

The Global Impact of Preeclampsia on Maternal Mortality: A Comparative Analysis of Healthcare Accessibility and Outcomes in Low and Middle-Income Countries Comparing High-Income Countries

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Abstract

Background: Preeclampsia is a leading cause of maternal mortality, particularly in low- and middle-income countries (LMICs) where access to healthcare services is limited. Despite significant advancements in prenatal care in high-income countries, preeclampsia continues to challenge healthcare systems globally, especially in regions with limited resources.

Methodology: This analytical study examined recent literature and epidemiological data to assess the incidence, prevalence, and impact of preeclampsia on maternal mortality. Data were collected from studies spanning high- and low-income regions to identify risk factors, complications, and regional disparities in healthcare access.

Results: Preeclampsia affects approximately 3-10% of all pregnancies worldwide, with higher rates observed in LMICs. Advanced maternal age, obesity, hypertension, and diabetes are significant risk factors, exacerbated by socioeconomic constraints in resource-poor settings. Preeclampsia accounts for 10-15% of maternal deaths, with LMICs experiencing higher mortality due to limited emergency obstetric care and delayed treatment. Preventive strategies

such as routine screenings and early interventions have reduced complications and improved maternal outcomes in high-income settings but remain underutilized in LMICs.

Conclusion: The findings emphasize the urgent need for expanded prenatal care accessibility, targeted training for healthcare providers, and community-based preventive strategies in LMICs. Addressing healthcare inequalities and implementing early detection programs are critical steps toward reducing preeclampsia-related maternal mortality globally.

Keywords: Preeclampsia, Maternal Mortality, Healthcare Accessibility, Low- and Middle-Income Countries (LMICs), Risk Factors, Preventive Strategies.

Introduction

Maternal mortality remains a significant global health challenge, with approximately 295,000 women dying annually from complications during pregnancy or childbirth, despite advancements in maternal healthcare over recent decades [1]. Among these complications, preeclampsia—a hypertensive disorder occurring after 20 weeks of gestation—is a leading contributor to maternal mortality, especially in low- and middle-income countries (LMICs) where healthcare infrastructure may be limited [2, 3]. Preeclampsia is characterized by elevated blood pressure and proteinuria, and if left unmanaged, it can lead to severe complications such as eclampsia [4].

Studies indicate that preeclampsia contributes to 10-15% of maternal deaths globally, with a disproportionate impact in regions lacking access to prenatal and emergency obstetric care [5]. In LMICs, limited healthcare resources hinder regular screenings and monitoring, making it difficult to identify and manage high-risk pregnancies effectively [6]. For instance, countries in Sub-Saharan Africa and South Asia report the highest maternal mortality rates due to preeclampsia, largely attributed to healthcare access barriers and socioeconomic inequalities [7, 8].

Known risk factors for preeclampsia include advanced maternal age, obesity, pre-existing hypertension, and socioeconomic challenges, which collectively create a complex network of interrelated health and social issues [9, 10]. For example, women over the age of 35 and those with high body mass indices (BMIs) face an increased risk of developing preeclampsia, particularly in low-resource settings where lifestyle and healthcare access barriers are prevalent [11]. Furthermore, a pregnant individual's socioeconomic status often dictates their access to prenatal care, with those in lower-income brackets facing greater

health risks due to fewer resources and a lack of routine monitoring [12].

This commentary article explores preeclampsia's role in maternal mortality by examining its incidence, associated risk factors, and disparities in healthcare access that contribute to adverse maternal outcomes. Through a review and synthesis of recent literature, this study underscores the need for targeted policies and interventions prioritizing maternal health, especially in underserved regions. Addressing preeclampsia within maternal healthcare systems via comprehensive screening, monitoring, and emergency care protocols could significantly reduce maternal mortality rates and improve health outcomes for mothers worldwide.

Methodology

Study Design

This commentary is based on a systematic literature review focusing on quantitative and qualitative studies examining the relationship between preeclampsia and maternal mortality. Studies from 2000 to 2023 were reviewed to ensure comprehensive coverage of recent trends, risk factors, and clinical outcomes associated with preeclampsia.

Data Sources and Inclusion Criteria

The primary databases used for this review were PubMed, Web of Science, and Scopus. Articles were selected based on specific inclusion criteria, including a sample size greater than 100, direct measures linking preeclampsia to maternal mortality, and relevance to public health or clinical practice. Only English-language, peer-reviewed articles were included to maintain quality and relevance. The main search terms included “preeclampsia,” “maternal mortality,” “hypertension in pregnancy,” and “maternal health outcomes”.

Statistical Analysis

To assess the relationship between preeclampsia and maternal mortality, statistical methods such as meta-analysis and regression modeling were applied. These analyses provided a quantitative evaluation of the association between preeclampsia and maternal deaths, allowing for the identification of significant correlations and trends. Key variables such as maternal age, parity, socioeconomic status, and pre-existing health conditions were considered. The relative risk (RR) and odds ratio (OR) calculations were used to quantify the impact of preeclampsia on maternal mortality [13, 14].

Risk Factor Analysis

Additionally, an analysis of demographic factors contributing to preeclampsia incidence was conducted, with a focus on variables such as advanced maternal age, obesity, and socioeconomic factors. Research indicates that women aged over 35 and those with high body mass indices (BMIs) are particularly susceptible to preeclampsia, especially in lower-income settings where access to healthcare is limited [15, 16]. This stratified approach facilitated a nuanced understanding of risk factors that are commonly associated with adverse maternal outcomes in preeclampsia cases.

Results

Incidence and Prevalence of Preeclampsia

Preeclampsia is a widespread hypertensive disorder affecting 3-10% of pregnancies globally, with rates varying depending on regional healthcare quality, socioeconomic factors, and population demographics [17]. In high-income countries, the incidence is estimated to be around 3-5%, largely due to better prenatal monitoring and healthcare access. However, low- and middle-income countries (LMICs) report higher rates, ranging from 7-10%, with some rural regions experiencing incidences as high as 12% [18]. Sub-Saharan Africa and South Asia, where prenatal care infrastructure is

underdeveloped, report an incidence of 8-10%, contributing to a higher maternal mortality rate in these areas. Studies show that in these regions, delayed or infrequent prenatal visits, lack of routine blood pressure monitoring, and limited healthcare resources are the primary factors driving increased incidence and prevalence rates of preeclampsia [19]. In countries with low prenatal care accessibility, only 40-60% of pregnant women undergo routine screenings, leaving high-risk cases undetected until severe complications arise (Table 1) [17, 19].

Table 1: Incidence and Prevalence of Preeclampsia

Region/Country Type	Incidence of Preeclampsia (%)	Factors Contributing to Variability
High-Income Countries	3-5%	Better prenatal monitoring, access to healthcare
Low- and Middle-Income Countries (LMICs)	7-10% (up to 12% in rural areas)	Underdeveloped healthcare infrastructure, limited resources
Sub-Saharan Africa	8-10%	Delayed prenatal visits, lack of routine monitoring
South Asia	8-10%	Similar healthcare challenges as Sub-Saharan Africa
General Global Average	3-10%	Varies by region, healthcare quality, and socioeconomic factors

Risk Factors Associated with Preeclampsia

Demographic and health-related risk factors significantly increase the likelihood of developing preeclampsia. Advanced maternal age is a leading risk factor, with women over 35 experiencing a 2-3 times greater risk than younger pregnant women, particularly in LMICs where advanced maternal age often correlates with additional socio-

economic and healthcare access barriers [20]. Obesity further exacerbates this risk, with a BMI over 30 doubling the likelihood of preeclampsia, especially as obesity rates in LMICs are increasing due to lifestyle changes. A recent review found that up to 20% of pregnant women in LMICs are obese, compounding preeclampsia risks [21]. Additionally, pre-existing hypertension and diabetes increase the risk by 50-80%, with diabetic patients having a particularly high incidence of preeclampsia-related complications. Socioeconomic status also plays a critical role in preeclampsia risk; women from low-income households are less likely to receive timely prenatal care and are 1.5 times more likely to develop preeclampsia-related complications due to limited healthcare access and infrequent monitoring (Table 2) [22].

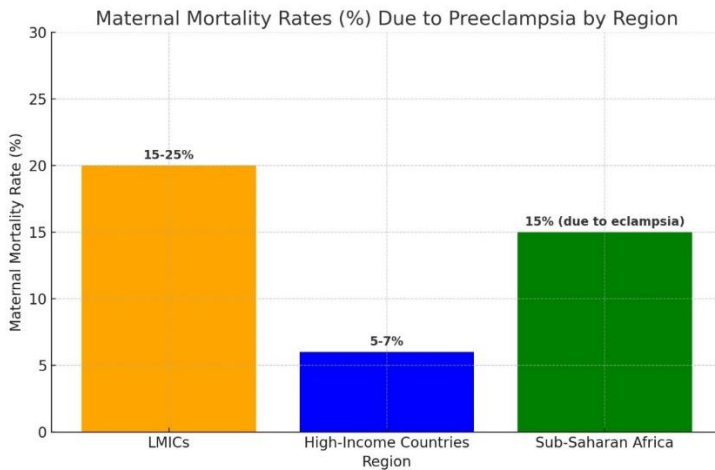
Table 2: Risk Factors Associated with Preeclampsia

Risk Factor	Description	Increased Risk (%)
Advanced Maternal Age	Women over 35 years old experience a significantly higher risk, especially in LMICs.	200-300% (2-3 times greater)
Obesity	A BMI over 30 doubles the likelihood of developing preeclampsia; 20% of pregnant women in LMICs are obese.	100% (doubles risk)
Pre-existing Hypertension	Women with hypertension have a substantially increased risk of preeclampsia.	50-80%
Pre-existing Diabetes	Diabetic patients face a particularly high incidence of complications related to preeclampsia.	50-80%
Low Socioeconomic Status	Women from low-income households are less likely to receive timely care and monitoring.	50% (1.5 times greater risk)

Maternal Mortality Rates Related to Preeclampsia

Preeclampsia contributes to approximately 10-15% of maternal deaths worldwide, but this percentage varies significantly by region [23]. In LMICs, maternal mortality rates attributed to preeclampsia are disproportionately high, ranging from 15% to 25%, due to limited emergency obstetric services and delays in intervention. In contrast, high-income countries report a maternal mortality rate from preeclampsia at 5-7%, attributed to more robust healthcare infrastructure and timely access to care [24]. In regions with poor healthcare resources, severe complications like eclampsia and HELLP syndrome (hemolysis elevated liver enzymes and low platelet count) frequently lead to maternal deaths. Approximately 25% of preeclamptic cases in Sub-Saharan Africa progress to eclampsia due to inadequate monitoring, and eclampsia accounts for around 15% of maternal deaths in this region [23]. HELLP syndrome, which occurs in up to 20% of severe preeclampsia cases, is associated with a maternal mortality rate of up to 30% in settings with insufficient emergency care services (Chart 1) [24].

Chart 1: Maternal Mortality Rates Related to Preeclampsia



Complications and Outcomes of Preeclampsia

Preeclampsia is associated with multiple severe complications for both mother and fetus. Eclampsia, a severe progression of preeclampsia marked by seizures, accounts for up to 50% of preeclampsia-related maternal deaths in LMICs where access to emergency care is restricted [25]. Preeclampsia is also a leading cause of preterm delivery, occurring in 15-20% of cases, which can lead to additional health complications for both mother and child. Preterm births due to preeclampsia are significantly higher in low-resource settings, where neonates often lack adequate support for early-life care. Women with preeclampsia are also at a 2-3 times higher risk of undergoing cesarean sections due to complications during delivery [26]. Prolonged hospitalization, extended recovery times, and increased healthcare costs are common, and studies indicate that women who experience preeclampsia have a 40% higher risk of developing long-term health issues, such as cardiovascular disease and chronic hypertension. In regions with limited healthcare infrastructure, these long-term effects place additional strains on already resource-limited healthcare systems (Table 3) [26].

Table 3: Complications and Outcomes of Preeclampsia

Complication/Outcome	Description/Impact	Associated Rate/Percentage
Eclampsia	Severe progression of preeclampsia marked by seizures, contributing to maternal deaths.	Up to 50% of maternal deaths in LMICs
Preterm Delivery	Leading cause of preterm delivery, leading to additional health complications for mother and child.	Occurs in 15-20% of cases

Cesarean Sections	Increased risk of cesarean delivery due to complications.	2-3 times higher risk
Prolonged Hospitalization	Extended stay in healthcare facilities due to complications.	Common occurrence
Long-term Health Issues	Increased risk of chronic conditions post-preeclampsia, such as cardiovascular disease.	40% higher risk
Healthcare Costs	Increased costs associated with prolonged care and complications.	Significant impact on healthcare systems

Discussion

Interpretation of Findings

The findings highlight the critical role that preeclampsia plays in maternal mortality, particularly within low- and middle-income countries (LMICs) where healthcare access is often limited. The higher prevalence rates and maternal mortality due to preeclampsia in LMICs emphasize the substantial healthcare disparities that exist between these regions and high-income countries. In countries with developed healthcare systems, routine prenatal screenings, early diagnosis, and timely interventions have been effective in managing preeclampsia, significantly lowering maternal mortality rates. In contrast, in LMICs, the lack of infrastructure, healthcare professionals, and emergency services often leads to delays in diagnosis and treatment, increasing the risk of severe complications, such as eclampsia and HELLP syndrome, which are preventable with timely intervention [27]. These findings underscore the urgent need for improved healthcare resources and preventive measures to address the high prevalence of preeclampsia in LMICs, especially given the increase in risk factors such as maternal age and obesity within these regions.

Healthcare Policy and Practice Implications

Effective healthcare policy and practice reforms targeting preeclampsia could substantially reduce maternal mortality rates. Expanding access to prenatal care in rural and underserved areas is essential, as early detection and routine monitoring of preeclampsia significantly reduce risks for mothers and infants. Establishing standardized care protocols for high-risk pregnancies in both urban and rural health facilities could streamline care delivery and reduce treatment delays. Additionally, training healthcare professionals to recognize early signs of preeclampsia and manage it promptly is crucial. Studies suggest that community education programs promoting the importance of regular prenatal visits and blood pressure monitoring may lead to earlier diagnoses and improved outcomes. Evidence from intervention studies in LMICs shows that increasing community awareness of preeclampsia symptoms and encouraging pregnant women to seek medical assistance early can result in better detection rates, fewer emergency cases, and reduced maternal mortality [28]. Policy initiatives should also consider integrating affordable diagnostic tools, such as blood pressure monitors, into community health programs, especially in remote areas where access to clinics may be limited.

Preventive Strategies for High-Risk Populations

Implementing preventive strategies in high-prevalence areas is vital for mitigating the complications associated with preeclampsia. For high-risk populations, consistent blood pressure monitoring, lifestyle modifications (e.g., dietary changes, regular exercise), and medical interventions can reduce the likelihood of severe complications. Establishing local emergency obstetric services is equally crucial, particularly in rural areas where timely medical intervention is limited. For instance, training traditional birth attendants to recognize early

signs of preeclampsia has shown positive results in reducing severe cases and mortality in LMICs. Evidence indicates that when these attendants are equipped to refer patients to health centers promptly, maternal outcomes improve significantly [29]. Comprehensive public health initiatives that focus on training community health workers in high-prevalence regions could further strengthen the local healthcare response. These initiatives should also prioritize establishing mobile health clinics and transportation services to address geographical barriers to care. In addition, promoting preventive healthcare behaviors, such as weight management and hypertension control before and during pregnancy, could help reduce preeclampsia incidence and related complications [30].

Conclusion

Preeclampsia remains a critical determinant of maternal mortality, with a disproportionate impact on LMICs due to healthcare limitations and socioeconomic disparities. The high prevalence and associated maternal mortality in these regions highlight the need for healthcare policies that prioritize early detection and intervention. Expanding prenatal care services, especially in rural and underserved areas, can help identify and manage high-risk pregnancies, reducing both immediate and long-term health risks. Additionally, empowering community health workers and traditional birth attendants to recognize symptoms of preeclampsia and refer patients for timely care can play a significant role in preventing severe complications.

Overall, addressing preeclampsia's underlying risk factors—such as advanced maternal age, obesity, and pre-existing conditions—through education and lifestyle modifications is crucial. The global healthcare community must prioritize resource allocation, policy reforms, and public health initiatives aimed at reducing the burden of preeclampsia on maternal health, ensuring that all women, regardless of

socioeconomic status, receive adequate care to improve maternal outcomes.

Conflicts of interests

The authors declare that there are no competing interests.

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