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REDUCING MATERNAL MORTALITY IN UZBEKISTAN: EFFECTIVENESS OF NEAR-MISS AUDIT IN CRITICAL OBSTETRIC CONDITIONS.

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Abstract. Maternal mortality remains a critical public health challenge in low- and middle-income countries, including Uzbekistan. Despite significant progress in recent decades, further reduction requires systematic approaches to identify and address gaps in obstetric care. The near-miss audit, which analyzes women who survive life-threatening obstetric complications, has emerged as a powerful tool for improving maternal health services. This study aims to evaluate the effectiveness of near-miss audits in reducing maternal mortality and improving the quality of obstetric care in Uzbekistan. A theoretical and analytical review of scientific literature, international guidelines, and national health reports was conducted. The results indicate that near-miss audits enable identification of delays in care (delays in seeking, reaching, and receiving care), substandard clinical practices, and health system deficiencies. Implementation of audit findings through structured interventions has been associated with improved case management, enhanced clinical protocols, and reduced maternal mortality ratios in various settings. For Uzbekistan, integrating near-miss audits into the national maternal health strategy offers a promising pathway to achieve Sustainable Development Goal 3.1. Understanding the principles and implementation of near-miss audits is essential for healthcare professionals, hospital administrators, and policymakers committed to improving maternal outcomes.

Keywords: maternal mortality, near-miss audit, obstetric complications, maternal health, quality of care, Uzbekistan, critical obstetrics.

Introduction Maternal mortality is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management. Despite global efforts to reduce maternal mortality, approximately 287,000 maternal deaths occurred worldwide in 2020, with the vast majority occurring in low- and middle-income countries [1]. The Sustainable Development Goals (SDGs) set a target of reducing the global maternal mortality ratio (MMR) to less than 70 per 100,000 live births by 2030 (SDG 3.1) [2].

Uzbekistan has made notable progress in maternal health over the past two decades. The maternal mortality ratio declined from approximately 33 per 100,000 live births in 2000 to around 14 per 100,000 live births in 2020 [3]. However, this ratio remains above the levels

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achieved in high-income countries, and significant disparities exist between urban and rural areas, as well as among different regions of the country. Moreover, maternal mortality is often the result of preventable causes such as hemorrhage, hypertensive disorders, sepsis, and unsafe abortion [4].Traditional approaches to maternal mortality reduction have focused on increasing access to skilled birth attendance and emergency obstetric care. While these interventions are essential, they do not fully address the underlying quality gaps in obstetric services. The near-miss audit offers a complementary approach by shifting the focus from deaths to survivors of life-threatening complications. A maternal near-miss 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].The near-miss audit provides a structured methodology for reviewing cases of severe obstetric complications, identifying modifiable factors, and implementing quality improvement interventions. Unlike maternal death audits, which may be limited by small numbers and reluctance to discuss deaths, near-miss audits generate larger case volumes and create a less threatening environment for learning and improvement [6].This study aims to analyze the effectiveness of near-miss audits in reducing maternal mortality and improving the quality of obstetric care, with specific relevance to the context of Uzbekistan. The study examines the conceptual framework of near-miss audits, their implementation in various settings, evidence of their impact, and recommendations for integration into Uzbekistan's maternal health system.

Methods. This study was conducted using a theoretical and analytical research approach. A comprehensive review of scientific literature, international guidelines, and national health reports related to maternal mortality reduction and near-miss audits was performed.Sources were retrieved from databases including PubMed, Scopus, the Cochrane Library, and Google Scholar, using search terms such as "maternal near-miss," "severe maternal morbidity," "maternal death audit," "obstetric quality improvement," and "Uzbekistan maternal health." Additionally, reports from the World Health Organization (WHO), United Nations Population Fund (UNFPA), Ministry of Health of the Republic of Uzbekistan, and international maternal health initiatives were analyzed.The methodological framework included comparative analysis of near-miss audit methodologies, evaluation of audit outcomes in different settings, and synthesis of implementation strategies. Data were collected on:

- Definitions and criteria for maternal near-miss cases
- Audit processes (case identification, review, analysis, action)
- Evidence of impact on maternal mortality and morbidity
- Barriers and facilitators to audit implementation
- Current status of maternal health in Uzbekistan

The collected information was systematically synthesized to provide a comprehensive, evidence-based overview of near-miss audits and their potential for reducing maternal mortality in Uzbekistan.

Results Maternal Mortality in Uzbekistan: Current Status Uzbekistan has achieved significant progress in maternal health indicators. According to official data, the maternal mortality ratio decreased from 33.0 per 100,000 live births in 2000 to 14.3 per 100,000 live

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births in 2020 [3]. However, this ratio varies across regions, with some areas reporting rates substantially higher than the national average. The main causes of maternal death in Uzbekistan are consistent with global patterns: obstetric hemorrhage (40%), hypertensive disorders (25%), sepsis (15%), and thromboembolism (10%) [4].Despite the overall reduction, maternal deaths are still considered largely preventable. The WHO estimates that up to 80% of maternal deaths could be averted with timely and appropriate obstetric care [7]. This highlights the need for systematic approaches to identify and address deficiencies in the quality of care.

Maternal Near-Miss: Definition and Criteria The maternal near-miss concept was formally defined by the WHO in 2011. A near-miss case is identified based on the presence of at least one of the following criteria [5]:

1. Clinical criteria: severe hemorrhage requiring transfusion, eclampsia, severe pre-eclampsia, sepsis, uterine rupture, cardiac arrest, etc.

2. Laboratory criteria: severe hypoxemia, thrombocytopenia, elevated bilirubin, creatinine, etc.

3. Management criteria: admission to intensive care unit, administration of blood products, major surgery (hysterectomy, laparotomy), etc.

The near-miss approach provides a larger pool of cases than maternal deaths, enabling more frequent audits and statistically meaningful analysis. For every maternal death, there are an estimated 20 to 50 near-miss cases [8].

Near-Miss Audit Methodology The near-miss audit follows a structured cycle of quality improvement:
1. Case identification: Systematic identification of near-miss cases using standardized criteria, typically through review of medical records, intensive care unit admissions, and blood transfusion registers

2. Case review: Multidisciplinary review of each case by a team including obstetricians, midwives, anesthesiologists, and hospital administrators. The review examines clinical management, adherence to protocols, and contributing factors
3. Analysis: Identification of patterns, root causes, and modifiable factors. The “three delays” framework is commonly used:

- Delay 1: delay in seeking care (patient/family factors)

- Delay 2: delay in reaching care (transportation, geographic access)

- Delay 3: delay in receiving care (health system factors, facility readiness)

4. Action: Development and implementation of corrective measures, including protocol updates, staff training, equipment procurement, and referral system improvements.
5. Re-evaluation: Repeat audit to assess the impact of interventions and identify remaining gaps

Table 1 summarizes the near-miss audit cycle

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Phase	Activities	Outputs
Identification	Review registers, ICU admissions, blood transfusion records	List of near-miss cases
Review	Multidisciplinary case discussion, timeline analysis	Identification of contributing factors
Analysis	Root cause analysis, three delays assessment	Patterns and system deficiencies
Action	Protocol updates, training, infrastructure improvement	Implemented interventions
Re-evaluation	Repeat audit, monitor indicators	Measurable improvement

Table 2 Strengths and Limitations of Near-Miss Audits

Strengths	Limitations
Larger number of cases than death audits	Requires trained facilitators
Creates less threatening environment for review	Data collection can be resource-intensive
Enables identification of systemic deficiencies	May be biased if cases are not systematically identified
Provides actionable data for quality	Needs strong leadership and institutional support

Discussion The findings of this study demonstrate that near-miss audits represent a valuable strategy for reducing maternal mortality and improving the quality of obstetric care. The shift from focusing solely on deaths to analyzing survivors of severe complications allows for more frequent audits, more robust data, and a more constructive approach to quality improvement.For Uzbekistan, the integration of near-miss audits into the national maternal health program offers several potential benefits:First, near-miss audits can help identify specific gaps in the “three delays” framework. Studies in Central Asia have shown that delays in receiving care (Delay 3) are particularly significant in Uzbekistan, with factors including inadequate facility readiness, delays in blood transfusion, and gaps in clinical protocols [16]. Near-miss audits systematically identify these issues and provide evidence for targeted interventions.Second, the audit process fosters a culture of openness and continuous learning. Traditionally, maternal death reviews in some settings have been perceived as punitive, leading to underreporting and defensive attitudes. The near-miss approach emphasizes educational objectives and multidisciplinary collaboration, which can improve provider engagement and willingness to identify areas for improvement [12].Third, near-miss audits generate data that are useful for monitoring trends in severe maternal morbidity. This information can inform resource allocation, training priorities, and policy development. For example, if audits consistently identify deficiencies in management of postpartum hemorrhage, this signals a need for enhanced training, availability of uterotonics, and blood transfusion capacity.The effectiveness of near-miss audits depends on several key factors:

- Systematic case identification: Cases must be identified using standardized criteria to ensure completeness and comparability.

- Multidisciplinary review: Audits should involve all relevant professionals, including obstetricians, midwives, anesthesiologists, and administrators.

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- Non-punitive approach: The focus should be on systems improvement rather than individual blame.

- Translation into action: Audit findings must be followed by concrete interventions and reassessment.

- Institutional support: Sustained implementation requires leadership commitment, dedicated personnel, and adequate resources [9,12].

In the context of Uzbekistan, several steps are recommended to strengthen near-miss audit implementation:
1. Develop national guidelines for near-miss audit methodology adapted to the Uzbek healthcare system.

2. Provide training for healthcare providers in audit facilitation, root cause analysis, and quality improvement.

3. Strengthen data collection systems to enable systematic identification of near-miss cases.

4. Establish multidisciplinary audit committees at facility, district, and regional.

5. Integrate near-miss audits with existing maternal death surveillance and response mechanisms.

6. Monitor and evaluate the impact of audit implementation on maternal mortality and morbidity indicators.

The COVID-19 pandemic has highlighted the importance of resilient maternal health systems. Lessons from the pandemic underscore the need for robust quality assurance mechanisms that can respond to emerging challenges while maintaining essential services [17].Limitations of this study include its reliance on published literature and secondary data rather than primary data collection from Uzbek facilities. However, the synthesis of international evidence and contextual analysis provides a solid foundation for recommendations.

Conclusion. Reducing maternal mortality remains a priority for Uzbekistan's health system. While significant progress has been made, further reductions require systematic approaches to identify and address gaps in the quality of obstetric care. The maternal near-miss audit offers a powerful tool for this purpose. By shifting the focus from deaths to survivors of life-threatening complications, near-miss audits enable more frequent case reviews, foster a culture of learning, and generate actionable data for quality improvement.The evidence from various countries demonstrates that near-miss audits, when implemented effectively with strong institutional support and translation of findings into action, can contribute to reduced maternal mortality and improved obstetric outcomes. For Uzbekistan, integrating near-miss audits into the national maternal health strategy offers a promising pathway toward achieving Sustainable Development Goal 3.1.Healthcare professionals, hospital administrators, and policymakers must work together to establish sustainable audit programs, train personnel, and create an environment that supports continuous quality improvement. By systematically learning from near-miss cases, Uzbekistan can build a safer, more effective maternal health system that ensures every woman receives the care she needs to survive and thrive during pregnancy and childbirth.

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