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Impact of School-Based Malaria Education Versus Standard Curriculum on Prevention Practices Among Adolescents in Endemic Regions: A Narrative Review

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ABSTRACT

Malaria continues to pose a serious public health threat in endemic regions, particularly affecting vulnerable populations such as adolescents and often-overlooked demographics in malaria prevention efforts. This narrative review explored the comparative impact of school-based malaria education versus the standard curriculum on improving malaria prevention practices among adolescents in endemic regions. School-based programs are shown to be more effective in enhancing knowledge, shifting attitudes, and promoting preventive behaviors through participatory learning, contextual relevance, and peer-led approaches. Standard curricula, by contrast, often provide limited, theoretical content with minimal behavioral emphasis. Utilizing a structured narrative review methodology, this article synthesized evidence from program evaluations and observational studies to examine how tailored educational interventions influence adolescent health behaviors. Key findings demonstrated that school-based malaria education improves consistent use of insecticide-treated nets, early treatment-seeking behavior, and environmental hygiene practices, while also fostering student-led initiatives that promote broader community engagement. However, implementation is hindered by infrastructural deficits, curricular inflexibility, and limited cross-sectoral coordination. To maximize impact, the review recommended integrating malaria education into the national curricula, enhancing teacher capacity, and strengthening collaboration between the health and education sectors. Empowering adolescents through structured malaria education not only improves immediate health outcomes but also supports long-term community-based malaria control and contributes to national elimination strategies.

Keywords: Malaria prevention**,** School-based education**,** Adolescents**,** Health behavior change**,** Endemic regions.

INTRODUCTION

Malaria remains a significant public health concern in many endemic regions, particularly sub-Saharan Africa and parts of Southeast Asia and Latin America -[1–3]. Despite sustained efforts through vector control, chemoprophylaxis, and public awareness campaigns, malaria morbidity and mortality continue to be disproportionately high among vulnerable populations. Among these, adolescents represent a unique yet under-researched group in malaria prevention efforts. Positioned between childhood vulnerability and adult responsibility, adolescents often engage in behaviors that increase their exposure to mosquito bites, such as evening outdoor activities, sleeping without nets, or reluctance to seek timely medical attention. Moreover, adolescence is a formative stage where health-related knowledge, attitudes, and behaviors can be positively influenced through structured educational interventions.

Traditionally, school curricula in endemic regions incorporate limited health education, often lacking specific, practical, or behaviorally oriented malaria content [4, 5]. In contrast, targeted school-based malaria education programs are designed to provide comprehensive, context-specific information on malaria transmission, symptoms, prevention, and control. These programs not only equip students with factual knowledge but also encourage participatory learning, peer-led initiatives, and community engagement, ultimately aiming to enhance prevention practices both within schools and in households. This narrative review critically examines the impact of school-based malaria education in comparison to the standard curriculum on improving prevention practices among

adolescents in endemic regions. The review synthesizes existing literature, program evaluations, and observational studies to explore how structured educational interventions can influence adolescents' knowledge, attitudes, and behaviors regarding malaria prevention. Furthermore, the review evaluates the sustainability and scalability of such educational models, identifies barriers to implementation, and proposes recommendations for integrating effective malaria education into formal school systems. By highlighting the pedagogical and epidemiological value of school-based interventions, this review aims to inform educational policy and public health programming that target malaria reduction among adolescent populations in high-risk settings.

The Burden of Malaria Among Adolescents in Endemic Regions

Adolescents in malaria-endemic regions represent an often-overlooked demographic in the global malaria response [6]. While much attention has rightly focused on children under five and pregnant women due to their heightened biological vulnerability, the adolescent population also experiences substantial malaria morbidity [7]. This age group frequently engages in outdoor social and economic activities during peak mosquito biting times and may adopt risk-prone behaviors that increase exposure. In school environments, poorly ventilated or unscreened classrooms and dormitories can also serve as breeding grounds for malaria transmission. Furthermore, adolescents often demonstrate lower levels of health literacy, which impacts their ability to recognize early symptoms, seek appropriate treatment, or consistently use preventive measures such as insecticide-treated nets (ITNs) [8]. In many endemic regions, malaria is normalized as a routine illness, further diminishing its perceived severity among youth. This complacency can hinder the adoption of preventive behaviors, especially in the absence of targeted educational efforts.

The burden of malaria during adolescence also has indirect consequences on academic performance, school attendance, and psychosocial development. Frequent episodes of malaria can lead to cognitive fatigue, absenteeism, and reduced educational attainment. These consequences have long-term implications, potentially perpetuating cycles of poverty and limiting socio-economic mobility. Therefore, malaria prevention among adolescents warrants a dedicated educational approach tailored to their developmental needs and social context.

Overview of Standard Curriculum Approaches to Health Education

Most national education systems in endemic countries incorporate some form of health education into their standard curriculum [9]. However, the depth, frequency, and relevance of this content vary widely across contexts. Health topics, including malaria, are often embedded within general science or biology subjects and delivered through didactic, teacher-centered methods. These curricula typically emphasize theoretical knowledge rather than applied behavioral change.

Key limitations of the standard curriculum include insufficient emphasis on vector control strategies, symptom recognition, and prompt treatment-seeking behavior. Moreover, the lack of participatory and experiential learning methods reduces student engagement and retention of information [10]. Teachers may also lack specialized training in delivering health content effectively, and textbooks may be outdated or fail to reflect local epidemiological realities. The integration of malaria education in standard curricula is frequently impeded by curricular overload and competing academic priorities. As a result, malaria education is either superficially addressed or entirely omitted. Furthermore, there is limited monitoring and evaluation to assess the impact of existing curricula on health outcomes or behavioral change. In this context, the standard curriculum fails to adequately prepare adolescents to serve as informed agents of malaria prevention within their communities.

School-Based Malaria Education: Components and Implementation

School-based malaria education refers to targeted instructional programs implemented within school settings, either as supplementary modules or integrated curriculum enhancements [11, 12]. These programs aim to provide comprehensive, context-specific, and behaviorally relevant information on malaria. Core components typically include instruction on malaria transmission cycles, recognition of early symptoms, correct use of ITNs, environmental management to reduce mosquito breeding sites, and prompt treatment-seeking behavior.

Implementation strategies often emphasize interactive teaching methods such as role-playing, group discussions, peer-led activities, and practical demonstrations. Many programs also involve educational materials such as illustrated booklets, flipcharts, posters, and audiovisual tools tailored to the cognitive levels and language preferences of adolescents. In some cases, health professionals and community health workers are invited to co-facilitate sessions, thereby bridging the gap between the health and education sectors.

An important feature of school-based programs is their potential to foster peer education and intergenerational knowledge transfer [13, 14]. Students are encouraged to disseminate malaria-related information to their families and communities, thereby expanding the reach and impact of school-based interventions. Additionally, these programs are often aligned with World Malaria Day, national malaria campaigns, or local community health events, reinforcing key messages through multiple channels.

Comparative Impact on Knowledge, Attitudes, and Practices

Several studies comparing the outcomes of school-based malaria education and standard curriculum have reported significant differences in student knowledge, attitudes, and practices (KAP). School-based programs consistently

outperform standard curricula in enhancing malaria-related knowledge, particularly regarding mosquito behavior, preventive measures, and symptom recognition [15, 16]. Adolescents exposed to targeted education demonstrate increased understanding of the importance of sleeping under ITNs, promptly seeking treatment for fever, and eliminating mosquito breeding sites around their homes.

In terms of attitudes, school-based interventions have been associated with greater perceived susceptibility and severity of malaria, increased self-efficacy in adopting preventive behaviors, and reduced misconceptions about malaria transmission. These attitudinal shifts are crucial precursors to sustained behavioral change.

Behaviorally, adolescents who participate in structured malaria education programs report higher rates of consistent ITN usage, greater likelihood of engaging in environmental hygiene practices, and improved healthcare-seeking behaviors [17]. In contrast, students who rely solely on standard curriculum often exhibit fragmented knowledge and inconsistent prevention practices.

Importantly, school-based education also fosters collective behavior change. Some programs have led to the formation of student health clubs, peer support groups, and environmental monitoring teams that contribute to school-wide and community-level malaria control. These positive externalities underscore the potential of school-based education to function as a catalyst for broader health improvements.

Barriers to Effective Implementation and Sustainability

Despite their demonstrated effectiveness, school-based malaria education programs face several implementation challenges. Resource constraints are a primary barrier. Schools in endemic regions may lack basic infrastructure, trained personnel, or educational materials necessary for effective program delivery. Teacher workload, limited time allocation, and insufficient incentives further constrain program implementation.

Curricular rigidity within national education systems also impedes the integration of malaria education [18]. Education ministries may prioritize academic subjects over health-related content, and there may be bureaucratic resistance to revising formal curricula. Moreover, coordination between the health and education sectors is often weak, leading to fragmented or duplicative efforts.

Socio-cultural factors can also affect programming uptake. Gender norms, for instance, may limit girls' participation in extracurricular health activities, while cultural misconceptions about malaria may hinder acceptance of scientific information [19, 20]. Language barriers, especially in multilingual societies, pose additional challenges in delivering standardized health messages.

Ensuring program sustainability requires ongoing political commitment, institutional support, and community engagement. Without mechanisms for regular funding, training, and evaluation, many school-based initiatives are short-lived or operate as pilot projects with limited scalability. Therefore, building resilient systems that institutionalize malaria education within school structures is critical for long-term success.

Recommendations for Policy and Practice

To maximize the impact of school-based malaria education, several strategic actions are recommended:

i. **Curricular Integration**: Ministries of Education should formally incorporate malaria education into national curricula, ensuring alignment with epidemiological data and public health priorities [21].
ii. **Teacher Training**: Ongoing capacity-building for teachers in health education methodologies is essential. Training should include content knowledge, participatory teaching techniques, and assessment tools.
iii. **Multi-sectoral Collaboration**: Strong partnerships between health and education sectors can facilitate resource sharing, program coordination, and integrated monitoring frameworks [22].
iv. **Community Involvement**: Programs should engage parents, local leaders, and community health workers to reinforce key messages and foster a supportive environment for adolescent behavior change.
v. **Innovative Pedagogy**: Incorporating technology, storytelling, and gamification can enhance student engagement and information retention.
vi. **Monitoring and Evaluation**: Establishing robust evaluation systems will help measure program impact, identify best practices, and inform policy refinements.

By adopting these recommendations, stakeholders can create a sustainable ecosystem for school-based malaria education that empowers adolescents to become health advocates and contributes meaningfully to malaria control in endemic regions.

CONCLUSION

Adolescents in malaria-endemic regions remain an underprioritized demographic in malaria prevention programming, despite their potential to influence both present and future disease trends. This narrative review has demonstrated that school-based malaria education significantly outperforms the standard curriculum in promoting preventive knowledge, shifting health-related attitudes, and fostering protective behaviors among adolescents. While standard curricula often offer limited and abstract information, structured school-based interventions provide contextually relevant, participatory, and behaviorally oriented education that is better suited to the needs and realities of young learners. However, the implementation of these interventions is frequently challenged by structural, institutional, and socio-cultural barriers. Addressing these obstacles requires a multi-pronged approach

involving curricular reform, teacher training, community participation, and intersectoral collaboration. Importantly, integrating malaria education into national education policies ensures continuity, scalability, and sustainability. As adolescents are not only learners but also influencers within their families and communities, empowering them with actionable malaria knowledge can yield far-reaching public health benefits. Going forward, research must focus on longitudinal studies that evaluate the sustained impact of school-based malaria education and identify scalable best practices. Ultimately, bridging the educational gap in malaria prevention is a critical step toward achieving equitable health outcomes and advancing malaria elimination goals in endemic regions.

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