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Navigating the Dangers: Critical Evaluation of Maternal Death in Obstetric ICU at DMCH

FOWZIA YASMIN[1], AKLIMA AKTER[2], SYEDA UMMAY KULSUM[3], SABINA SHARMEEN[4], NASIMA BEGUM[5], ANZUMAN ARA BEGUM[6], FAIZA ANAN NOOR[7]

Abstract

Background: *Maternal mortality in intensive care units represents the most severe end of the obstetric complication spectrum. Understanding the patterns of delays in care, clinical progression, and outcomes is crucial for improving maternal survival in tertiary care settings.*

Objective: *To critically evaluate maternal deaths in the Obstetric Intensive Care Unit (ICU) of Dhaka Medical College Hospital (DMCH) by analyzing delays in care, management approaches, and the progression from primary to final causes of death.*

Methods: *A retrospective observational study was conducted from January 2024 to December 2024 analyzing 65 maternal deaths in the Obstetric ICU. Data was collected on three types of delays (seeking, reaching, and receiving care), duration of ICU stay, primary management, causes of ICU referral, and progression from primary to final causes of death. Cases were analyzed using the Three Delays Model framework.*

Results: *Delays in seeking care predominated (63.1%, n = 4), followed by delays in reaching care (20%, n = 13 and receiving care (16.9%, n = 1). The median ICU stay was 24 hours, with 49.2% of deaths occurring within 24 hours of admission. Lower Segment Cesarean Section was the primary management approach (44.6%, n = 29). Severe pre-eclampsia and antepartum eclampsia were the leading primary causes (27.7%, n = 18 , while the most common final causes were DIC with/without Acute Kidney Injury (AKI) (23.1%, n = 15) and cardiac arrest (21.5%, n = 14). Pulmonary edema was the predominant cause for ICU referral (30.8%, n = 20).*

Conclusions: *Delays in seeking care significantly impact maternal mortality, with rapid clinical deterioration evident in the high proportion of early ICU deaths. The progression patterns from primary to final causes suggest opportunities for earlier intervention. Improving community awareness, strengthening referral systems, and implementing aggressive early management protocols are crucial for reducing maternal mortality in similar settings.*

Keywords: *Maternal mortality; Intensive care; Three delays model; Obstetric complications; Bangladesh; Maternal health; Critical care; Pre-eclampsia; Healthcare access; Clinical outcomes.*

Introduction

Maternal mortality continues to be a major global health challenge, particularly in developing countries where it remains a critical indicator of healthcare system effectiveness[1]. Despite significant advances in obstetric care, maternal deaths in intensive care units (ICUs) represent the most severe cases of maternal morbidity and require detailed analysis to identify

1. Professor, Department of Obstetrics and Gynaecology,Dhaka Medical College, Dhaka, Bangladesh
2. Associate Professor, Department of Obstetrics and Gynaecology,Dhaka Medical College, Dhaka, Bangladesh
3 Associate Professor, Department of Obstetrics and Gynaecology, Bangladesh Medical University, Bangladesh
4. Professor, Department of Obstetrics and Gynaecology,Sir Salimullah Medical College, Dhaka, Bangladesh
5,6. Associate Professor, Department of Obstetrics and Gynaecology,Sir Salimullah Medical College, Dhaka, Bangladesh
7. Research Assistant, Department of Computing, University of Helsinki, Finland

Correspondence: Dr. Fowzia Yasmin. Professor, Department of Obstetrics and Gynaecology,Dhaka Medical College, Dhaka, Bangladesh, Email: happy69mmc@gmail.com Cell: 01819142467

preventable factors[2]. This study examines maternal deaths in the Obstetric ICU of Dhaka Medical College Hospital (DMCH), focusing on critical aspects of care delivery and outcomes.

The concept of delayed access to appropriate obstetric care, as described in the "Three Delays Model," has been widely recognized as a fundamental framework for understanding maternal mortality[3]. These delays—in seeking care, reaching care, and receiving adequate care—form a crucial paradigm for analyzing preventable maternal deaths[4]. Our analysis of 65 maternal deaths in the DMCH Obstetric ICU provides insights into these delays and their consequences.

The study investigates multiple dimensions of maternal mortality, including the duration of ICU stay, primary management approaches, and the progression from initial complications to final outcomes. The spectrum of cases encompasses severe conditions such as pre-eclampsia, HELLP syndrome, hemorrhagic shock, and sepsis, often culminating in critical complications including Disseminated Intravascular Coagulation (DIC), Acute Kidney Injury (AKI), and pulmonary edema[5].

This critical evaluation aims to analyze patterns in care delays, examine the relationship between primary pathologies and final outcomes, and assess the effectiveness of various management strategies. Understanding these factors is essential for developing targeted interventions to reduce maternal mortality in tertiary care settings[6].

Materials and Methods

Study Design and Setting: This retrospective observational study was conducted during January to December 2024 at the Obstetric Intensive Care Unit (ICU) of Dhaka Medical College Hospital (DMCH), a tertiary care referral center in Bangladesh [7]. The study analyzed maternal deaths occurring during the study period, focusing on critical care parameters and mortality patterns.

Study Population: The study included 65 maternal deaths that occurred in the Obstetric ICU. Maternal death was defined according to WHO criteria as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management [8].

Data Collection and Variables: Data was collected from obstetric ICU records and patient files using a structured format. The following parameters were analyzed:

- Delay categories (seeking care, reaching care, receiving care)
- Duration of ICU stay
- Primary management approaches (including LSCS, conservative management, laparotomy, and other surgical interventions)
- Primary cause of death
- Final cause of death
- Cause of ICU referral

Classification of Delays: The three-delay model was used to categorize delays in maternal care [9]: Delay in seeking care: Time interval between onset of complications and decision to seek care. Delay in reaching care: Time taken to reach the healthcare facility after deciding to seek care. Delay in receiving care: Time interval between reaching the facility and receiving appropriate treatment.

Management approaches were, surgical interventions (LSCS, laparotomy, peripartum hysterectomy), conservative management, emergency procedures, outcome measures. Primary outcomes measured included: final cause of death, Progression of complications, duration of survival in ICU, relationship between delays and mortality

Data Analysis: Data was systematically analyzed to identify patterns in:

- Distribution of delay types
- Correlation between management approaches and outcomes
- Relationship between primary and final causes of death
- Common pathways leading to maternal mortality [10].

Ethical Considerations: the study was conducted following approval from the institutional Review board of DMCH. Patient confidentiality was maintained throughout the data collection and analysis process [11].

Results

Delay patterns and ICU stay duration among the 65 maternal deaths were analyzed. The majority (41, 63.1%) were associated with delays in seeking care, while 13 cases (20%) involved delays in reaching care, and 11 cases (16.9%) experienced delays in receiving care. The duration of ICU stay varied significantly, ranging from 15 minutes to 18 days, with a median stay of 24 hours. Notably, 32 patients (49.2%) had an ICU stay of less than 24 hours, suggesting late presentation or rapid deterioration of condition.

Table-I

Distribution of Delays and Associated Outcomes

Delay Category	Number of Cases (%)	Median ICU Stay	Most Common Final Cause
Seeking Care	41 (63.1%)	24 hours	DIC/Cardiac Arrest
Reaching Care	13 (20%)	14 hours	DIC/AKI
Receiving Care	11 (16.9%)	30 hours	ARDS/Cardiac Arrest

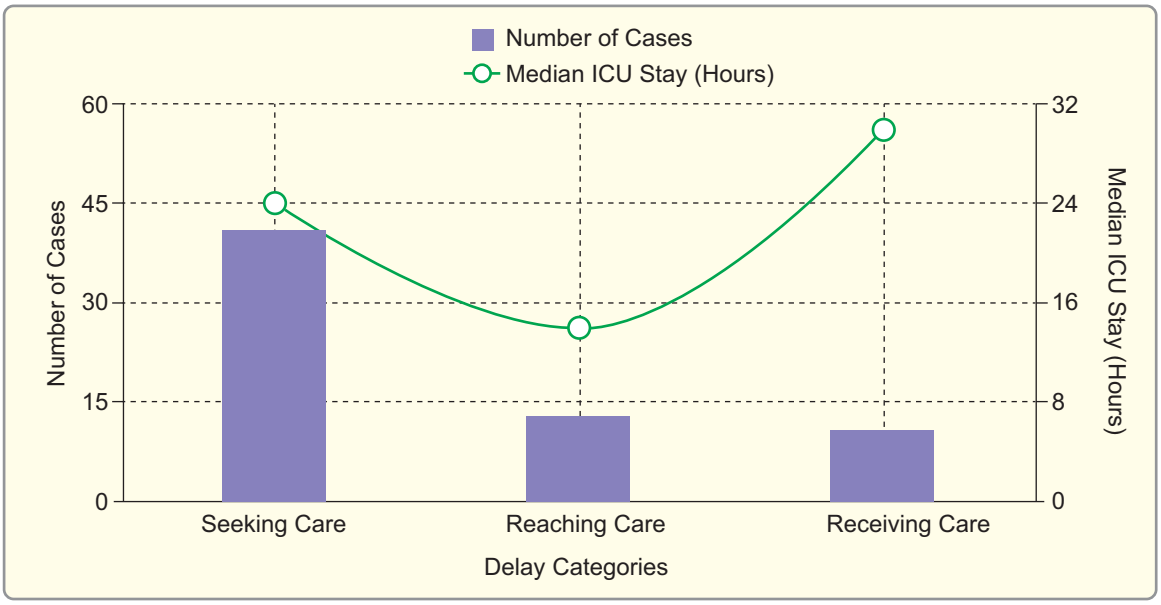

Figure 1: *Distribution of delay categories showing number of cases (bars) and median ICU stay duration in hours (line)*

Lower Segment Cesarean Section (LSCS) was the predominant management approach, performed in 29 cases (44.6%). Conservative management was implemented in 12 cases (18.5%), while various forms of laparotomy procedures, including peripartum hysterectomy, were performed in 14 cases (21.5%). The remaining cases underwent other interventions including vaginal delivery and evacuation.

Regarding primary and final causes of death The analysis revealed a complex pattern of disease progression. Severe pre-eclampsia (SPE) and antepartum eclampsia (APE) were the leading primary causes, accounting for 18 cases (27.7%). Hemorrhagic complications, including ruptured ectopic pregnancy and postpartum hemorrhage, constituted 16 cases (24.6%). HELLP syndrome was identified in 9 cases (13.8%).

Table-II

Management Approaches and Outcomes

Management Approach	Number of Cases (%)	Survival Duration (Median)	Common Final Causes
LSCS	29 (44.6%)	24 hours	DIC, PE, CA
Conservative	12 (18.5%)	48 hours	ARDS, MOF
Laparotomy/TAH	14 (21.5%)	30 hours	HS, CA
Others	10 (15.4%)	24 hours	Various

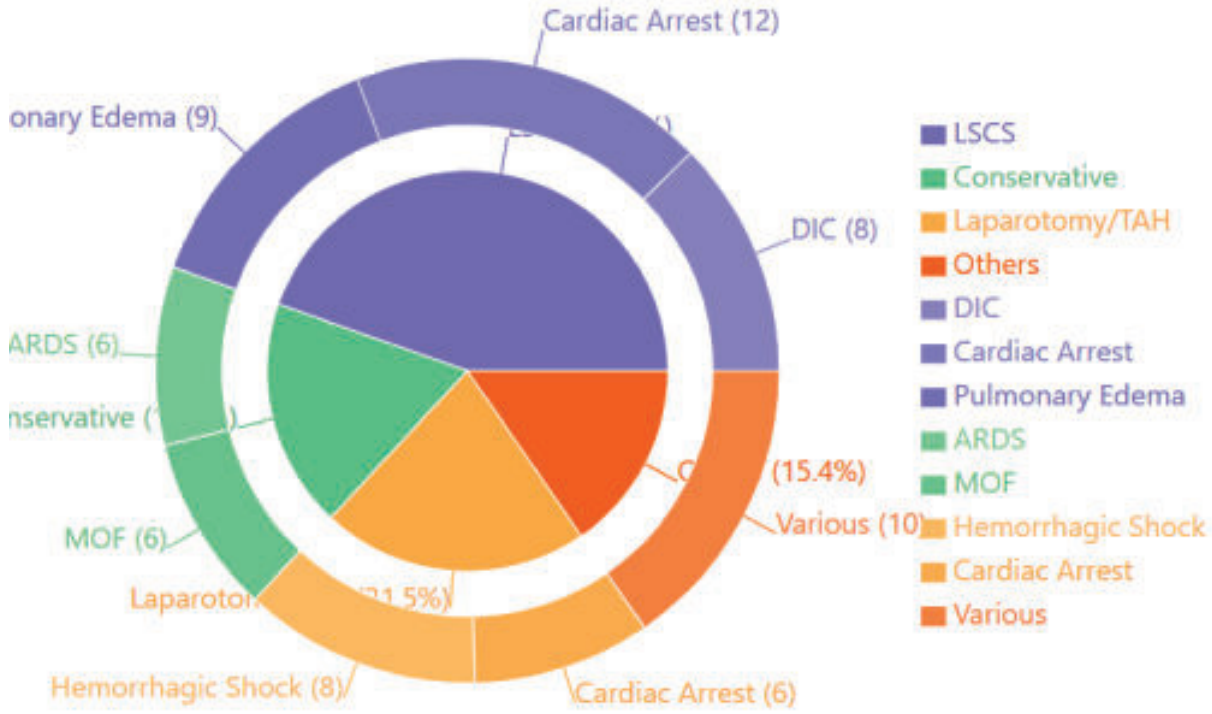

Figure 2: *Pie chart showing distribution of management approaches with nested rings showing associated final causes of death]*

The final causes of death showed a predominance of multi-organ complications:

- DIC with or without AKI: 15 cases (23.1%)
- Cardiac arrest: 14 cases (21.5%)
- ARDS: 11 cases (16.9%)
- Multi-organ failure with pulmonary edema: 8 cases (12.3%)
- Hemorrhagic shock: 7 cases (10.8%)
- Others: 10 cases (15.4%)

Table-III

Progression from Primary to Final Cause of Death

Primary Cause	Cases (%)	Most Common Final Cause	Median Time to Death
SPE/APE	18 (27.7%)	DIC/Cardiac Arrest	24 hours
Hemorrhagic	16 (24.6%)	Hemorrhagic Shock	16 hours
HELLP Syndrome	9 (13.8%)	DIC	48 hours
Sepsis/Infection	5 (7.7%)	ARDS	72 hours
Others	17 (26.2%)	Various	36 hours

ICU Referral Patterns The most frequent causes for ICU referral were:

1. Pulmonary edema: 20 cases (30.8%)
2. Acute Kidney Injury: 12 cases (18.5%)
3. Cardiac arrest: 10 cases (15.4%)
4. Respiratory distress: 8 cases (12.3%)
5. Others: 15 cases (23%)

Table-IV

ICU Referral Causes and Associated Outcomes

Referral Cause	Cases (%)	Mean ICU Stay	Survival Rate <24h
Pulmonary Edema	20 (30.8%)	36 hours	45%
AKI	12 (18.5%)	48 hours	33%
Cardiac Arrest	10 (15.4%)	12 hours	80%
Resp. Distress	8 (12.3%)	24 hours	50%
Others	15 (23%)	30 hours	47%

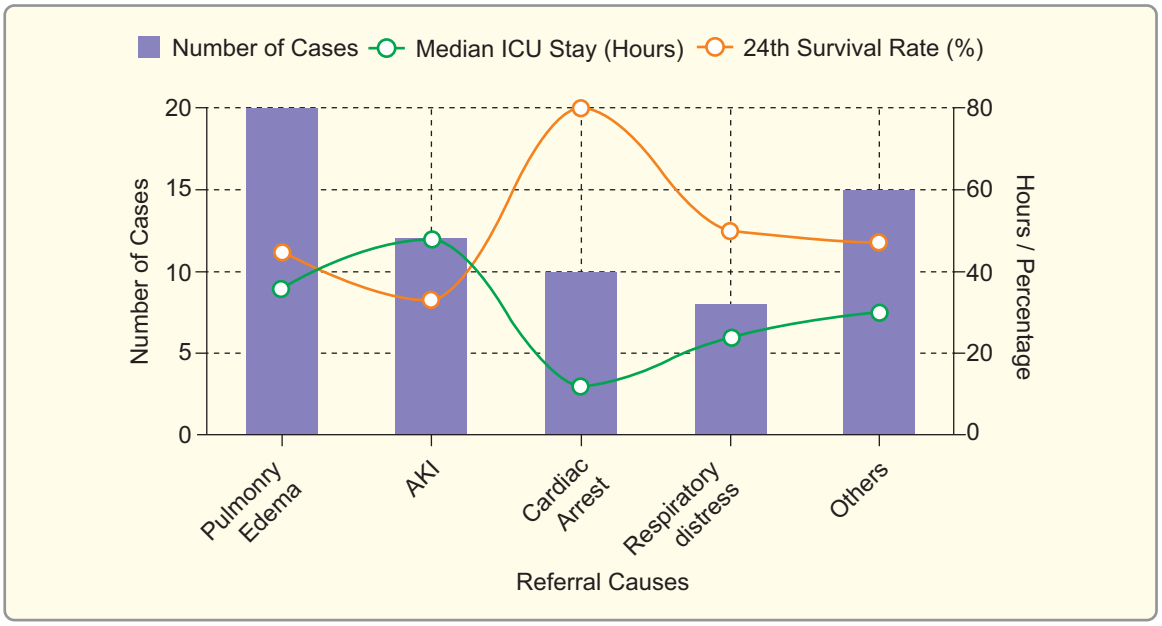

Figure 3: *Distribution of ICU referral causes showing number of cases (bars), mean ICU stay duration (green line), and 24-hour survival rates (orange line)*

Temporal Patterns and Survival Analysis of the temporal relationship between delays and survival showed that patients with delays in seeking care had the poorest outcomes, with 56% dying within 24 hours of ICU admission. Those experiencing delays in receiving care showed slightly better survival times, with a median of 30 hours, possibly due to earlier presentation allowing for some intervention time.

This comprehensive analysis reveals critical patterns in maternal mortality, highlighting the significance of early intervention and the complex interplay between initial presentation, management approaches, and final outcomes.

Discussion

This study provides crucial insights into maternal mortality patterns in a tertiary care obstetric ICU setting, highlighting several critical aspects of care delivery and outcomes. The findings reveal complex interactions between delays in care, clinical management approaches, and ultimate maternal outcomes.

The predominance of delays in seeking care (63.1%) aligns with findings from similar studies in developing countries[12]. This pattern suggests persistent sociocultural and economic barriers to accessing maternal healthcare, despite improvements in facility-based care. The high proportion of deaths within 24 hours of ICU admission (49.2%) particularly among those with delays in seeking care, underscores the critical nature of early intervention in maternal complications[13]. These findings parallel those reported in other South Asian studies, where delayed healthcare-seeking behavior significantly impacted maternal outcomes[14].

The high proportion of cases requiring surgical intervention (44.6% LSCS) reflects the complex nature

of cases reaching tertiary care. However, the survival duration post-intervention raises questions about the timing and appropriateness of interventions. Similar studies have reported better outcomes with earlier surgical intervention in severe obstetric complications[15]. The progression from primary causes to final outcomes suggests a need for more aggressive early management protocols, particularly in cases of pre-eclampsia and hemorrhagic complications[16].

The evolution from primary causes to final outcomes reveals several critical patterns:

1. Pre-eclampsia Spectrum: The high prevalence of severe pre-eclampsia and HELLP syndrome progressing to DIC and multi-organ failure aligns with global patterns[17]. However, the rapid progression to death in many cases suggests opportunities for earlier intervention and more aggressive management protocols.
2. Hemorrhagic Complications: The significant proportion of hemorrhagic complications (24.6%) progressing to irreversible shock highlights the need for rapid response protocols and better blood product availability, as emphasized in recent literature[18].
3. Multi-organ Failure: The emergence of multi-organ failure as a common final pathway (particularly DIC and ARDS) suggests the need for earlier recognition of deterioration and more aggressive ICU interventions[19].

The findings have several implications for healthcare delivery:

1. Referral Systems: The pattern of ICU referrals, dominated by pulmonary edema and acute kidney injury, suggests late recognition of deterioration at referring facilities. This aligns with studies highlighting the importance of early warning systems in maternal care[20].
2. Resource Allocation: The high mortality rate within 24 hours of ICU admission indicates a need for better resource allocation and possibly pre-ICU stabilization protocols[21].
3. Quality of Care: The progression patterns from primary to final causes of death suggest opportunities for quality improvement in both early recognition and management of complications[22].

Preventable Factors and Future Directions: Analysis of the cases reveals several potentially preventable factors:

1. Educational Interventions: The high proportion of delays in seeking care suggests a need for community-level interventions to improve awareness of maternal danger signs [23].
2. Healthcare Access: The geographic and logistical barriers implicit in the reaching-care delays indicate a need for better emergency transport systems and distributed obstetric care facilities[24].
3. Clinical Protocols: The progression patterns suggest opportunities for standardized management protocols, particularly for common complications like pre-eclampsia and postpartum hemorrhage[25].

Study Limitations and Strengths: This study's strengths include its comprehensive analysis of multiple factors contributing to maternal mortality. However, The study has several limitations:

- Retrospective nature of data collection
- Single-center experience
- Limited socioeconomic data
- Potential documentation gaps in primary care settings

Future Research Directions: Further research is needed in several areas:

1. Prospective studies of early warning systems in preventing severe maternal morbidity
2. Implementation research on community-level interventions to reduce delays
3. Evaluation of standardized management protocols for common obstetric complications
4. Cost-effectiveness analysis of various intervention strategies

Conclusion

This comprehensive analysis of 65 maternal deaths in the Obstetric ICU at Dhaka Medical College Hospital reveals critical patterns and opportunities for intervention in maternal healthcare delivery. The study demonstrates that delays in seeking care remain the predominant contributor to maternal mortality, accounting for 63.1% of cases, with particularly poor outcomes evidenced by high mortality within the first

24 hours of ICU admission.

Several key conclusions emerge from this analysis:

1. Care-Seeking Behavior: The high proportion of delays in seeking care points to persistent sociocultural and economic barriers that must be addressed through targeted community interventions and health education programs. The critical time lost before reaching medical care significantly impacts survival chances, particularly in cases of pre-eclampsia and hemorrhagic complications.
2. Clinical Management: While LSCS was the predominant management approach (44.6%), the high mortality rate suggests need for:
    - Earlier recognition of deteriorating cases
    - More aggressive management protocols
    - Enhanced pre-ICU stabilization measures
    - Improved emergency response systems
3. Disease Progression: The study identifies clear patterns in the progression from primary to final causes of death, with DIC, cardiac arrest, and ARDS emerging as common final pathways. This understanding should inform the development of targeted intervention protocols at earlier stages of complication.
4. Healthcare System Implications: The findings indicate the urgent need for:
    - Strengthened referral systems
    - Enhanced emergency transport services
    - Better resource allocation in intensive care settings
    - Standardized management protocols for common obstetric complications
    - Improved communication between primary and tertiary care facilities
5. Preventive Strategies: Implementation of the following measures is crucial:
    - Community-based education programs about maternal danger signs
    - Enhanced antenatal surveillance for high-risk cases
    - Development of early warning systems in primary care settings
    - Strengthened emergency obstetric care facilities
    - Regular training of healthcare providers in managing obstetric emergencies
6. Quality Improvement: Continuous quality improvement initiatives should focus on:
    - Regular audit of maternal deaths
    - Implementation of evidence-based protocols
    - Enhanced documentation and monitoring systems
    - Regular staff training and skill development
    - Strengthened feedback mechanisms between various levels of care

This study underscores the complex interplay between social determinants, healthcare-seeking behavior, and clinical management in maternal mortality. While improvements in clinical care are essential, addressing the fundamental issues of delayed care-seeking through community engagement and health system strengthening remains paramount. Future interventions should adopt a comprehensive approach, targeting both community awareness and healthcare delivery systems to achieve meaningful reductions in maternal mortality.

These findings provide valuable insights for policymakers, healthcare administrators, and clinicians working to reduce maternal mortality in similar settings. The patterns identified can inform the development of targeted interventions and resource allocation strategies to improve maternal health outcomes in Bangladesh and similar developing countries.

The way forward requires a coordinated effort involving community engagement, healthcare system strengthening, and continued research to implement and evaluate intervention strategies. Only through such comprehensive approaches can we hope to achieve significant reductions in maternal mortality and progress toward global maternal health goals.

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