near-miss cases
based on the WHO near-miss criteria.
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RESULT:

Proportion of near- miss cases:

Among 5012 medical records of the labour room pertaining to 2023, 227 women were identified as near-misses in that year. Severe complications, critical interventions, organ dysfunction, maternal death, infant/perinatal death, underlying causes and contributory/associated conditions were recorded.

1. Proportion of pregnant woman who had maternal near miss outcome in past one year:

- • Total number of admissions in the labour room in the year 2023 =5012

- • Total near-miss outcome = 227

- • Proportion of near-miss outcome = 227/5012*100

Proportion of near-miss cases = 4.5 %
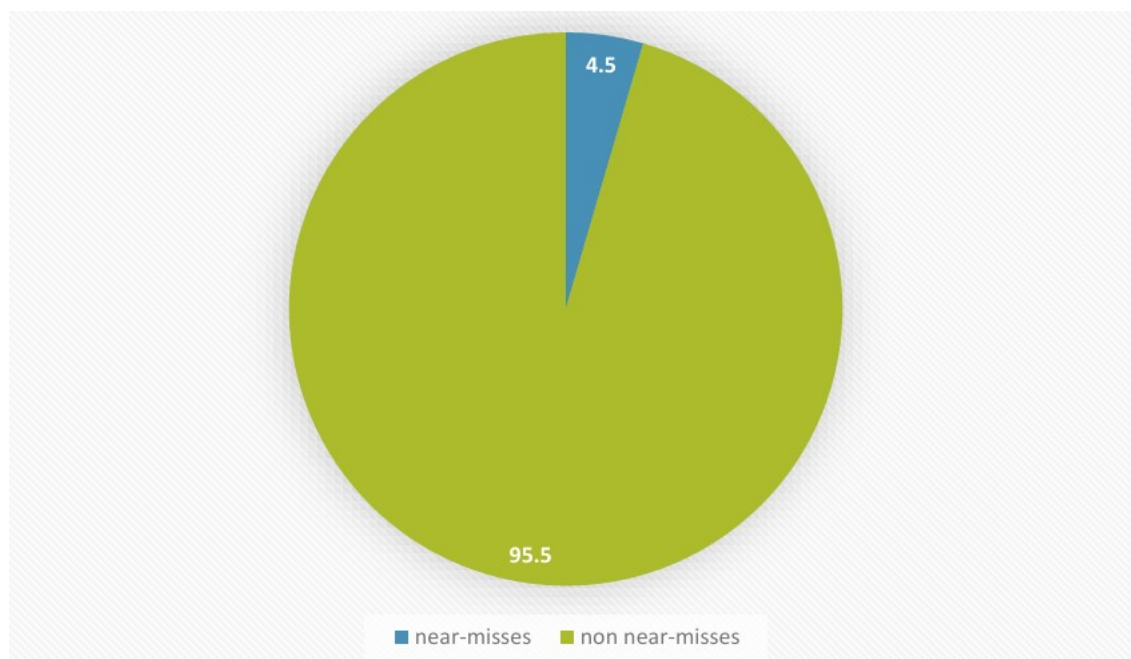
Geographical Distribution of near miss cases:

The table below shows the geographical distribution of the near miss cases:

Total Cases	5012
Total near-miss outcome 1. Raxaul 2. Ramgharwa 3. Adapur 4. Nepal 5. Other Blocks	227 66 25 48 59 29

Maternity Census:

A total of 5012 women were admitted in the year 2023. Out of 5012 births, 69.8% were spontaneous vaginal delivery, 25.5% were caesarean section, 3% were through vacuum aspiration, 1.1% were breech presentation, 0.45% were through forceps delivery. 0.18% woman undergone laparotomy for rupture uterus. 0.47%women underwent total abdominal hysterectomy.

Sex of the infants:

Sex	Number	Percent
Female	2322	46.3
Male	2690	53.7

Out of total birth, 2322 female infant were born and 2690 male infant were born at the hospital in the year 2023. The male to female ratio was 1.15 :1 (869 females for every 1000 males)

Birth Status of Infants:

Live birth	4850	96.7%
IUD/ Stillbirth	162	3.2 %

Out of 5012 births, total live births were 4850 (96.7%) and total 162 (3.2%) were stillborn.

Still birth/ IUD in healthy women and near-miss women:

	Number	Percent
Still birth/IUD in near miss cases (n=227)	37	16.3
Still birth/IUD in non- near-miss cases (n=4785)	125	2.61

Still birth rate was 16.3 % among near- misses and 2.61 % among non near-misses

Health status of mother and infant in the near-miss cases:

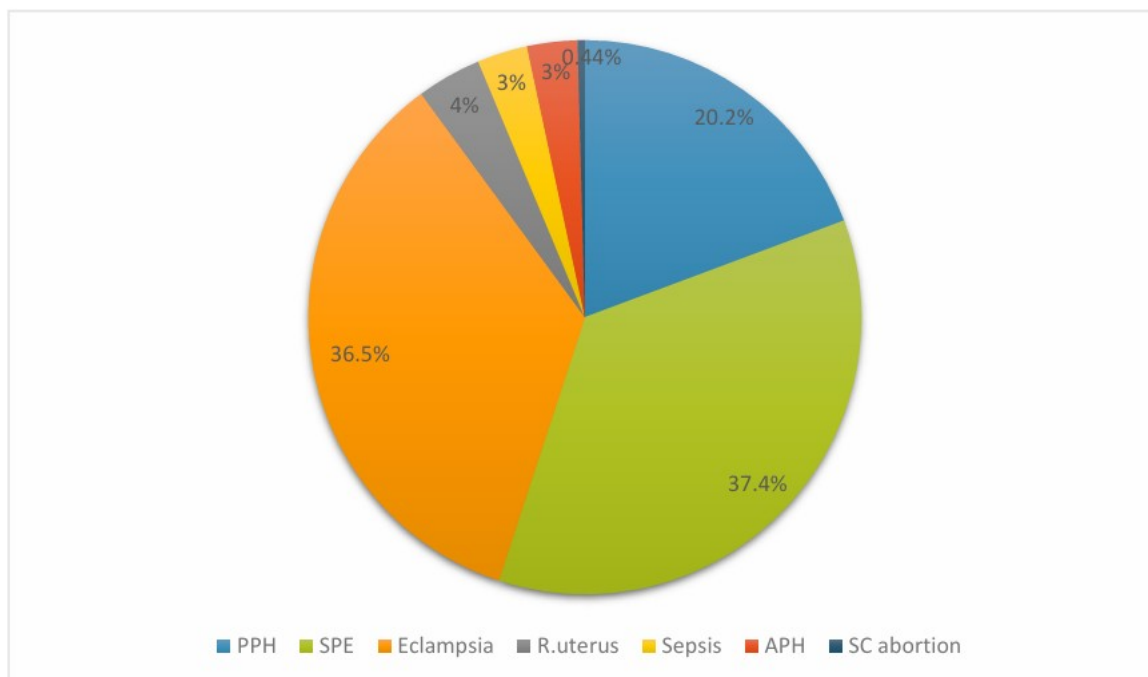|	Number	Percent
Mother alive	227	100
Mother dead	00	0
Infant alive	194	85.4
Perinatal death	37	16.3
IUD/ Still birth	34	15
Neonatal death	03	1.3

None of the mothers who experienced near-miss condition, died. 4 mothers gave birth to a pair of twins each. Two women had intrauterine death of one twin . Total of 37 infants born to these

women died. Out of 37, 34 infants had intra uterine death or stillbirth, 3 infants had neonatal death.

List of complications among near-misses:

Complications	Number	Percentage
Severe PPH	46	20.26
Severe Pre-eclampsia (SPE)	85	37.4
Eclampsia	83	36.5
Sepsis	7	3
Rupture uterus	9	3.9
Ante partum haemorrhage (APH)	7	3
Severe complication of abortion	1	0.4
Total number	238	

Among all the near-misses, the most common complication was severe pre-eclampsia (37.4%) and eclampsia (36.5%) followed by Severe PPH (20.2%), rupture uterus (3.9%), sepsis (3%), APH (3%) and severe complication of abortion (0.44%).

Women having more than one complications:

Complications	Number	Percentage
PPH and Eclampsia	2	0.88
Severe Pre Eclampsia and PPH	2	0.88
Rupture uterus and PPH	3	1.32
APH and PPH	2	0.88
Severe Pre Eclampsia and Complication of abortion	1	0.44

Severe Pre Eclampsi and rupture uterus	1	0.44

Ten among the near-miss women had more than one complication. Rupture uterus and PPH women, sever pre-eclampsia and severe PPH together were found in two women, ante partum haemorrhage and post partum haemorrhage together were found in two women. Severe pre-eclampsia and severe complication of abortion and severe pre eclampsia and rupture uterus together were found in three women. Severe PPH and eclampsia together were found in two women, sever pre-eclampsia and severe PPH together were found in two women, ante partum haemorrhage and post partum haemorrhage together were found in two women. Severe pre-eclampsia and severe complication of abortion and severe pre-eclampsia and rupture uterus together were found in one women each.

Dysfunction amongst near miss cases:

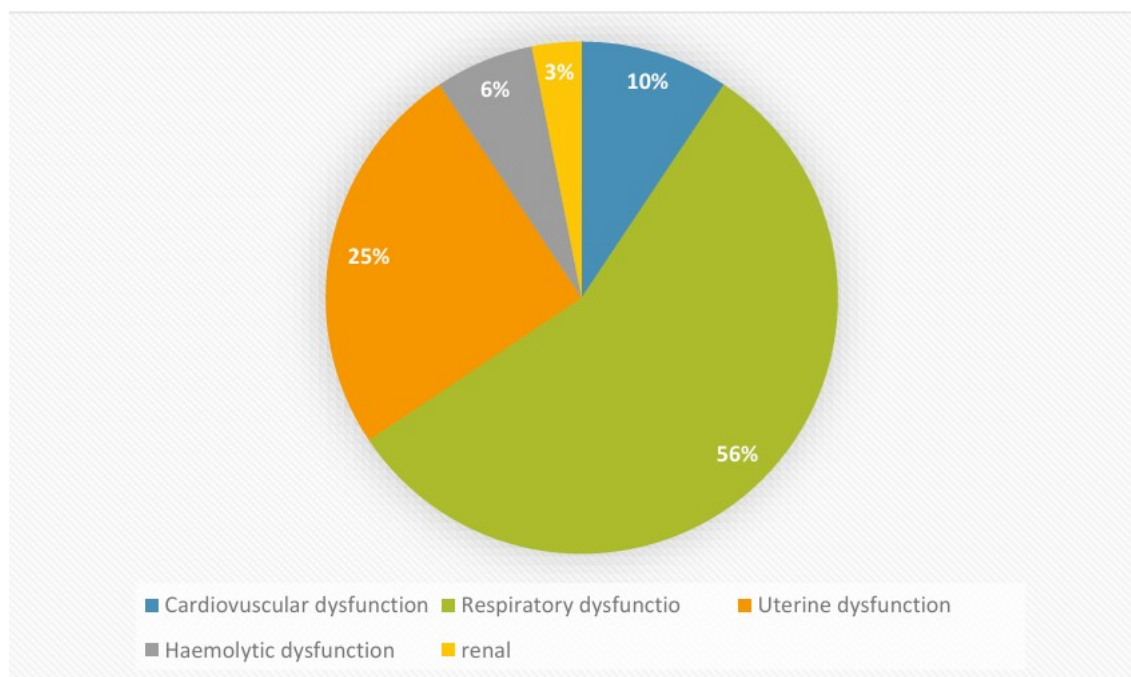|	PPH (46)	SPE (85)	Eclampsia (83)	Rupture Uterus (9)	Sepsis (7)	Total (227)
Organ Dysfunction	5 (10.8%)	3 (3.5%)	7 (8.4%)	5(55.5%)	2 (28.8%)	22 (9.6%)
Cardiovascular Dysfunction	1 (2.1%)	1 (1.2%)	1 (1.2%)	0	0	3 (1.32%)
Respiratory Dysfunction	4 (8.7%)	1 (1.2%)	7 (8.4%)	4 (44.4%)	2 (28.57%)	18 (7.92%)
Renal Dysfunction	0	0	0	1(11.1%)	0	1 (0.44%)
Uterine dysfunction	1 (2.1%)	1 (1.2%)	3 (3.6%)	3 (33.3%)	0	8 (3.52%)
Coagulation/Haemolytic dysfunction	0	0	0	2 (22.2%)	0	2 (0.88%)

Total twenty-two women (9.7%) among the near-misses experienced organ dysfunction. Respiratory dysfunction was the most common organ dysfunction (7.9%)

Among women who had suffered from severe pre-eclampsia (n=85), three women experienced organ dysfunction. One women each had cardiovascular , respiratory and uterine dysfunction. Among women who suffered from eclampsia, seven women experienced organ dysfunction.

All seven women had respiratory dysfunction while three of these women also suffered from uterine dysfunction and one of these had cardiovascular dysfunction.

Out of the nine who suffered with rupture uterus, five experienced organ dysfunction, most of them having multiple organ dysfunction. Among these, four experienced respiratory dysfunction, three experienced uterine dysfunction, two experienced haemolytic dysfunction and one experienced renal dysfunction.

Out of the seven women who had suffered from sepsis, two experienced organ dysfunction. Both of them experienced respiratory dysfunction.

Critical intervention given to the near misses:

	Severe PPH (46)	SPE (85)	Eclampsia (83)	Rupture Uterus (9)	Sepsis (7)	APH (7)	Severe Complications of abortion (1)	Total
Critical intervention given	28 (60.8%)	16 (18.8%)	21 (25.3%)	9 (100%)	6 (85.7%)	4 (57.1%)	1 (100%)	85 (37.4%)
Use of blood products	26 (56.5%)	11 (12.9%)	4 (4.8%)	8 (88.8%)	2 (28.5%)	4 (57.1%)	1 (100%)	56 (24.6%)
ICU Admission	15 (32.6%)	7 (8.2%)	20 (24%)	7 (77.7%)	6 (85.7%)	2 (28.5%)	1 (100%)	58 (25.5%)
Laparotomy	0	0	0	9 (100%)	0	0	0	9 (3.9%)
Total % for each near miss	149.9%	39.9%	54.1%	366.5%	199.9%	142.7%		

Among all the near-misses eighty-five (37.4%) women required critical intervention. Fifty-eight women (25.5%) required ICU admission; fifty-six women (24.6%) required blood transfusion. Nine women underwent laparotomy. Twenty-eight out of forty-six women suffering from severe PPH required critical intervention. Twenty-six of these required blood transfusion, fifteen of them required ICU admission. Sixteen out of eighty-five women suffering from severe pre-eclampsia required critical intervention. Eleven required blood transfusion and seven were admitted to ICU.

Among the eighty-three women suffering from eclampsia, twenty-one required critical intervention. Twenty women were admitted to ICU and four women required blood transfusion. All nine women suffering from rupture uterus required critical intervention. All nine underwent laparotomy , eight of them required blood transfusion and seven were admitted to ICU. Among the

seven women suffering from sepsis, six required critical intervention. All six were admitted to ICU and two required blood transfusion. Among the seven women suffering from antepartum haemorrhage four required critical intervention. All four required blood transfusion and two of them were admitted to ICU. One women who suffered from serious complication of abortion, required critical intervention. She required ICU admission and blood transfusion. Women suffering from PPH, Rupture uterus, Sepsis and APH the use of critical intervention was more than 100% because few patients required more than one critical intervention.

Contributory causes/ associated conditions:

Contributory Causes	Number	Percentage
Anaemia	78	34.3
HIV Infection	1	0.44
Previous Caesarean Section	17	7.5
Prolonged/Obstructed Labor	8	3.5
Non Progression of labor	16	7
Placenta Previa	5	2.2
Abruption if placenta	6	2.6

Among the near-miss women, one hundred and thirty-one women had contributory conditions. Seventy-eight (34.3%) of these women had anaemia, seventeen of them (7.5%) had undergone previous caesarean section, sixteen women (7%) experienced non-progression of labour, six (2.6%) had abruption placenta, five (2.2%) had experienced placenta Previa.

DISCUSSION:

This study assessed the incidence and characteristics of maternal near-miss (MNM) cases in a secondary-level hospital in Bihar using the WHO near-miss criteria. Among 5012 medical records audited from 2023, 227 women met the MNM definition, yielding a near-miss proportion of 4.5%. This is within the range reported in other Indian studies but slightly lower than studies conducted in tertiary care centers. For instance, a study at a tertiary hospital in North India found an MNMR of 22.5 per 1000 live births, while a study in South India reported a rate of 8.46 per 1000 live birth[21][20]. A study from Rajasthan recorded an even lower incidence of 4.18 per 1000 live births, similar to our findings [42]. The relatively lower incidence in our study may be attributed to the hospital's secondary care status, where earlier interventions and fewer referrals of extremely complicated cases may result in fewer severe outcomes.

The present study identified severe pre-eclampsia (37.4%) and eclampsia (36.5%) as the most common causes of near-miss events, followed by postpartum hemorrhage (20.2%). This pattern aligns with global and national literature, where hypertensive disorders and hemorrhage consistently emerge as the leading direct obstetric complications contributing to both near-miss and maternal deaths. According to a systematic review by Say et al. (2014), hypertensive disorders and hemorrhage account for more than 50% of maternal deaths in Asia and Africa[11]. A study conducted in West Bengal similarly found that eclampsia (33%) and severe PPH (29%) were predominant among MNM cases[43]. These findings reaffirm the urgent need to improve antenatal screening for hypertension, timely administration of magnesium sulfate, and active management of the third stage of labour (AMTSL) to prevent PPH.

The survival rate in this study was 99.14%, indicating effective emergency obstetric care. Similar outcomes were observed in a Delhi-based tertiary hospital, where MNM survival was over 98%, reflecting improved critical care response(44). However, despite maternal survival, the perinatal outcomes remained poor, with a 20% stillbirth rate among near-miss women, much higher than the 3.86% among non-near-miss cases in the same facility. This trend mirrors findings from Karnataka, where perinatal mortality was significantly elevated among MNM cases, emphasizing the need to not only save mothers but also ensure neonatal preparedness(45).

Regarding organ dysfunction, 9.7% of women in this study showed signs of failure, primarily respiratory, which is in line with WHO's near-miss classification. Similar organ dysfunction patterns have been reported in other Indian studies, with respiratory and cardiovascular dysfunctions being most common(46). In this study, the use of critical interventions—such as ICU admission (25.5%), blood transfusions (24.6%), and laparotomies—was aligned with WHO recommendations and reflects competent triage and emergency care. A multicentric study by WHO found that the proportion of women requiring ICU admission among near-miss cases varied between 10% to 40%, indicating variability based on resources and case severity(16).

Notably, all women with uterine rupture in our study required immediate surgical intervention and ICU admission—further emphasizing the importance of emergency surgical readiness in rural secondary facilities. This finding echoes the conclusions of a study in Bihar that identified delays in performing laparotomy for rupture uterus as a key contributor to maternal morbidity(33).

Finally, adherence to WHO near-miss criteria and treatment protocols at Duncan Hospital suggests a high standard of care, especially considering the resource constraints typical of rural hospitals. This also highlights the feasibility and importance of implementing structured MNM audits even in non-tertiary centers. By regularly analyzing near-miss events, health facilities can pinpoint systemic bottlenecks and improve obstetric outcomes through targeted training, protocol adherence, and infrastructure enhancement.

LIMITATIONS:

This study is hospital-based and may not capture maternal near-miss cases occurring at home or in peripheral centers that did not reach the facility. Additionally, reliance on retrospective medical records introduces the possibility of underreporting or missing data, particularly for parameters like socioeconomic factors and delays in seeking care. The study also did not apply the three-delay model, which could have added insight into barriers at the community and health system levels.

CONCLUSION:

This study underscores the significance of maternal near-miss assessments as a practical, life-saving tool for evaluating the quality of maternal care in resource-constrained environments. With a near-miss incidence of 4.5%, the findings reveal that most life-threatening obstetric complications were effectively managed through timely critical interventions in accordance with WHO guidelines. However, the high perinatal mortality among near-miss cases and the considerable use of emergency caesarean sections point toward the need for stronger antenatal screening and early risk identification.

The hospital's adherence to standardized protocols reflects its potential to provide high-quality maternal care, despite being a secondary-level facility. Moving forward, integrating community-level awareness, better referral mechanisms, and regular near-miss audits into the health system

can bridge existing gaps, ultimately reducing both maternal and neonatal mortality. This approach can be replicated across similar settings to ensure safer pregnancies and healthier outcomes for mothers and infants alike.

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