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Socioeconomic and Environmental Risk Factors for Malaria in Young Children: A Review

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ABSTRACT

Malaria remained a significant public health challenge in sub-Saharan Africa, disproportionately affecting children under five years of age. Understanding the socioeconomic and environmental risk factors associated with malaria in this vulnerable population was crucial for developing targeted interventions to reduce transmission and improve health outcomes. This review examined the complex interplay between socioeconomic status, housing conditions, environmental factors, and malaria risk among young children. A comprehensive literature search was conducted to synthesize current research findings on the topic. Key socioeconomic determinants included household income, maternal education, and access to preventive measures. Children from low-income families were at higher risk due to limited resources for malaria prevention and treatment, as well as poorer living conditions that facilitate mosquito breeding. Environmental factors such as proximity to stagnant water bodies, inadequate sanitation, and climate variability further exacerbated malaria transmission. The review highlighted the need for multifaceted approaches that address both biological and social determinants of health to effectively reduce the burden of malaria among children under five in sub-Saharan Africa.

Keywords: Malaria, Socioeconomic factors, Environmental factors, young children, Sub-Saharan Africa

INTRODUCTION

Malaria continues to be a leading cause of morbidity and mortality in young children, particularly in sub-Saharan Africa (SSA), where the disease disproportionately affects those under five years of age [1,2]. Despite global efforts to control malaria, significant disparities persist, largely driven by a complex interplay of socioeconomic and environmental factors [3,4]. Understanding these risk factors is crucial for developing effective interventions aimed at reducing malaria transmission and improving health outcomes among vulnerable populations [5]. Socioeconomic factors, including household income, maternal education, and living conditions, have been shown to significantly influence the risk of malaria infection in young children [6]. For instance, children from low-income households or those whose mothers have limited educational attainment are at a higher risk of contracting malaria. These socioeconomic determinants not only affect access to preventive measures such as insecticide-treated nets (ITNs) and healthcare services but also shape community awareness and practices related to malaria prevention [7,8]. Environmental conditions further exacerbate the risk of malaria among young children. Factors such as proximity to stagnant water bodies, poor housing quality, and inadequate sanitation create favorable breeding grounds for anopheles mosquitoes, the primary vectors of malaria [9]. Rural areas often face greater challenges due to limited infrastructure and resources, increasing the vulnerability of children residing in these settings [10,11]. This review aims to synthesize current knowledge on the socioeconomic and environmental risk factors associated with malaria in young children. By examining existing literature and highlighting key findings, this review seeks to inform public health strategies that address these determinants holistically. Ultimately, understanding and mitigating these risk factors is essential for reducing the burden of malaria in young children and achieving broader health equity goals in sub-Saharan Africa.

SOCIOECONOMIC FACTORS

Socioeconomic factors play a pivotal role in shaping the prevalence and severity of malaria among young children, particularly in sub-Saharan Africa (SSA), where the disease burden is disproportionately high [12]. The interplay between household income, maternal education, living conditions, and access to healthcare significantly influences malaria risk, making it essential to understand these dynamics for effective public health interventions.

i. **Household Income and Wealth:** One of the most critical socioeconomic determinants of malaria risk is household income or wealth status [13]. Studies have consistently shown that children from low-income households are at a significantly higher risk of contracting malaria compared to those from wealthier families [14]. For instance, a recent analysis revealed that children living in the poorest households had a malaria prevalence rate of 38.2%, while those from the richest households had a prevalence of only 3.6%. Wealthier households have better access to preventive measures like ITNs and IRS, while poorer households lack these resources, increasing their vulnerability to malaria transmission [15,16]. Additionally, higher-income families have better healthcare access, preventing delays and enhancing disease severity.

ii. **Maternal Education:** Maternal education is another significant factor influencing malaria risk among young children [17]. Research indicates that children whose mothers have secondary education are about 56% less likely to contract malaria compared to those whose mothers have no formal education. Educated mothers are better equipped to understand malaria prevention guidelines and navigate healthcare systems, and their higher education often correlates with increased household income, enhancing access to resources for effective treatment [18,19].

iii. **Living Conditions:** The quality of living conditions significantly impacts malaria transmission dynamics [20]. Poor housing structures, characterized by inadequate sanitation and proximity to mosquito breeding sites, exacerbate the risk of infection among young children [21]. Housing quality, environmental sanitation, and waste management practices play crucial roles in reducing mosquito entry points and breeding sites, while inadequate sanitation infrastructure leads to higher malaria transmission rates due to increased vector populations [22].

iv. **Rural vs. Urban Disparities:** Geographical disparities also play a significant role in malaria risk associated with socioeconomic factors. Rural children face higher risk due to infrastructure limitations, lack of quality healthcare, and agricultural practices that increase mosquito breeding habitats, exacerbate vulnerability and complicate malaria control efforts [23,24].

ENVIRONMENTAL FACTORS

Environmental factors significantly influence the transmission dynamics of malaria, particularly among vulnerable populations such as young children in sub-Saharan Africa. Understanding these factors is crucial for developing effective control strategies and mitigating the impact of malaria [25]. The interplay between natural and human-made environmental conditions, including climatic variables, land use, and sanitation practices, shapes the habitat and behavior of malaria vectors, primarily anopheles mosquitoes [26].

i. **Climatic Influences:** Malaria transmission is influenced by climatic factors such as temperature, rainfall, and humidity [27]. Temperature is crucial for mosquito development, with optimal temperatures between 20°C and 30°C. Rainfall patterns affect mosquito breeding habitats, with heavy rains leading to increased breeding sites [28]. Humidity is vital for mosquito survival, with higher levels facilitating longer lifespans. Low humidity levels decrease mosquito lifespan, reducing transmission rates. Overall, climatic factors play a significant role in malaria transmission [29].

ii. **Land Use and Human Activities:** Human activities and land use changes significantly impact malaria transmission dynamics. Agricultural practices, such as irrigated agriculture, can create breeding habitats for mosquitoes, increasing vector densities. Urbanization, on the other hand, can either exacerbate or mitigate malaria transmission, with informal settlements lacking adequate infrastructure and households near stagnant water bodies at greater risk [30-32].

iii. **Sanitation and Waste Management:** Poor waste management and community awareness are key to controlling malaria transmission [33]. Poor waste management creates mosquito breeding

sites, increasing malaria incidence [34]. Engaging communities in environmental sanitation, such as regular cleaning and proper waste disposal, reduces mosquito breeding sites and empowers them to take proactive measures [35-37].

CONCLUSION

Addressing the socioeconomic and environmental determinants of malaria is vital for reducing its burden among children under five in sub-Saharan Africa. Comprehensive strategies that improve household wealth, enhance maternal education, and increase access to healthcare are essential components of effective malaria control programs. Simultaneously, interventions targeting environmental factors, such as habitat modification and community education on reducing standing water, can significantly contribute to lowering malaria transmission rates. By addressing these multifaceted risk factors, public health initiatives can more effectively protect vulnerable populations from the devastating impacts of malaria.

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