



Eclampsia and Maternal Mortality: Challenges and Pathways to Safer Care in Low-Resource Settings

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Abstract: - Eclampsia remains a major contributor to maternal and perinatal mortality, particularly in resource-limited settings where disparities in healthcare access and quality persist. This review examines the current evidence on the pathophysiology, global burden, diagnostic challenges, and management strategies of eclampsia, with a focus on low- and middle-income countries. A narrative review methodology was employed, synthesizing findings from existing literature and clinical reports.

The findings highlight significant barriers to effective management, including limited diagnostic infrastructure, inconsistent availability and use of magnesium sulfate, delayed patient presentation, and severe healthcare workforce shortages. These systemic challenges contribute to high case fatality rates and poor maternal outcomes. Additionally, sociocultural factors, inadequate health literacy, and weak health systems further exacerbate delays in diagnosis and treatment.

The study emphasizes the need for context-specific interventions, including community-based surveillance, task-sharing, mHealth innovations, and the implementation of standardized care protocols. Strengthening healthcare systems and improving access to timely, evidence-based interventions are critical to reducing preventable deaths associated with eclampsia in resource-constrained environments.

Keywords: Eclampsia; Preeclampsia; Maternal mortality; Resource-limited settings; Magnesium sulfate; Healthcare systems; Diagnostic barriers; Task-shifting; mHealth; Obstetric care.



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1.0. INTRODUCTION TO ECLAMPSIA

Eclampsia, defined by new-onset tonic-clonic seizures in a patient with preeclampsia, remains a primary driver of maternal and perinatal mortality, accounting for approximately 42,000 global deaths annually. This burden is highly inequitable, with maternal mortality ratios in low-resource settings being significantly higher than those in high-income regions. This reflects a wide disparity in access to standardized, high-quality obstetric care¹⁻³. Limited diagnostic infrastructure for early detection of preeclampsia and delays in life-saving treatments, such as magnesium sulfate, significantly worsen outcomes^{3,4}. Consequently, addressing eclampsia in these environments requires shifting focus from mere drug availability to ensuring effective, context-specific care that significantly reduces preventable mortality.

This review synthesizes the current evidence on the pathophysiology, diagnostic challenges, and therapeutic interventions, while highlighting the urgent need for standardized protocols in regions where socioeconomic barriers impact clinical outcomes. Beyond these structural deficits, the pathophysiology of the condition involves complex systemic endothelial dysfunction and angiogenic imbalance, which frequently culminate in multi-organ failure if not mitigated by timely and appropriate medical interventions⁵. Although magnesium sulfate serves as the gold standard for seizure prophylaxis, its effective administration is frequently hindered by logistical challenges and the lack of adequate training in resource-limited clinical environments^{6,7}. Recent investigations suggest that simplified, single-loading dose regimens of magnesium sulfate may provide a viable alternative to complex maintenance protocols in settings where continuous monitoring is unattainable⁸. Furthermore, expanding the use of validated, low-cost diagnostic technologies for early hypertensive screening at the community level is critical to shifting the focus from reactive emergency management to proactive, population-based prevention^{9,10}.

2.0.METHODS

This article is a narrative review of the current evidence on the management of eclampsia in resource-limited settings. The review synthesizes data from peer-reviewed studies, clinical guidelines, systematic reviews, and relevant grey literature to provide comprehensive understanding of existing knowledge, gaps, and future directives. The search was carried out across multiple electronic databases including PubMed/MEDLINE, Embase, CINAHL, Cochrane Library, Web of Science, Scopus, Google Scholar and African Journals Online (AJOL). Search strategies combined Medical Subject Headings (MeSH) and free-text terms related to eclampsia, its, management and resource-poor settings. The following search string was adopted for

each database: (“eclampsia” OR “preeclampsia” OR “hypertensive disorders of pregnancy”) AND (management OR treatment OR care OR prophylaxis) AND (“resource-limited settings” OR “low-resource settings” OR “low-income countries” OR Africa OR “developing countries”). Filters were applied to include human studies and studies in English language. Given the heterogeneity of the study, a narrative synthesis approach was used. Findings were grouped thematically under key domains: pathophysiology, diagnosis, seizure prophylaxis, acute management, blood pressure control, obstetric management, and future directives. Evidence was interpreted in the context of feasibility, effectiveness, and applicability in resource-limited settings.

3.0.CLINICAL PATHOPHYSIOLOGY

The progression from preeclampsia to eclamptic seizures is fundamentally driven by severe placental ischemia and subsequent systemic maternal inflammation, which compromise the blood-brain barrier and eventually lead to cerebral edema¹¹. These neurological disturbances appear to correlate with hemodynamic shifts similar to hypertensive encephalopathy, characterized by the systemic downregulation of vasodilatory mechanisms and a concomitant elevation in pro-inflammatory cytokines such as TNF- α and IL-6¹². These lead to localized intracranial vasoconstriction and subsequent reperfusion injury, further heightening the risk of irreversible neurological deficits or permanent cognitive impairment¹³.

The clinical manifestations of eclampsia, including persistent frontal headaches, visual disturbances, and epigastric pain, serve as distinct overt markers of the underlying cerebral and systemic compromise occurring prior to seizure onset⁷. Such symptoms are not merely incidental but reflect a critical escalation in end-organ damage, where the progressive failure of cerebral autoregulation and persistent systemic inflammation manifest as clear neurological and visceral precursors to the terminal event of convulsive eclampsia¹².

Despite the recognition of these premonitory signs, clinicians often struggle with diagnosis in atypical cases where seizures occur without pre-existing hypertension or manifest beyond the immediate postpartum window¹⁴⁻¹⁸.

4.0. GLOBAL DISEASE BURDEN

The global disease burden of eclampsia is characterized by a huge geographic divide, with the vast majority of morbidity and mortality concentrated in resource-poor settings. While the global prevalence of eclampsia is estimated to be between 0.3% and 0.43% of all pregnancies, these aggregate figures obscure extreme disparities in clinical outcomes and healthcare access^{4,19}.

4.1. Disparities in Prevalence and Incidence

In developed nations, the incidence of eclampsia has declined dramatically over the last several decades, now occurring in fewer than 0.2% of deliveries^{7,20}. For example, the United Kingdom reports an incidence as low as 2.7 per 10,000 deliveries²⁰. In contrast, the World Health Organization estimates that the incidence in developing nations is approximately 2.8% per live delivery—many times higher than in high-income countries²¹. In specific low-resource regions, the numbers are even more alarming; Sierra Leone has reported an incidence of 142 per 10,000 deliveries, representing a 50-fold disparity compared to the UK²⁰.

4.2. Nigeria: A High-Burden Landscape

Within the context of low- and middle-income countries, Nigeria faces one of the most significant burdens of eclampsia globally. The prevalence of pre-eclampsia and eclampsia (PE/E) in Nigeria is estimated to range from 2% to as high as 16.7%, though significant internal regional variations exist²²:

- **Southern Nigeria:** Prevalence rates have been recorded as low as 0.44% in Enugu and 1.66% in Lagos²¹.

- **Northern Nigeria:** Some studies have reported prevalence rates reaching 9.42%²³.

Currently, PE/E has overtaken other complications to become the leading direct cause of maternal mortality in Nigerian health facilities, accounting for approximately 28.3% of all maternal deaths^{24,25}.

4.3. Case Fatality and Mortality Disparities

The most critical disparity lies in the case fatality rate (CFR). In high-income countries like Sweden, the CFR for eclampsia ranges from 0% to 1.8%, with some periods recording zero deaths due to robust surveillance and immediate intervention³.

In contrast, the CFR in Nigeria and other sub-Saharan African nations frequently exceeds 10%²³. Institutional data from Benin, Nigeria, recorded a CFR of 15% and a perinatal mortality rate of 195 per 1,000 births²⁶. In some severe cases within Northern Nigeria, maternal fatality rates from eclampsia have been reported as high as 42%²¹. Globally, nearly 94% of all maternal deaths occur in low-resource settings, with Sub-Saharan Africa and Southern Asia alone accounting for 86% of the global maternal death toll^{27,28}.

Summary of Disparities between Regions

Metric	Developed Countries	Nigeria & Other LMICs
Incidence	< 0.2% (< 2.7 per 10k in UK) ^{7,20}	~2.8% (up to 14.2% in Sierra Leone) ^{20,21}
Case Fatality Rate	0% – 1.8% ³	> 10% (up to 42% in parts of Nigeria) ^{21,23}
Primary Risk Groups	General obstetric population	Adolescents, low education, first pregnancy ^{4,20}
Outcome Driver	Early detection & prophylaxis	Delayed presentation & resource scarcity ^{21,29}

5.0. DIAGNOSTIC BARRIERS

In resource-limited settings, the ability to manage eclampsia effectively is fundamentally undermined by significant diagnostic barriers. These barriers prevent the timely identification of preeclampsia before it progresses to life-threatening seizures and continue to hinder clinical decision-making during acute emergencies.

5.1. Limited Diagnostic Infrastructure

The lack of basic medical hardware and laboratory capacity is a primary obstacle to accurate diagnosis and severity assessment.

- **Essential Monitoring Tools:** Many primary and even tertiary facilities lack validated, semi-automated blood pressure devices, which are essential for the accurate detection of hypertensive disorders of pregnancy^{9,30}. Inaccurate readings from manual sphygmomanometers can lead to the

underdiagnosis of severe hypertension (systolic BP ≥ 160 mmHg or diastolic BP ≥ 110 mmHg)³⁰.

- **Screening Deficiencies:** Reliable proteinuria screening, a cornerstone of preeclampsia diagnosis, is frequently unavailable due to a lack of reagent strips or poor storage conditions that compromise their efficacy^{9,30}.
- **Laboratory Constraints:** Comprehensive management of eclampsia requires monitoring of organ function. Some of the laboratory tests required for this includes full blood count, serum electrolytes and creatinine levels, coagulation profile, liver enzymes, etc. However, many laboratories in low-resource regions suffer from frequent stockouts of necessary reagents and power instability, leading to significant delays in results that are needed to decide on "definitive delivery"^{9,29}

5.2. Patient and Provider Factors

- **Health Literacy and Awareness:** Diagnostic delays are often exacerbated by a lack of community awareness regarding warning signs such as severe headaches, visual disturbances, or epigastric pain²⁹. Many patients do not seek care until after a seizure, as they do not perceive the earlier, more subtle symptoms as life-threatening.
- **Staffing and Time Pressures:** Extreme patient-to-provider ratios—sometimes reaching three midwives for 50 beds—leave almost no time for the thorough clinical assessments needed to detect early signs of preeclampsia^{29,31}. Vital signs are often not monitored on schedule, meaning that sudden spikes in blood pressure may go unnoticed until the patient experiences a fit³¹.

5.3. Early Detection Challenges

Preeclampsia is frequently asymptomatic in its early stages, yet the lack of point-of-care diagnostic tests means that cases are often only identified once clinical symptoms become severe⁹. In addition to this, three critical stages of delay have been identified to further deter early detection and timely management of preeclampsia and eclampsia in resource limited settings: the delay in deciding to seek care, the delay in reaching a suitable health facility, and the delay in receiving appropriate medical treatment. Sociocultural factors, illiteracy and poverty are some factors that may negatively affect their decision to seek care. Patient-led transportation, bad road, cost of transportation and physical remoteness of the rural communities are some of the factors that may constitute delay in reaching a suitable health facility. Consequently, these sequential delays fundamentally undermine early diagnostic efforts, frequently resulting in patients arriving at the secondary level only after experiencing multi-organ compromise^{32,33}.

Furthermore, the absence of routine laboratory tests to monitor kidney and liver function in most facilities in resource-poor countries limits the ability of clinicians to accurately assess a patient's risk, often masking the severity of complications until the damage becomes permanent²⁹. Atypical presentations of the condition, such as cases without proteinuria or hypertensive spikes, further complicate early identification, necessitating a broader clinical index of suspicion beyond classic diagnostic criteria³⁴. In addition, these patients may first be seen at presentation by low cadre health care personnels who may lack the specialized training required to interpret subtle warning signs, thereby missing the critical window for preemptive intervention before clinical deterioration occurs³⁵.

Innovative risk stratification tools, such as the miniPIERS model, could mitigate these outcomes by enabling clinicians to predict adverse maternal events within 48 hours of initial assessment, thereby facilitating timely triage and targeted

medical intervention³⁶. However, these tools remain largely inaccessible in most of these low-resource settings due to the absence of integrated digital health infrastructure and the high cost of implementation³⁷. Beyond clinical barriers, the integration of such technology is further hindered by community misconceptions—such as attributing seizures to supernatural causes—which discourage women from seeking formal antenatal care even when diagnostic services are technically available. These cultural challenges, stemming from traditional beliefs about the causes of eclampsia, often interact with a widespread distrust of formal health systems, frequently leading patients to choose informal or traditional care rather than professional medical intervention. Also, the uptake of life-saving research evidence in clinical practice is significantly reduced by the persistent stigma surrounding facility-based care, compounded by poor perceptions of provider quality^{38,39}. As a result of untimely detection and treatment of preeclampsia with severe features and eclampsia, adverse maternal and neonatal outcomes remain disproportionately high.

6.0. CURRENT MANAGEMENT STRATEGIES

In low-resource settings, the management of eclampsia is characterized by a reliance on established pharmacological interventions that are frequently compromised by systemic deficiencies, lack of standardization, and resource scarcity.

6.1. Magnesium Sulfate ($MgSO_4$) Utilization and Limitations

Magnesium sulfate remains the "sole agent of choice" for the prevention and treatment of eclamptic seizures due to its cost-effectiveness and proven efficacy⁹. However, its implementation in low-resource settings faces significant hurdles:

- **Availability Gaps:** Although $MgSO_4$ is included in approximately 84.6% of Essential Medicine Lists in low- and middle-income countries, actual availability at the facility level is inconsistent, with notably lower prevalence in African regions compared to others³⁰.
- **Dosing Inconsistencies:** There is a huge lack of standardization in clinical practice. A systematic review identified 39 different $MgSO_4$ dosing regimens across LMICs, which can lead to provider confusion and either sub-therapeutic dosing or increased risk of magnesium toxicity in settings where monitoring (such as patellar reflex checks or serum magnesium levels) is limited³⁰. Some of these dosage regimens include the Pritchard, Zuspan, and Sibai protocols. However, the lack of standardized protocols often leads to inappropriate administration that jeopardizes patient safety⁴⁰. The regimen recommended in Nigeria by SOGON is the Pritchard regimen⁴¹. This recommendation was due to ease of administration and non-

requirement of infusion pumps which are unavailable in most resource-limited settings, as well as its favorable safety profile in settings where frequent monitoring of serum magnesium levels or deep tendon reflexes is difficult to sustain. Although these protocols are widely supported, yet persistent implementation gaps across rural health facilities frequently result in deviations from these established guidelines. Also, their practical application is frequently limited by inconsistent drug supplies, infrequent use by primary care providers, and insufficient ongoing training for front-line healthcare staff ^{23,42,43}.

- **Underutilization:** Despite its status as the gold standard, there is frequent underuse of $MgSO_4$ for severe preeclampsia, often due to a lack of provider confidence or institutional protocols ³⁰. Other medications used in some facilities in the rural settings include diazepam, phenytoin, or lytic cocktails, despite evidence indicating these are inferior to magnesium sulfate and should be withdrawn from clinical practice ⁴⁴.

6.2. Antihypertensive Therapy Challenges

Management of severe hypertension (systolic BP ≥ 160 mmHg or diastolic BP ≥ 110 mmHg) typically involves oral or intravenous agents like nifedipine, labetalol, or methyldopa ⁹.

- **Suboptimal Targets:** Current evidence suggests that treating non-severe hypertension to a target diastolic BP of 85 mmHg can improve outcomes, yet many low-resource facilities only initiate

treatment at much higher thresholds, missing the window to prevent progression to eclampsia ⁹.

- **Drug Availability:** While antihypertensives are generally more accessible than $MgSO_4$, many facilities face stockouts of fast-acting intravenous agents required for hypertensive emergencies, forcing a reliance on oral nifedipine which may have variable absorption in acute crises ^{29,30}.

6.3. Procedural and Diagnostic Inadequacies

- **The "Delivery as Cure" Fallacy:** While timely delivery of the placenta is the definitive treatment to initiate the resolution of preeclampsia, it is often wrongly equated with a complete "cure" ⁹. In reality, many women experience significant postpartum deterioration, yet post-delivery monitoring is often the weakest link in resource-limited settings due to inadequate staffing ^{9,29}.
- **Diagnostic Delays:** Management is frequently delayed by the non-recognition of different hypertensive disorders of pregnancy and a scarcity of basic diagnostic tools like validated semi-automated blood pressure devices or reliable proteinuria screening ^{9,30}.
- **Systemic Burden:** These management inadequacies have led to a shift in maternal mortality profiles; in some major tertiary hospitals in regions like Ghana, hypertensive disorders of pregnancy have now overtaken hemorrhage as the leading cause of maternal death ²⁹.

Summary of Management Gaps

Strategy	Implementation Inadequacy	Consequence
Seizure Control	39 different dosing regimens for $MgSO_4$ ³⁰	Increased risk of toxicity or treatment failure.
BP Control	Delayed initiation of antihypertensives ⁹	Progression from preeclampsia to eclamptic seizures.
Definitive Care	Focus on delivery without postpartum follow-up ⁹	High rates of postpartum eclampsia and maternal death.
Health Literacy	Low patient awareness and poor ANC attendance ²⁹	Patients present late with advanced eclampsia.

7.0. INADEQUATE STAFFING LEVELS

In low-resource settings, inadequate staffing is a primary barrier to effective eclampsia management, often resulting in a severe mismatch between patient needs and available healthcare personnel. This shortage manifests in several critical ways that directly impact maternal outcomes:

7.1. Critical Patient-to-Provider Mismatch

The disparity between the number of patients and the available staff frequently leads to suboptimal care. In many tertiary facilities in low-resource regions, it is common to find as few as three midwives responsible for a ward of 50

beds, or a single healthcare worker managing close to 30 patients ^{29,31}. This extreme ratio makes it nearly impossible to provide the intensive, one-on-one monitoring required for a patient experiencing eclamptic seizures or severe preeclampsia ²⁹.

7.2. Failure in Vital Sign Monitoring and Medication Timing

Eclampsia management requires timely intervention to prevent further seizures and control blood pressure. Staffing shortages lead to specific clinical failures:

- **Delayed Monitoring:** Vital signs, particularly blood pressure, are often not checked on schedule

because the limited staff are overwhelmed by the patient load³¹.

- **Medication Delays:** The administration of life-saving drugs like magnesium sulfate (MgSO_4) or antihypertensives is frequently delayed. In busy wards, the time taken to move from one patient to the next means that those in hypertensive crisis may not receive their medication in the critical window needed to prevent complications³¹.

7.3. Informal Task-Shifting and Scope of Practice

Due to a lack of specialists or experienced obstetric teams, junior staff or less-qualified healthcare workers are often forced to "exceed their scope of practice" to fill gaps⁴⁵. While this "informal task-shifting" is a necessary coping mechanism, it increases the risk of clinical errors and places an immense psychological burden on the providers, who fear blame in the event of a poor maternal or neonatal outcome⁴⁵.

7.4. Erosion of Patient Counseling and Education

The high volume of patients relative to doctors leaves almost no time for patient counseling²⁹. Clinicians often lack the time to explain the severity of eclampsia or its warning signs to patients and their families, which is essential for ensuring adherence to treatment and follow-up care. This lack of communication can exacerbate the psychosocial distress already faced by women in these high-risk situations²⁹.

7.5. Staff Burnout and Quality of Care

The chronic understaffing creates a "very stressful" environment for nurses and midwives, leading to professional burnout and a decrease in the overall technical quality of emergency obstetric care^{29,46}. When providers are exhausted, the likelihood of missing early warning signs of physiological deterioration—such as changing patellar reflexes or respiratory rates during MgSO_4 therapy—increases significantly, directly compromising patient safety.

8.0. FUTURE DIRECTIVES

Future directives for the management of eclampsia in resource-limited settings prioritize a shift toward decentralized care, technological integration, and standardized clinical "bundles" to bridge the gap between evidence and practice.

8.1. Community-Based Surveillance and Task-Sharing

A primary future directive is the decentralization of eclampsia prevention and treatment to the community level.

- **The CLIP Model:** Ongoing research, such as the Community Level Interventions for Pre-eclampsia trials, emphasizes reducing adverse outcomes through community engagement and task-sharing with community health providers⁴⁷.

- **Primary Health Care Integration:** Future strategies advocate for using preeclampsia/eclampsia (PE/E) as an entry point to improve the quality of the entire pregnancy continuum. Bringing treatment nearer to where women live at the PHC level allows for earlier identification and timely delivery⁴⁸.

8.2. mHealth and Telehealth Interventions

To address the lack of specialist access, innovative care delivery modalities must be expanded:

- **Remote Monitoring:** Implementing home blood pressure monitoring and telehealth interventions empowers women to participate in their own health surveillance²⁹.
- **Mobile Technology:** The use of mobile technology supports community health workers in decision-making and ensures that high-risk cases are identified and referred before they progress to eclamptic seizures⁴⁷.

8.3. Optimized Facility Flow

At the hospital level, future directives focus on modifying existing workflows to reduce delays in life-saving care:

- **Dedicated Personnel:** Improving efficiency by using dedicated health personnel to process laboratory samples, rather than relying on the patient's relatives, can significantly speed up the diagnosis of severe complications²⁹.

8.4. Implementation of "Management Bundles"

There is an immediate need to generate and disseminate evidence-based "bundles" of care that are tailored to the local context³⁰.

- **Standardized Guidelines:** Policy should focus on building management guides adjusted to the availability of local medicines and community perceptions³⁰.
- **Clinical Workshops:** Disseminating simplified management guidelines through workshops for all levels of providers, including midwives and non-obstetric doctors, ensures a consistent standard of care even in primary facilities²⁹.

8.5. Co-Designed "Policy Labs"

To expedite the transition from research to impact, future directives recommend the use of "Policy Labs."

- **Stakeholder Engagement:** These labs bring together diverse local stakeholders—such as female team members and healthcare providers—to co-design strategies that address specific local barriers, such as a lack of awareness or hurdles to offering planned early delivery⁴⁹.

8.6. Strengthening Health Systems

- **Workforce Training:** While systemic policies to increase the number of healthcare providers are a

long-term goal, a more immediate directive is the better training of existing providers in primary facilities to improve clinical outcomes²⁹.

- **Essential Resource Access:** Policy frameworks must prioritize the availability of essential pharmacological and technological resources, such as magnesium sulfate and validated blood pressure devices, as clinical guidelines alone are insufficient without the tools to implement them³⁰.

9.0. CONCLUSION

The management of eclampsia in resource-limited settings remains a critical public health challenge, as the condition continues to be a leading cause of preventable maternal mortality⁹. This article has highlighted that while the clinical "gold standard" interventions—specifically magnesium sulfate and rapid-acting antihypertensives—are well-established, their effective delivery is consistently undermined by systemic deficiencies^{9,30}. The transition from severe preeclampsia to eclamptic seizures is often a direct consequence of diagnostic delays, inconsistent medication availability, and the use of non-standardized dosing regimens that vary widely across regions^{29,30}.

Furthermore, the human resource crisis in these settings serves as a profound bottleneck to quality care. With staffing ratios sometimes as low as three midwives for fifty beds, the intensive monitoring required to prevent magnesium toxicity and stabilize hypertensive crises is frequently compromised^{29,31}. These staffing shortages not only lead to delays in time-sensitive medication administration but also contribute to provider burnout and a degradation of patient counseling, which is essential for ensuring follow-up care and recognizing postpartum deterioration^{9,31,46}.

Moving forward, future directives must prioritize the decentralization of care through community-based surveillance and task-sharing models that empower primary healthcare workers^{47,48}. The integration of mHealth technologies and the implementation of standardized "management bundles" offer a path toward reducing clinical errors and bridging the gap between evidence and practice^{30,47}. By adopting innovative frameworks like co-designed "policy labs" to address local barriers, health systems in resource-limited settings can move beyond the "delivery as cure" fallacy and provide the continuous, high-quality monitoring necessary to safeguard maternal health^{9,29,49}. Ultimately, addressing eclampsia in these regions requires more than just clinical tools; it demands a robust investment in infrastructure, workforce training, and a fundamental shift toward evidence-based, equitable maternal healthcare systems.

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