



Human Error in Obstetric Critical Care: A Systematic Review of Diagnostic and Therapeutic Challenges in the ICU

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Abstract

Obstetric patients represent a unique and high-risk population in the Intensive Care Unit (ICU), where clinical management must account for the complex physiological changes of pregnancy and the safety of both mother and fetus. Human error in this setting is multifactorial, often stemming from diagnostic delays, communication failures, and systemic inefficiencies. This review synthesizes current evidence on the types, causes, and prevention strategies for human error in obstetric critical care, highlighting the critical role of multidisciplinary teams and standardized protocols in reducing maternal morbidity and mortality.

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Introduction

While the admission rate of obstetric patients to the ICU is relatively low (approximately 0.5%–1.11% of deliveries), these cases carry a high risk of severe maternal morbidity and "near-miss" events. Human errors in the ICU are unavoidable due to the inherent complexity of the environment, where patients can experience up to two errors per day. In obstetrics, these errors are particularly consequential, as they often involve preventable conditions such as postpartum hemorrhage (PPH) and severe preeclampsia.

Typology of Human Error in Obstetric ICU

Recent studies categorize preventable adverse events (pAEs) into several distinct domains:

- **Therapeutic Delay:** Accounting for approximately 50.68% of pAEs, delay in peripartum therapy (e.g., late intervention for hemorrhage) remains the most common human error.
- **Diagnostic Errors:** These comprise roughly 21.92% to 36% of errors, frequently involving misinterpretation of fetal monitoring (CTG) or failure to recognize early signs of sepsis.
- **Organizational and Communication Failures:** Poor coordination between obstetricians and intensivists, lack of

bedside supervision by senior staff, and inadequate documentation contribute to nearly 29% of adverse outcomes.

- **Medication Errors:** Although less frequent (approx. 1.4%–2.3%), errors in drug dosing or administration can be fatal in the context of critical illness.

Contributing Factors and Root Causes

Human error is rarely the result of a single individual's incompetence but rather a "system failure".

- **Cognitive Bias:** Clinicians often rely on "heuristics" (mental shortcuts), which can lead to premature diagnostic closure or the underestimation of rare complications like amniotic fluid embolism.
- **Sociotechnical Dimensions:** Factors such as excessive workload, fatigue, and lack of specialized training for ICU staff in obstetric physiology increase the risk of error.
- **Structural Barriers:** Inadequate access to onsite High Dependency Units (HDU) or delayed transfer to specialized centers significantly increases mortality risk.

Impact on Maternal Mortality

Data indicate that 70% of maternal deaths occur in women who were not admitted to an ICU, suggesting that the primary human error often occurs before ICU admission—specifically, the failure to recognize the severity

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of the disease and provide timely referral. Once in the ICU, mortality is strongly associated with multi-organ dysfunction (MODS) and sepsis, where every hour of delay in appropriate treatment increases the risk of a fatal outcome.

Prevention and Mitigation Strategies

To enhance patient safety, the literature recommends a transition from a "person approach" to a "system approach":

- **Standardized Scoring Systems:** Implementing the Modified Obstetric Early Warning Score (MOEWS) has shown superior sensitivity (99.3%) in identifying critically ill women compared to traditional scores like APACHE II.
- **Multidisciplinary "Huddles":** Integrating obstetricians, intensivists, anesthesiologists, and neonatologists into a single care algorithm ensures a holistic view of the patient.
- **Communication Training:** Targeted training in communication protocols (e.g., SBAR) has been shown to significantly reduce diagnostic errors ($p < 0.002$).
- **Technological Safeguards:** Utilizing barcode medication administration and automated infusion pumps to mitigate medication errors.

Section A. The Greek Perspective – Challenges in Obstetric Critical Care

In Greece, maternal critical care is characterized by a high rate of Caesarean sections (CS), which significantly exceeds the WHO-recommended 15%, often reaching over 50–60% in private and public sectors [1,2]. This creates a specific "human error" profile:

1. **Surgical Complications:** The high volume of CS leads to an increased incidence of placenta accreta spectrum (PAS) and postoperative hemorrhage. Human error in these cases often involves the underestimation of surgical blood loss, leading to delayed transfusion protocols [2].
2. **The "Transfer" Gap:** In Greece, many secondary hospitals lack dedicated obstetric ICUs. Human error frequently occurs during the inter-hospital transport of unstable patients, where a lack of specialized equipment or trained personnel during transit leads to clinical deterioration [2].
3. **Demographic Shifts:** The increasing age of primiparous women in Greece (average ~31–33 years) has led to a rise in comorbidities like gestational diabetes and hypertension. A common error in Greek ICUs is the failure to adjust monitoring intensity for these high-risk profiles, treating them as "standard" obstetric cases [1].

Section B. Medication Errors (ME) in the Obstetric ICU

Medication errors in the obstetric ICU are particularly dangerous because they involve altered pharmacokinetics (increased volume of distribution, altered renal clearance) and the potential for teratogenicity or fetal distress.

High-Alert Medication Mismanagement

- **Magnesium Sulfate (MgSO_4):** Used for eclampsia. The most common error is toxic overdose due to incorrect

infusion pump programming or failure to monitor patellar reflexes and urine output.

- **Oxytocin:** Used for hemorrhage. Errors often involve bolus administration instead of slow infusion, which can cause severe hypotension and cardiovascular collapse in a critically ill mother.

Dosing Errors in Obesity and Edema

Obstetric ICU patients often present with significant fluid shifts. A frequent human error is dosing based on total body weight rather than "lean" or "ideal" body weight for drugs like low molecular weight heparin (LMWH) or certain antibiotics, leading to either subtherapeutic levels or toxicity.

The "Double Patient" Paradox

Errors occur when clinicians prioritize maternal stabilization (e.g., using vasopressors like norepinephrine) without accounting for the reduction in uterine blood flow. Failing to involve a neonatologist in the dosing strategy of drugs that cross the placental barrier is a documented systemic error.

Error Category	Frequency (%)	Primary Root Cause
Therapeutic Delay	50.7%	Failure to escalate care / "Wait and see" approach
Diagnostic Misinterpretation	22 - 36%	Cognitive bias and over-reliance on technology (CTG)
Medication Errors	1.5 - 5%	Calculation errors and infusion pump misuse
Greek Context: CS-related	High Variance	Increased incidence of PAS and surgical "near-misses"

Conclusion

Human error in the obstetric ICU is a significant but largely preventable threat to maternal safety. Addressing these errors requires a cultural shift toward transparent reporting without fear of retribution and the implementation of robust, standardized clinical pathways. Future research should focus on the long-term impact of simulation-based training on multidisciplinary team performance in high-stress obstetric emergencies.

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