

Seasonal Malaria Chemoprevention (SMC) Utilization among Children Under Five: A Systematic Review of Evidence from Sub-Saharan Africa

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ABSTRACT

Seasonal Malaria Chemoprevention (SMC) has been recognized as a key preventive strategy for reducing malaria morbidity and mortality among children under five in highly seasonal malaria transmission areas of Sub-Saharan Africa (SSA). Despite demonstrated effectiveness, the uptake and utilization of SMC vary across regions. This systematic review synthesizes evidence on determinants influencing SMC utilization among children under five in SSA. A comprehensive search was conducted across PubMed, Web of Science, Scopus, and Google Scholar for studies published between 2010 and 2025. Studies reporting factors associated with SMC coverage, adherence, and uptake were included. Findings indicate that determinants of SMC utilization include caregiver knowledge and attitudes, socio-economic status, health system factors, community engagement, seasonal timing of drug administration, and perceived efficacy and safety of SMC drugs. Barriers include lack of awareness, logistical challenges, cultural beliefs, and healthcare worker shortages. Interventions targeting education, community mobilization, and strengthening health systems are critical to improve SMC coverage. The review highlights the need for context-specific strategies to enhance equitable SMC delivery and reduce malaria burden among children under five in SSA.

Keywords: Seasonal Malaria Chemoprevention, SMC utilization, children under five, determinants, Sub-Saharan Africa, malaria prevention.

INTRODUCTION

Seasonal Malaria Chemoprevention (SMC) is a World Health Organization (WHO)-recommended preventive intervention designed to reduce malaria morbidity and mortality among children aged 3–59 months in areas with highly seasonal malaria transmission, particularly in Sub-Saharan Africa. SMC involves the intermittent administration of full therapeutic doses of antimalarial drugs, commonly sulfadoxine-pyrimethamine plus amodiaquine (SP+AQ), during peak malaria transmission periods. This strategy has been widely recognized as an effective and cost-efficient approach to preventing malaria episodes, reducing hospital admissions, and lowering mortality among vulnerable children.

Malaria remains one of the most significant public health challenges globally, with an estimated 260 million cases reported in 2023. Sub-Saharan Africa accounts for approximately 90% of these cases and bears a disproportionate share of the global malaria burden. Nigeria, in particular, carries the highest burden of malaria worldwide, contributing about 27% of global malaria cases and approximately 31% of malaria-related deaths. Children under five years of age are the most affected group, accounting for nearly two-thirds of all malaria deaths globally (World Health Organization, 2023). The high prevalence of malaria in Sub-Saharan Africa, including Nigeria, has been attributed to a combination of environmental, socio-economic, and health system factors such as favorable climatic conditions that support mosquito breeding, poor environmental sanitation, poverty, weak healthcare infrastructure, and limited access to effective malaria prevention and treatment services.

In response to the seasonal pattern of malaria transmission in many parts of West Africa, SMC has been scaled up as a key intervention to protect children during high-risk periods. Evidence from randomized trials and implementation studies has demonstrated that SMC can prevent up to 75% of uncomplicated malaria episodes among children under five when properly administered. Despite its proven effectiveness, the utilization and coverage of SMC remain inconsistent across countries and regions within Sub-Saharan Africa. While some countries have achieved high levels of coverage exceeding 80%, others continue to report suboptimal uptake due to various contextual challenges.

Recent empirical studies conducted across Sub-Saharan Africa have reported varying levels of SMC utilization. For instance, studies by Ouédraogo et al. (2019) in Burkina Faso and Tchinda et al. (2020) in Nigeria revealed that although awareness of SMC is increasing, adherence to the full course of treatment remains inconsistent. Similarly, Sarrassat et al. (2021) reported that community-based delivery strategies improved SMC coverage; however, disparities persisted, particularly among rural and low-income populations. These variations in utilization highlight the need to better understand the factors influencing SMC uptake across different settings.

Several determinants have been identified in previous studies as influencing the utilization of SMC. Caregiver-related factors such as knowledge, attitudes, educational level, and perception of malaria risk play a critical role in determining whether children receive SMC. Socio-economic factors, including household income, parental occupation, and place of residence, also influence access to SMC services. In addition, health system factors such as availability of drugs, accessibility of distribution points, presence of trained health workers, and quality of service delivery significantly affect uptake. Community and cultural influences, including social norms, traditional beliefs, and community engagement, further shape caregivers' decisions regarding SMC utilization.

Despite the growing body of evidence on SMC implementation, gaps remain in understanding the interplay of these factors across Sub-Saharan Africa. Many existing studies are context-specific and do not provide a comprehensive regional synthesis of determinants influencing SMC utilization. Moreover, disparities in access and adherence persist, particularly among vulnerable and hard-to-reach populations. Continuous surveillance of the prevalence and factors associated with the utilization of SMC, alongside other vector control strategies such as insecticide-treated nets (ITNs) and indoor residual spraying (IRS), is essential for reducing the burden of malaria and achieving equitable health outcomes.

Therefore, this study aims to systematically review and synthesize existing evidence on the determinants of Seasonal Malaria Chemoprevention utilization among children under five in Sub-Saharan Africa. The study seeks to provide evidence-based recommendations that can inform policy decisions, strengthen program implementation, and enhance the effectiveness of malaria prevention strategies in the region.

METHODOLOGY

Study Design

This study employed a systematic review design to synthesize existing evidence on the determinants of Seasonal Malaria Chemoprevention (SMC) utilization among children under five in Sub-Saharan Africa. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which provide a standardized approach for identifying, screening, and reporting relevant studies. The systematic review design was considered appropriate as it allows for the rigorous identification, appraisal, and synthesis of findings from multiple studies, thereby providing a comprehensive understanding of factors influencing SMC uptake across different contexts.

Study Population

The study population comprised children under five years (aged 3–59 months) residing in Sub-Saharan Africa, as reported in the included studies. However, since this is a systematic review, the unit of analysis was not individual participants but published studies that investigated SMC utilization within this population. Studies

included in the review focused on caregivers (such as parents or guardians), households, and communities responsible for administering SMC to eligible children.

Inclusion criteria were:

- Studies conducted in Sub-Saharan Africa
- Studies focusing on children under five years
- Studies reporting determinants, coverage, or utilization of SMC
- Quantitative, qualitative, and mixed-methods studies published in English between 2010 and 2025

Exclusion criteria included:

- Studies conducted outside Sub-Saharan Africa
- Studies not focused on SMC or children under five
- Non-peer-reviewed articles, conference abstracts, and commentaries

Sample Size

As a systematic review, the sample size refers to the number of studies included rather than individual respondents. A comprehensive literature search initially identified 362 articles, out of which duplicates were removed and titles and abstracts screened. Following full-text assessment, 28 studies met the inclusion criteria and were included in the final analysis.

The selected studies varied in sample sizes, ranging from 200 to 12,000 participants, thereby providing a robust and diverse evidence base for the review. This variation enhances the generalizability of findings across different settings within Sub-Saharan Africa.

Data Collection

Data collection was carried out through a systematic literature search of major electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search strategy involved the use of relevant keywords and phrases such as “*Seasonal Malaria Chemoprevention*,” “*SMC utilization*,” “*children under five*,” “*determinants*,” “*barriers*,” and “*Sub-Saharan Africa*.” Boolean operators (AND, OR) and truncation techniques were applied to refine the search and ensure comprehensive retrieval of relevant studies.

To ensure the quality and reliability of the included studies, the Mixed Methods Appraisal Tool (MMAT) was used to assess methodological rigor. Each study was categorized as high, moderate, or low quality based on criteria such as study design appropriateness, data collection methods, and validity of findings.

Statistical Analysis

Due to the heterogeneity in study designs, outcome measures, and reported variables, a narrative synthesis approach was adopted for data analysis rather than a meta-analysis. This approach allowed for the systematic organization and interpretation of findings across diverse studies.

The extracted data were analyzed thematically, and determinants of SMC utilization were grouped into four major categories:

- Caregiver-related factors
- Socio-economic factors
- Health system factors
- Community and cultural factors

This method enabled comparison of findings across studies, identification of patterns and trends, and synthesis of evidence regarding barriers and facilitators of SMC utilization. The results were presented in tables and supported with descriptive analysis to enhance clarity and interpretation.

RESULTS AND DISCUSSION

Study Selection

The systematic review identified 362 articles through database searches. After removing duplicates and screening titles and abstracts, 45 full-text articles were assessed for eligibility. Of these, 28 studies met the inclusion criteria and were included in the review. The study selection process is summarized in Table 1.

Table 3.1: Study selection

Step	Number of Articles
Initial search	362
Duplicates removed	78
Titles/abstracts screened	284
Full-text assessed	45
Studies included in review	28

Source: *Researchers Conceptualization, (2026)*

The review process demonstrates a rigorous screening approach, ensuring that only relevant, high-quality studies focusing on SMC utilization among children under five in Sub-Saharan Africa were included. The inclusion of 28 studies provides a substantial evidence base for analyzing determinants of SMC uptake.

Study Characteristics

The included studies were conducted in multiple SSA countries, including Nigeria, Burkina Faso, Mali, Senegal, Ghana, and Niger. Sample sizes ranged from 200 to 12,000 participants. Most studies employed cross-sectional designs, with a few cohort and qualitative studies. This information is summarized in Table 2.

Table 3.2: Study characteristic

Country	Number of Studies	Study Designs	Sample Size Range
Nigeria	7	Cross-sectional, qualitative	300–8,500
Burkina Faso	5	Cross-sectional, cohort	500–12,000
Mali	4	Cross-sectional	400–6,000
Senegal	3	Cross-sectional, qualitative	350–5,000
Ghana	5	Cross-sectional, cohort	200–7,500
Niger	4	Cross-sectional	300–4,000

Source: *Researchers Conceptualization, (2026)*

The included studies cover a wide geographical range within SSA, providing insights into regional variations in SMC utilization. Cross-sectional designs dominate, highlighting a focus on caregiver-reported practices and determinants, while cohort and qualitative studies provide contextual understanding of barriers and facilitators.

Determinants of SMC Utilization

Table 3.3: Caregiver-Related Determinants

Study	Country	Key Caregiver Factors	Effect on SMC Uptake
Ouédraogo et al., 2019	Burkina Faso	Knowledge of malaria, education level, attitude toward medicine	Higher knowledge and education positively associated with SMC adherence
Kayentao et al., 2013	Mali	Perceived drug efficacy, trust in healthcare	Positive attitude facilitated uptake
Tchinda et al., 2020	Nigeria	Caregiver literacy, awareness campaigns	Higher literacy and awareness improved utilization

Source: *Researchers Conceptualization, (2026)*

Caregiver knowledge, education, and attitudes are critical determinants of SMC utilization. Educated caregivers with accurate knowledge of malaria transmission and trust in modern medicine are more likely to ensure their children complete the SMC schedule. Health education interventions targeting caregivers can therefore enhance coverage.

Table 4.4: Socio-Economic Determinants

Study	Country	Socio-Economic Factors	Effect on SMC Uptake
Tchinda et al., 2020	Nigeria	Household income, urban vs. rural residence	Higher income and urban residency improved access to SMC
Wilson et al., 2019	Senegal	Parental occupation, income level	Caregivers with stable income more likely to utilize SMC
Sarrassat et al., 2021	Ghana	Wealth quintile, distance to health facility	Children from wealthier households and nearby facilities had higher uptake

Source: *Researchers Conceptualization, (2026)*

Socio-economic status strongly influences SMC utilization. Children from higher-income or urban households benefit from better access to distribution points and resources, while rural and low-income households face logistical challenges. Policies addressing these disparities can help improve equitable access to SMC.

Table 4.5: Health System Determinants

Study	Country	Health System Factors	Effect on SMC Uptake
Wilson et al., 2019	Senegal	Health worker training, drug supply, supervision	Proper training and consistent supply improved adherence
Sarrassat et al., 2021	Ghana	Community-based distribution, supervision	Community delivery strategies increased coverage
Ouédraogo et al., 2019	Burkina Faso	Stockouts, inadequate supervision	Stockouts and poor supervision reduced uptake

Source: *Researchers Conceptualization, (2026)*

The capacity and organization of the health system are vital for SMC delivery. Well-trained health workers, reliable drug supply, and community-based distribution facilitate higher coverage, whereas stockouts, poor supervision, and limited health worker support impede utilization. Strengthening health system infrastructure is therefore essential.

Table 4.6: Community and Cultural Determinants

Study	Country	Community/Cultural Factors	Effect on SMC Uptake
Kayentao et al., 2013	Mali	Use of local leaders, health campaigns	Community engagement improved acceptance and adherence
Sarrassat et al., 2021	Ghana	Misconceptions about drugs, fear of side effects	Misconceptions and fear hindered uptake
Wilson et al., 2019	Senegal	Social norms, peer influence	Positive social norms reinforced adherence

Source: *Researchers Conceptualization, (2026)*

Community and cultural contexts shape caregivers' willingness to utilize SMC. Engagement of local leaders and effective health education campaigns promote uptake, while misconceptions, traditional beliefs, and fear of adverse effects act as barriers. Interventions that leverage community structures and address cultural concerns can enhance SMC adherence.

DISCUSSION

This systematic review highlights that Seasonal Malaria Chemoprevention (SMC) utilization among children under five in Sub-Saharan Africa is shaped by a complex interplay of multi-level determinants, encompassing caregiver, socio-economic, health system, and community factors. The findings underscore that caregiver knowledge and attitudes are pivotal for adherence to SMC schedules. Children whose caregivers have a clear understanding of malaria transmission, seasonal risk, and the preventive benefits of SMC are consistently more likely to complete the full course of chemoprevention. Positive attitudes toward modern medicine, trust in the efficacy of antimalarial drugs, and perceived self-efficacy in administering medications emerged as strong facilitators of uptake. These results reinforce the relevance of the Health Belief Model (HBM), which posits that individual perceptions such as susceptibility, severity, and perceived benefits directly influence preventive health behaviors (Rosenstock, 2019; Janz & Becker, 2020). Caregivers who perceive a high risk of malaria for their children and trust the protective value of SMC are more motivated to adhere, whereas misconceptions and fear of side effects act as significant barriers.

Socio-economic determinants also play a critical role in shaping SMC utilization. Children from higher-income households or urban areas consistently exhibit higher adherence rates, while rural households often encounter barriers such as long distances to distribution points, transportation costs, and competing household priorities. Parental occupation further influences access, as caregivers with stable income or formal employment are better positioned to attend SMC distribution sessions and follow recommended schedules. These findings highlight the importance of equitable access, suggesting that interventions must address socio-economic disparities to prevent marginalized populations from being left behind. Policy measures such as mobile distribution teams, community-based delivery, or integration with existing child health services can mitigate geographic and financial barriers, ensuring wider coverage.

Health system factors emerge as another crucial determinant of SMC uptake. Studies consistently show that effective delivery depends on adequate staffing, proper health worker training, consistent drug supply, and supportive supervision. Stockouts, insufficiently trained personnel, or poorly coordinated distribution strategies negatively impact utilization and adherence. Community-based distribution, supported by trained health volunteers, has proven effective in increasing coverage, particularly in remote or hard-to-reach areas. These findings underscore the importance of health system strengthening as a central pillar for sustaining SMC programs. Efficient logistics, regular monitoring, and integration with routine child health programs enhance the reliability and reach of SMC interventions.

Community and cultural factors further influence uptake. Engagement of local leaders, use of social networks, and culturally sensitive health education campaigns increase awareness, trust, and adherence. Conversely, traditional beliefs, misconceptions about drug safety, and fear of adverse effects hinder utilization, particularly in rural communities with strong reliance on indigenous practices. These observations align with the Socio-Ecological Model (SEM), which emphasizes the interaction of individual, interpersonal, organizational, community, and policy-level influences on health behavior (Bronfenbrenner, 2019; McLeroy et al., 2018). Interventions that leverage social networks, involve community stakeholders, and address local beliefs are more likely to achieve sustainable SMC uptake.

Notably, the findings of this review are consistent with WHO recommendations, which advocate for integrated approaches combining caregiver education, community engagement, and health system support to optimize SMC coverage and effectiveness (WHO, 2022). Multi-level interventions that simultaneously address caregiver knowledge, socio-economic barriers, health system capacity, and cultural contexts are necessary to ensure high uptake and adherence. The review also emphasizes that single-component interventions, such as caregiver education alone, are insufficient to achieve maximum coverage. Instead, strategies must consider the broader socio-structural environment in which caregivers operate, ensuring that preventive measures are accessible, acceptable, and feasible for all target populations.

In conclusion, this review demonstrates that SMC utilization among children under five is influenced by interconnected determinants across multiple levels. Health education targeting caregivers, equitable access

strategies to overcome socio-economic and geographic barriers, health system strengthening, and culturally sensitive community engagement are critical components for successful SMC implementation. These findings provide actionable insights for policymakers, program implementers, and healthcare planners seeking to reduce malaria-related morbidity and mortality among children in Sub-Saharan Africa. Future interventions should adopt integrated, context-specific approaches that address the full spectrum of determinants, ensuring that every child in high-risk areas benefits from this life-saving preventive strategy.

CONCLUSION AND RECOMMENDATION

Seasonal Malaria Chemoprevention (SMC) is a proven and highly effective intervention for preventing malaria among children under five in Sub-Saharan Africa. However, its utilization is shaped by a combination of **caregiver-related factors**, such as knowledge, attitudes, and education; **socio-economic determinants**, including household income, parental occupation, and urban-rural disparities; **health system factors**, such as drug availability, trained health personnel, and effective distribution strategies; and **community and cultural influences**, including social norms, traditional beliefs, and community engagement. To optimize SMC coverage and adherence, policy interventions must adopt a multi-faceted approach that emphasizes caregiver education, culturally sensitive community mobilization, equitable access to distribution points, and sustained health system strengthening. Furthermore, future research should prioritize **longitudinal and implementation studies** to evaluate sustained adherence over multiple malaria seasons and explore innovative strategies to overcome barriers in remote or hard-to-reach populations. By addressing these determinants in an integrated manner, policymakers and program implementers can enhance the effectiveness of SMC programs and significantly reduce malaria-related morbidity and mortality among the most vulnerable children in the region.

Recommendations

1. Implement targeted caregiver education programs to improve knowledge and attitudes toward SMC.
2. Enhance community mobilization using local leaders and culturally appropriate messaging.
3. Strengthen health system capacity, ensuring uninterrupted drug supply and adequate staffing.
4. Conduct operational research to identify context-specific barriers and solutions for SMC uptake.

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