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Review Article

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Preventing Congenital Malaria: Context Matters Globally

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ABSTRACT

Background: Congenital malaria results from vertical transmission of Plasmodium parasites from mother to fetus and it remains a significant, yet often under-recognized public health issue. It is primarily observed in malaria-endemic regions such as sub-Saharan Africa, parts of Asia, and South America. However, it is an emerging concern in non-endemic developed countries due to increased international travel, economic migration, and conflict-induced displacement. These healthcare systems often lack the capacity to effectively recognize and manage tropical diseases, leading to delays in diagnosis and treatment. Major challenges include low clinical suspicion, inadequate antenatal screening, weak surveillance systems, and poor strategies for drug resistance mitigation. The prevalence of congenital malaria varies widely, from 0% in Colombia to 46.7% in Nigeria, highlighting significant contextual and geographic disparities. These differences underscore global inequities in maternal and neonatal care and malaria prevention efforts. Leveraging on Innovative tools, such as Thailand's electronic malaria information system (eMIS) which demonstrates how adaptable digital tools can strengthen surveillance and response systems, countries can adopt novel, context-sensitive, culturally competent, adaptable and acceptable approaches that strengthens the health systems to meet the challenges of malaria in pregnancy locally while fostering international collaboration. This article explores the global burden of congenital malaria, highlighting the contextual factors and intervention gaps, emphasizing early detection, prompt treatment and optimal outcomes for mothers and newborns across diverse settings.

Keywords: Congenital Malaria, Global, Context, Prevention, Outcomes.

Introduction

Malaria is one of the most devastating infectious diseases, the second most common cause of infectious disease-related death globally [1]. It is a parasitic infection transmitted by mosquitoes and remains the most severe and complex health challenge facing most of the countries in tropical and subtropical regions of the world [2]. Congenital malaria occurs when malaria parasites cross the placenta either during pregnancy or at the time of delivery. It is defined by the presence of asexual forms of malaria parasites in the peripheral blood of the newborn within the first 7 days of life or later, if there is no possibility of postpartum infection by a mosquito bite [3,4]. It is a public health concern that is rare, usually indolent, but can be fatal [5,6]. Malaria in pregnancy can lead to severe adverse outcomes for both mother and fetus. Outcomes, such as anemia, intrauterine growth retardation, abortion, premature birth, low birth weight and death have been reported [7-9].

Congenital malaria is the least known manifestation of malaria, a very neglected area of research and thus under-reported [10]. Suboptimal coverage of malaria prevention interventions, further increases the risk of complications especially for the infants at risk of congenital malaria [11]. Most countries who bear the burden of malaria are bedeviled by poor socio-economic conditions, limited healthcare access, cultural practices and health systems unable to provide surveillance and systematic screening for congenital malaria. Understanding these disparities can inform global health policies and priorities, identifying practices and outcomes from different health systems and tailor region-specific interventions.

The Burden of Congenital Malaria

The burden of malaria is greatest in sub-Saharan Africa, where approximately 25 million pregnant women are at risk every year, and one in four women have evidence of placental infection at the time of delivery [12]. Studies on congenital malaria reveal significant global variability in prevalence. Bilal et al. reported rates ranging from 0.0% in Colombia to 46.7% in Nigeria, with

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an overall global prevalence of 6.9% [13]. In contrast, Danwang fellow researchers found a markedly higher crude prevalence of clinical congenital malaria in endemic settings at 40.4%, underscoring the burden in regions with sustained transmission [14]. In the United States, cases of congenital malaria are rare and primarily linked to importation from malaria-endemic regions [15]. Over a span of 40 years, the U.S. documented 81 cases of congenital malaria, while Europe recorded 10 cases over a 25-year period [16,17]. On average, the U.S. reports approximately 2,000 malaria cases annually [18]. Across the Americas, an estimated 0.55 million malaria cases were reported in 2022, with Venezuela, Brazil, and Colombia accounting for more than 73% of the regional burden [19].

Contextual Drivers of Congenital Malaria Risk

The risk of congenital malaria is directly shaped by maternal exposure to Plasmodium during pregnancy, which in turn is heavily influenced by a range of contextual determinants. These include health system functionality, socioeconomic conditions, environmental exposures, and cultural practices. In high-burden regions such as sub-Saharan Africa, widespread poverty, inadequate housing, and limited access to antenatal care heighten maternal vulnerability to malaria, increasing the risk of transplacental transmission to the fetus. Aberese-Ako in a study in Ghana highlight how health system limitations, economic hardship, and socio-cultural norms affected the use of preventive tools like long-lasting insecticide-treated nets (LLINs), undermining protection during pregnancy [20]. Individual-level factors also vary contextually and significantly affect maternal infection rates and thus fetal exposure. Maternal age, parity, educational status, and access to malaria education all influence infection risk. In Ethiopia, primigravidae without health education or access to insecticide-treated nets were more likely to have asymptomatic malaria during pregnancy [21]. In Uganda, malaria prevalence was highest during the first trimester (a critical period when fetal development is most vulnerable) and among women with fewer than four antenatal visits [22].

In settings where health education, screening, and preventive therapies are underutilized, the likelihood of congenital malaria correspondingly increases. Malaria transmission is higher in rural and poorly planned urban settings, where climatic factors and inadequate sanitation create favorable conditions for mosquito breeding. Areas with heavy rainfall, stagnant water, and proximity to swamps or garbage heaps see intensified exposure. In such contexts, the combination of environmental risk and weak infrastructure results in higher parasite loads in pregnant women and an elevated chance of placental infection, a key pathway for congenital malaria. Ultimately, health system capacity is a decisive factor in shaping maternal and neonatal outcomes. In regions with weak primary care, insufficient drug stocks, or poorly trained personnel, both prevention and treatment of malaria in pregnancy suffer. This limits the implementation of intermittent preventive therapy (IPTp) and delays in diagnosis and care. As noted by Kajoba et al. "the interconnectedness of poverty, housing, and healthcare in malaria risk is a complex vicious cycle" that perpetuates poor maternal health and elevates the risk of congenital transmission [23]. Addressing congenital malaria, therefore, requires more than biomedical solutions, it demands a context-sensitive approach that strengthens systems, reduces inequities, and tailors interventions to the specific realities of affected populations.

Challenges, Gaps and Opportunities in Congenital Malaria Control

Despite notable progress in malaria control, significant challenges persist particularly in developing countries where contextual factors continue to undermine disease elimination efforts [24,25]. Weak health systems, limited vaccine access, and insufficiently tailored interventions hinder impact. Strengthening control efforts requires not just medical interventions, but also community education, awareness campaigns, and culturally relevant communication strategies to promote the use of preventive tools [26]. A life-course approach that recognizes how risk accumulates and is transmitted over time is essential to designing holistic programs that address both maternal and neonatal vulnerabilities.

Globalization and migration have introduced new dynamics to congenital malaria. While traditionally concentrated in endemic regions of sub-Saharan Africa, Asia, and South America, congenital malaria is now emerging in non-endemic, developed countries due to increased international travel, conflict-driven displacement, and economic migration [15,17]. These imported cases expose gaps in preparedness, as many healthcare systems in non-endemic regions lack the clinical awareness, trained personnel, and surveillance infrastructure to manage tropical diseases effectively [27]. As a result, low clinical suspicion and underreporting may delay diagnosis and compromise outcomes. Major gaps remain in our understanding of congenital malaria, particularly in non-endemic regions where available data are mostly limited to isolated case reports [16,17]. Research is needed to explore the epidemiology among migrant populations, assess the cost-effectiveness of routine screening, and evaluate the safety of malaria vaccines in pregnancy. Comprehensive integration of malaria screening into antenatal care programs and updating prevention guidelines are critical next steps. As Mwendera et al. argue, evidence-based research must drive a paradigm shift, from controlling malaria to eliminating it [28].

Despite the challenges, opportunities abound. Global collaboration and policy alignment are now more urgent than ever [25]. Developed countries can leverage their advanced diagnostics to detect low-level parasitemia in pregnant women and neonates, while also adopting culturally inclusive maternal care systems that support migrant populations. Thailand's electronic Malaria Information System (eMIS) provides an example of an innovative surveillance tool that enhances early detection and case tracking [29]. Scaling up such tools globally could support both control and elimination efforts.

Conclusion

Congenital malaria remains a neglected yet significant consequence of malaria in pregnancy, driven by a complex mix of contextual, structural, and individual factors. From endemic regions in sub-Saharan Africa to rising imported cases in non-endemic countries, maternal-fetal transmission is influenced by poverty, inadequate housing, limited health system capacity, cultural practices, and environmental exposure. These factors hinder access to preventive tools, antenatal care, and timely diagnosis, revealing deep inequities in maternal and newborn health. Addressing this burden requires a shift toward integrated, context-sensitive strategies that strengthen health systems, enhance diagnostic capacity, and incorporate culturally

tailored interventions, especially for vulnerable populations like migrants. Research into vaccine safety, screening effectiveness, and the epidemiology of congenital malaria in non-endemic settings is vital. Ultimately, progress will depend not only on medical innovations but on confronting the underlying social and systemic inequities that sustain risk across diverse settings.

Declaration

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