

Literature Review on the Effectiveness of Mass Drug Administration as a Control of Soil-Transmitted Helminth Infections

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ABSTRACT

Background: Soil-transmitted helminth (STH) infections remain a major public health problem in tropical and subtropical regions, particularly among school-aged children. However, evidence on the long-term effectiveness of Mass Drug Administration (MDA) as a primary control strategy remains inconsistent as a standalone intervention. This study aimed to review the effectiveness of MDA in controlling STH infections and to identify complementary measures required for sustainable control. **Methods:** A literature review was conducted using PubMed and ScienceDirect databases for articles published between 2015 and 2025. Original research articles focusing on school-aged children were screened based on predefined inclusion criteria. **Results:** The findings showed that repeated rounds of MDA were associated with reductions in STH prevalence and intensity in some settings. Persistent transmission remained evident with prevalence ranging from around 13% to over 80% despite long-term MDA implementation. Continued infection was consistently associated with poor water, sanitation, and hygiene (WASH) conditions, inadequate hand hygiene practices, and exposure to contaminated water sources. **Conclusion:** Sustainable control of STH infections requires integrated interventions that combine MDA with improvements in WASH infrastructure, hygiene promotion, and community-based health education to prevent rapid reinfection and achieve long-term public health impact.

Keywords: *Deworming, Soil-transmitted helminths, Mass Drug Administration, WASH*

Introduction

Soil-transmitted helminth (STH) infections are parasitic intestinal worm infections transmitted through contaminated soil⁽¹⁾ and primarily affect poor communities with limited access to clean water in tropical and subtropical regions.⁽²⁾ These infections are classified as neglected tropical diseases (NTDs) because the morbidity and disability are closely linked to lack of access to essential resources.^(3,4) The main STH species infecting humans include roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*), and hookworms (*Necator americanus* and *Ancylostoma duodenale*).⁽²⁾

Evidence suggests that preventive chemotherapy, implemented through frequent, large-scale administration of anthelmintic drugs to at-risk populations, can significantly reduce the incidence of STH infections.⁽⁵⁾ Therefore, since 2001, through the World Health Assembly (WHA), endemic countries have been encouraged to implement control measures recommended by the World Health Organization (WHO), primarily through Mass Drug Administration (MDA) programs, complemented by health education and hygiene promotion.⁽²⁾

MDA programs have been implemented in several tropical countries, such as Togo, Ghana, Cameroon, and Nigeria, targeting school-aged children between 5 and 14 years of age.⁽²⁾ In Indonesia, the government has implemented a national MDA program for STH control since 2017, targeting preschool and elementary school children every six months.⁽⁶⁾ Despite these efforts, according to a 2022 WHO report, five years after the implementation of MDA in Indonesia, there are still 46,868,763 school-age children in Indonesia requiring preventive chemotherapy for STH infections.⁽²⁾ Preschool and elementary school children are particularly vulnerable to STH infections due to frequent exposure to contaminated hands or other

transmission media. ⁽⁷⁾ These infections are associated with various morbidities, including iron deficiency anemia, malnutrition, ^(8,9) impaired growth and development, short stature, and delayed cognitive development. ^(10,11)

Globally, an estimated 1.5 billion people, or 24% of the world's population, are still infected with STH. ⁽²⁾ The prevalence of STH infections varies across geographic regions, with the highest burden reported in most parts of Africa and some parts of Latin America in 2021. ⁽¹²⁾ Although preventive chemotherapy through MDA has substantially reduced STH morbidity in many endemic areas, growing evidence suggests that MDA alone is insufficient to sustainably interrupt transmission. ^(8,13) Furthermore, many studies have demonstrated the efficacy of MDA, but very few have shown that MDA as a single strategy is insufficient to stop transmission. Therefore, this review was created to fill this gap and provide an overview for Indonesia.

METHODS

This study used a narrative review approach in accordance to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) procedure. The use of PRISMA aims to ensure that methodology and results of the literature review are reported completely, clearly and reproducibly.

A literature search was conducted in December 2025 across the PubMed and ScienceDirect databases. The search strategy employed MeSH terms and specific keywords combined with Boolean operators to optimize the results: (“deworming” OR “mass drug administration” OR “MDA”) AND (“water” OR “sanitation” OR “hygiene”). The selected articles were original research articles focusing on school-aged children as the age group most vulnerable to STH exposure. Inclusion criteria were articles published between 2015 and 2025, written in English, and available in full-text.

Articles were screened based on titles and abstracts to eliminate duplicates and assess relevance, followed by a full-text review of potentially eligible studies. To minimize selection bias, all authors independently screened the records. However, a formal critical appraisal of the methodological quality of the included studies was not performed. Finally, data synthesis was conducted and summarized based on author, year, location, study design, subjects, and main findings.

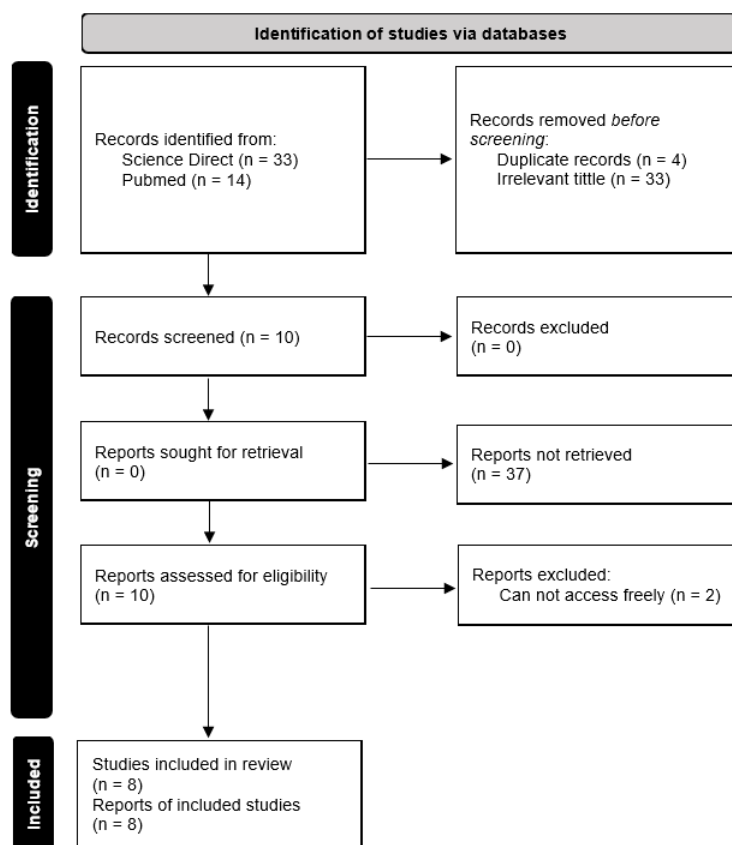


Figure 1. PRISMA flow diagram

RESULT

A literature search using keywords yielded 47 articles. Eight articles met the inclusion criteria, and a synthesis was performed. Across Kenya, Ethiopia, Cameroon, Tanzania and Nigeria (2018–2025), STH infections remained common among school children despite multiple rounds of MDA. In Kenya, STH were still detected at a low prevalence of approximately 13% after 5 years of MDA implementation, but in Cameroon, STH prevalence reached 80% despite 16 years of MDA. The continued presence of STH is thought to be associated with inadequate access to clean water and poor personal and environmental hygiene practices. The results are presented in Table 1 below.

Table 1. Results of Literature Review

Author (Year)	Location	Study Design	Subject	Key Findings
Alemu et al. (2018)	Arbaminch Zuria district, Southern Ethiopia	Community-based cross-sectional study	391 primary school-age children	Overall intestinal helminth prevalence was 46.3%. Most common parasite was <i>Ascaris lumbricoides</i> . Not washing fruits/vegetables and swimming habits were significant risk factors. High burden indicates need to integrate deworming with WASH and health education.
Okoyo et al. (2020)	Six regions, Kenya	Cross-sectional survey (stratified)	School-age children from ~100 schools after five MDA rounds	After five rounds of deworming, STH prevalence declined to 12.9%, but infections persisted in some regions. WASH factors were associated with infection persistence, highlighting

Author (Year)	Location	Study Design	Subject	Key Findings
Walker et al. (2021)	Ethiopia, Lao PDR, and Pemba Island (Tanzania)	two-stage sampling) Re-analysis of three standardized clinical trials using Bayesian modelling	645 school children treated with single-dose albendazole	need for complementary control strategies. Albendazole efficacy was lower in Pemba Island, an area with long-term MDA exposure. The proportion of satisfactory responses against <i>Trichuris trichiura</i> was substantially lower than in Ethiopia and Lao PDR. Higher pre-treatment infection intensity was associated with poorer treatment response, suggesting possible reduced drug effectiveness in settings with high drug pressure.
Landeryou et al. (2022)	Wolaita Region, Ethiopia	Longitudinal community-based monitoring study	Communities receiving community-wide MDA (2018–2020)	Community-wide MDA reduced overall STH infection intensity, but transmission persisted due to incomplete treatment compliance. Individuals who repeatedly missed treatment acted as reservoirs for infection, contributing to reinfection and limiting the potential for transmission interruption. The study emphasizes improving compliance alongside MDA and WASH interventions.
Masaku et al. (2023)	Three endemic counties, Kenya	Mixed-methods cross-sectional study	1,874 school children + parents/guardians (FGDs)	STH prevalence remained 30.8% after seven MDA rounds. Persistent transmission linked to behavioral, environmental, and programmatic factors. Authors recommend strengthening WASH, coverage, and community engagement.
Efon-Ekangouo et al. (2024)	Lomie Health District, East Region, Cameroon	Quantitative cross-sectional study	School-aged children in 10 schools after ~16 years of preventive chemotherapy	STH prevalence remained extremely high at 83.9% after sixteen years of preventive chemotherapy, with many children moderately to heavily infected. Continued transmission was strongly associated with poor hand hygiene and reliance on unsafe river water for drinking.
Gebreyesus et al. (2024)	Southern Ethiopia	Prospective cohort study	984 STH-infected school children following MDA	Albendazole showed high efficacy against hookworm but reduced efficacy against <i>Ascaris lumbricoides</i> and poor efficacy against <i>Trichuris trichiura</i> . Reinfection occurred rapidly, particularly for <i>T. trichiura</i> (52.4% within 8 weeks after cure). Findings highlight the need for alternative treatment strategies and complementary preventive measures beyond MDA alone.
Mogaji et al. (2025)	Ondo State, Nigeria	Cross-sectional impact assessment	2,093 school children after five effective rounds of preventive chemotherapy	Five rounds of albendazole-based preventive chemotherapy substantially reduced STH prevalence and most remaining infections were of low intensity. However, poor access to water, sanitation, and hygiene (WASH), including high rates of open

Author (Year)	Location	Study Design	Subject	Key Findings
				defecation, remained important risk factors. Continued WASH improvements were recommended to sustain gains and achieve elimination targets.

DISCUSSION

The findings highlight a critical public health paradox: despite nearly two decades of preventive chemotherapy in some regions, STH remains highly endemic, driven primarily by environmental and behavioral risk factors that cannot be mitigated by drug administration. This suggests that MDA is insufficient as a single strategy to halt transmission in areas characterized by poor water, sanitation, and hygiene (WASH) conditions. These results are reflected that preventive chemotherapy must be complemented by improvements in environmental sanitation and hygiene behaviors to achieve sustainable STH infection control. (13,14)

The decline in STH prevalence observed in Kenya after several rounds of MDA suggests that preventive chemotherapy can effectively reduce infection rates and morbidity when program coverage is relatively high and implementation is consistent. (15) In contrast, the very high prevalence observed in Cameroon despite 16 years of uninterrupted MDA reflects the limitations of long-term chemotherapy in highly endemic areas with entrenched structural risk factors, including limited access to clean water, use of unsafe river water, and inadequate sanitation facilities. (16) These findings suggest that prolonged reliance on MDA without substantial improvements in living conditions may lead to stagnation in control efforts rather than progressive reduction in transmission. This reinforces the notion that MDA primarily reduces worm burden temporarily but does not address environmental sources of infection. (14,17,18)

Poor WASH conditions emerged as the most consistent factor associated with persistent STH transmission across all included studies. (14–17,19–22) Poor food hygiene practices and exposure to contaminated water sources were significantly associated with infection and inadequate handwashing practices and the use of unsafe water were strongly associated with persistent infection. (20,23,24) These patterns suggest that reinfection occurs rapidly after deworming when children return to environments contaminated with worm eggs or larvae. (25) The role of WASH in maintaining transmission underscores the importance of integrating deworming programs with interventions aimed at improving access to clean water, promoting hand hygiene, encouraging proper disposal of human waste, and reducing environmental contamination. (26–28) Without addressing these determinants, MDA largely serves as a short-term measure that temporarily clears infections but fails to disrupt the transmission cycle. (13,25)

The implications of these findings are particularly relevant for other endemic countries, including Indonesia, where national MDA programs have been implemented for several years but a significant number of children remain at risk of STH infections. (2,18) Similar to the environments reviewed in this study, many communities in Indonesia continue to face challenges related to sanitation, access to clean water, and hygiene practices. (11,29) The experiences of Kenya and Cameroon suggest that while MDA can reduce infection prevalence in the short term, long-term control and potential elimination of STH will require sustained investment in WASH infrastructure, expansion of treatment coverage beyond school-age children, and comprehensive health education to encourage behavior change. (30) Therefore, integrating deworming programs with broader public health and development initiatives may be necessary to achieve meaningful and sustainable reductions in STH transmission. (31)

Utilizing a systematic search strategy with Boolean operators across reputable databases like PubMed and ScienceDirect was a strength of this study. However, several limitations must be noted. The initial search yielded 47 articles, but only eight studies met the inclusion criteria. The heterogeneity of settings across Kenya, Ethiopia, Cameroon, Tanzania and Nigeria

(2018–2025) may limit the generalizability of the findings to other regions. Furthermore, a formal critical appraisal was not performed, and the restriction to English-language publications in specific databases introduces a potential publication bias, as relevant studies from other sources or languages may have been overlooked.

CONCLUSION

In conclusion, this review indicates that while MDA remains an essential component of STH control programs due to its ability to reduce infection burden and morbidity, it is inadequate as a standalone intervention for achieving sustained control or elimination. Persistent transmission in multiple endemic settings highlights the urgent need for integrated control strategies that combine preventive chemotherapy with improvements in water, sanitation, hygiene and health education. Strengthening these complementary interventions is crucial to breaking the cycle of reinfection and achieving long-term reductions in the burden of STH infections among vulnerable populations.

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