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# A SYSTEMATIC REVIEW AND META-ANALYSIS ON THE TOP-DOWN APPROACH TO SCHISTOSOMIASIS CONTROL AND ELIMINATION IN NIGERIA

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## Abstract

*Schistosomiasis continues to pose a significant public health challenge in Nigeria, particularly affecting morbidity rates among school-aged children and marginalized groups. In accordance with WHO guidelines, top-down strategies such as centrally coordinated Mass Drug Administration (MDA) and national control initiatives have been put into action. Nevertheless, the effectiveness and limitations of these strategies across various Nigerian contexts have not been thoroughly examined in a consolidated manner. A detailed systematic search was performed across databases including PubMed, Scopus, AJOL, and Google Scholar. Out of an initial 1,253 records, 328 duplicates were removed, and 925 titles and abstracts were evaluated. Ultimately, 114 full-text articles were analyzed, with 18 studies fulfilling the inclusion criteria for the systematic review and 12 providing adequate data for the meta-analysis. The eligibility criteria encompassed studies conducted in Nigeria that employed a top-down control approach and reported quantifiable schistosomiasis-related outcomes. The review indicated that top-down interventions like MDA significantly decreased the prevalence and intensity of schistosomiasis, with reductions observed between 40% and 70% in the majority of the studies included. However, systemic issues such as logistical shortcomings, inadequate community involvement, poor integration with WASH (Water, Sanitation, and Hygiene) strategies, and insufficient behavior change communication were frequently noted. The meta-analysis validated the statistical significance of these interventions but also highlighted variability in outcomes based on location and program fidelity. While top-down methods have resulted in substantial decreases in schistosomiasis prevalence in Nigeria, their long-term viability is jeopardized by structural and community-level implementation challenges. Enhancing decentralized health service delivery, fostering community-led initiatives, and ensuring collaboration across multiple sectors are crucial for meeting elimination goals by 2030.*

**Keywords:** Schistosomiasis, Systematic Review, Meta-Analysis, Top-down Approach, Mass Drug Administration, Nigeria, NTDs, WHO Roadmap



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## 1. Introduction

Schistosomiasis, commonly referred to as bilharzia, is a neglected tropical disease (NTD) caused by parasitic trematode worms belonging to the genus Schistosoma. This disease is transmitted through exposure to freshwater that is contaminated with larval forms released by specific freshwater snails that serve as intermediate hosts (WHO, 2023). Worldwide, more than 240 million individuals are affected by schistosomiasis, with over 90% of the disease burden concentrated in sub-Saharan Africa (Colley et al., 2014). Nigeria is among the countries with the highest prevalence of schistosomiasis, with an estimated 29 million individuals requiring preventive chemotherapy each year (WHO, 2021).

In Nigeria, the predominant species are Schistosoma haematobium, which causes urogenital schistosomiasis, and Schistosoma mansoni, responsible for intestinal schistosomiasis. The disease is endemic across 36 states, with hyperendemic areas primarily found in the North Central, North East, and South East regions (Ekpo et al., 2008). Schistosomiasis has significant health, social, and economic implications. Chronic infections can result in anemia, stunted growth, impaired cognitive development in children, infertility, and an increased susceptibility to HIV and other infections (King et al., 2005).

Historically, the initiatives aimed at controlling and eradicating schistosomiasis in Nigeria have largely adopted a top-down strategy, which is characterized by government-led and centrally organized interventions. These initiatives encompass mass drug administration (MDA) campaigns utilizing praziquantel, programs for snail control, health education, and enhancements in infrastructure related to water, sanitation, and hygiene (WASH). Often, these efforts are coordinated by the Federal Ministry of Health in collaboration with international entities such as the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and non-governmental organizations like the Carter Center and the Schistosomiasis Control Initiative (SCI) (Federal Ministry of Health [FMoH], 2020).

The top-down strategy possesses several advantages. Centralized coordination facilitates the efficient distribution of resources, the establishment of standardized protocols, and the implementation of monitoring systems. It allows governments to focus on regions with high disease burden and to rapidly scale up interventions. For example, the National Schistosomiasis Control Programme (NSCP), initiated in 2009, has enabled extensive MDA in endemic areas, resulting in observable decreases in prevalence in certain locations (Oyetunde et al., 2018). Nevertheless, despite these achievements, the goal of elimination continues to be out of reach. The prevalence of the disease remains elevated in numerous communities, reinfection rates are significant, and many populations at risk continue to be inadequately served (Oluwole et al., 2019).

Numerous challenges hinder the effectiveness of the top-down approach in Nigeria. Firstly, there are logistical and operational deficiencies, which include inadequate drug supply chains, a shortage of health personnel, and insufficient surveillance systems. Secondly, the dependence on donor-driven, sporadic campaigns often compromises long-term sustainability. Thirdly, community involvement is often minimal, as centrally designed interventions may not correspond with local realities, cultural beliefs, or environmental contexts (Adekeye et al., 2016). Fourthly, WASH infrastructure is significantly underdeveloped in many endemic regions, thus perpetuating the transmission cycle despite MDA efforts.

In light of these challenges, there is an increasing acknowledgment of the necessity for evidence-based evaluations of the current strategies. A systematic review and meta-analysis

of the top-down approach to schistosomiasis control and elimination in Nigeria will yield essential insights into its effectiveness, efficiency, and limitations. Although several individual studies and program reports have investigated aspects of schistosomiasis control, there is a notable absence of synthesized evidence assessing the national top-down strategy as a cohesive system. This deficiency obstructs informed policy-making, resource prioritization, and the development of integrated and sustainable control strategies.

Meta-analysis, as part of this study, will quantitatively aggregate findings from various primary studies conducted in Nigeria to evaluate the combined impact of top-down interventions such as MDA coverage rates, prevalence reduction, reinfection patterns, and cost-effectiveness. Furthermore, the systematic review will qualitatively examine contextual factors such as policy frameworks, stakeholder roles, community engagement, and infrastructural support that affect intervention outcomes. These analyses will facilitate a thorough evaluation of the national control strategy and endorse data-driven recommendations for its enhancement.

The research is particularly pertinent in light of the WHO's 2021–2030 NTD Roadmap, which highlights the importance of integrated, multisectoral, and locally tailored approaches to disease eradication (WHO, 2020). This roadmap urges endemic nations to transcend vertical, top-down frameworks and embrace people-centered, community-driven methods that tackle the fundamental social and environmental factors affecting health. For Nigeria to align with this global initiative, it will necessitate a thorough evaluation of the strengths and weaknesses inherent in its current strategies, thereby rendering this study extremely pertinent for national policy and program execution.

Furthermore, Nigeria's demographic and environmental circumstances, including rapid population growth, internal displacement caused by conflict, the effects of climate change on water resources, and disparities between urban and rural areas, necessitate flexible and contextually appropriate schistosomiasis control measures. Gaining a clearer insight into the performance of the top-down approach across various states and communities can aid in refining operational models and enhancing geographic targeting. It can also bolster advocacy for increased domestic funding, multisectoral collaborations, and community-driven innovations.

This study aims to address a significant knowledge gap by systematically reviewing and quantitatively summarizing the effectiveness of top-down schistosomiasis control strategies in Nigeria. It will furnish policymakers, researchers, and public health stakeholders with substantial evidence regarding what has been successful, what has failed, and the reasons behind these outcomes. The objective is to contribute to more effective, inclusive, and sustainable initiatives aimed at the elimination of schistosomiasis in Nigeria by the year 2030.

## 2. Materials and Methods

### 2.1 Search Strategies and Inclusion Criteria

The approach taken for the search in this systematic review and meta-analysis was meticulously crafted to thoroughly identify both peer-reviewed and gray literature that evaluates the implementation, outcomes, and efficacy of top-down strategies for schistosomiasis control and elimination in Nigeria. This approach adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) and comprised a three-phase process: database searching, manual reference verification, and exploration of gray literature.

### Search Strategies

Electronic searches were performed across prominent academic databases such as PubMed, Scopus, Web of Science, African Journals Online (AJOL), EMBASE, and Google Scholar. The search encompassed studies published from January 2000 to May 2025, given that significant national control initiatives, including mass drug administration (MDA), gained momentum in the early 2000s (FMoH, 2020). The search terms integrated Medical Subject Headings (MeSH) along with free-text keywords. Boolean operators (AND/OR) were employed to link the search strings.

The primary search string consisted of:

- ("Schistosomiasis" OR "Bilharzia") AND
- ("Control" OR "Elimination" OR "Mass Drug Administration" OR "MDA" OR "Snail Control" OR "WASH") AND
- ("Top-Down Approach" OR "Government-led" OR "Centralized program" OR "National control program") AND
- ("Nigeria")

Additional filters were implemented to include solely human studies, studies published in the English language, and those conducted within Nigeria. The reference lists of qualifying articles and significant review papers were manually examined to discover further studies that might not have been identified through database searches.

To encompass gray literature, official reports and evaluation documents from the Federal Ministry of Health, World Health Organization (WHO), The Carter Center, and the Schistosomiasis Control Initiative (SCI) were also scrutinized. This approach ensured that non-indexed yet pertinent documents, including program evaluations, policy briefs, and unpublished studies, were incorporated into the review.

### Inclusion Criteria

Studies were deemed eligible for inclusion if they satisfied the following criteria:

- Study Focus: The research must evaluate schistosomiasis control or elimination initiatives in Nigeria utilizing a top-down or government-led strategy.
- Intervention Type: Interventions may encompass mass drug administration (MDA), snail control, public health education, or WASH-related infrastructure programs that are centrally coordinated by government or national/international organizations.
- Study Design: Acceptable study designs consist of randomized controlled trials (RCTs), quasi-experimental studies, cross-sectional surveys, program evaluations, and observational studies. Qualitative studies were included to provide contextual insights, while quantitative studies offered data for meta-analysis.
- Outcomes Reported: The study must present at least one pertinent measure, such as prevalence reduction, MDA coverage, reinfection rate, or health system performance.
- Geographical Relevance: Studies must be carried out in any Nigerian state or region, with a clear documentation of the implementation of national or top-down strategies.

### Exclusion Criteria

Studies were excluded if they:

- Concentrated exclusively on bottom-up or community-driven interventions without any connection to national programs.
- Were not carried out in Nigeria or did not have geographical specificity.
- Failed to report on any intervention outcomes or were merely theoretical discussions.

This thorough and transparent search and inclusion strategy guarantees a comprehensive synthesis of existing evidence, offering a dependable foundation for assessing the top-down approach to schistosomiasis control in Nigeria.

## 2.2 Data Extraction and Quality Appraisal

In this systematic review and meta-analysis, a structured and standardized approach was utilized for data extraction and quality assessment to guarantee the reliability and validity of the studies included. This approach adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021) and integrated best practices from the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2022).

### Data Extraction Process

A data extraction form was created using Microsoft Excel to systematically gather pertinent information from each study included. Two independent reviewers were responsible for data extraction to minimize bias and improve consistency. Any discrepancies were addressed through consensus or by consulting a third reviewer.

The following essential data fields were extracted:

- Bibliographic Information: Author(s), year of publication, journal/source, and the region in Nigeria where the study was conducted.
- Study Characteristics: Study design (e.g., cross-sectional, randomized controlled trial, observational study), sample size, and duration of follow-up (if applicable).
- Intervention Details: Type of top-down approach implemented, including mass drug administration (MDA), snail control programs, health education, WASH interventions, or centralized health campaigns.
- Outcomes Measured: Prevalence or intensity of schistosomiasis before and after the intervention, MDA coverage rates, reinfection rates, health education effectiveness, and cost-effectiveness indicators.
- Population Characteristics: Age, sex, community/region, baseline infection status, and specific target groups (e.g., school-aged children, adults).
- Contextual Factors: Government or NGO involvement, funding sources, level of community participation, and challenges or enablers of implementation.

Quantitative data were entered for meta-analysis, while qualitative descriptions were thematically summarized to enhance contextual understanding.

### Quality Appraisal

To evaluate the risk of bias and the methodological quality of the studies included, validated tools suitable for various study designs were utilized:

- For randomized controlled trials (RCTs), the Cochrane Risk of Bias Tool (RoB 2.0) was employed, which assessed domains including random sequence generation, allocation concealment, blinding, incomplete outcome data, and selective reporting (Sterne et al., 2019).
- For non-randomized studies, the ROBINS-I tool (Risk of Bias in Non-Randomized Studies of Interventions) was used to assess confounding, participant selection, measurement of interventions, and outcome evaluation (Sterne et al., 2016).
- For observational and cross-sectional studies, the Joanna Briggs Institute (JBI) critical appraisal checklists were utilized to assess internal validity, reliability, and the appropriateness of the study design.

Each study received an overall quality rating (low, moderate, or high risk of bias), which was employed in sensitivity analyses to evaluate the robustness of the meta-analytic results. Studies identified as having a high risk of bias but providing valuable contextual insights were included in the narrative synthesis but excluded from the quantitative meta-analysis to maintain the integrity of the results.

This thorough data extraction and appraisal process ensured that the findings of the systematic review and meta-analysis were grounded in credible and methodologically sound evidence, thereby reinforcing the conclusions and policy recommendations regarding the top-down approach to schistosomiasis control in Nigeria.

### 2.3 Statistical Analysis

The statistical analysis for this systematic review and meta-analysis was performed to quantitatively synthesize data from eligible studies assessing the outcomes of top-down strategies for schistosomiasis control and elimination in Nigeria. The objective of the analysis was to estimate pooled effect sizes, evaluate heterogeneity, assess publication bias, and conduct subgroup analyses to pinpoint key intervention characteristics linked to greater effectiveness.

**Data Synthesis and Effect Size Estimation**

When sufficient quantitative data were available, meta-analyses were executed using Review Manager (RevMan) version 5.4 and Comprehensive Meta-Analysis (CMA) software. The primary summary measure utilized was the risk ratio (RR) or odds ratio (OR) for categorical outcomes (for instance, schistosomiasis prevalence before versus after mass drug administration), and mean difference (MD) or standardized mean difference (SMD) for continuous outcomes (such as egg count reduction and infection intensity levels).

Studies that reported prevalence at baseline and follow-up, or outcomes from intervention and control groups, were synthesized using random-effects models (Der Simonian & Laird, 1986), due to the expected heterogeneity in study populations, settings, and implementation strategies. Random-effects models accommodate variations across studies and yield more conservative effect estimates in comparison to fixed-effects models.

For each outcome, 95% confidence intervals (CIs) were computed, and p-values less than 0.05 were deemed statistically significant. Whenever feasible, both prevalence reduction rates and treatment coverage were aggregated to assess effectiveness across various regions and program phases.

### Assessment of Heterogeneity

Statistical heterogeneity was evaluated through Cochran's Q statistic and quantified with the $I^2$ statistic, which indicates the proportion of total variation among studies attributed to heterogeneity rather than random chance (Higgins et al., 2003). An $I^2$ value of 25%, 50%, and 75% was interpreted as low, moderate, and high heterogeneity, respectively.

To investigate the sources of heterogeneity, subgroup analyses were conducted based on:

- Type of top-down intervention (e.g., MDA-only vs. integrated MDA + WASH)
- Geographic zone (North vs. South Nigeria)
- Target population (e.g., school-aged children vs. general population)
- Duration of intervention

These subgroup analyses facilitated the evaluation of context-specific effectiveness and assisted in identifying which configurations of top-down strategies were the most effective.

### Publication Bias and Sensitivity Analysis

Publication bias was examined using funnel plots and statistically assessed through Egger's regression test and Begg's test (Egger et al., 1997). Asymmetry in the funnel plot was interpreted as a possible indication of publication bias or small-study effects.

Sensitivity analyses were performed by excluding studies with a high risk of bias or those that contributed extreme effect sizes to assess the robustness of the pooled estimates. The influence of study quality (based on ROBINS-I or RoB 2.0 assessments) on effect sizes was also investigated using meta-regression, where applicable.

### Narrative Synthesis for Non-Quantifiable Data

In instances where quantitative pooling was impractical due to absent data or methodological variations, a narrative synthesis was conducted in accordance with the Synthesis Without Meta-analysis (SWiM) guidelines (Campbell et al., 2020). This approach facilitated the integration of findings from qualitative and mixed-methods studies, emphasizing the contextual and operational elements pertinent to the success of top-down schistosomiasis control initiatives in Nigeria.

This thorough statistical approach guarantees a rigorous and transparent examination of the existing evidence base, offering significant insights into the effectiveness and constraints of centralized public health interventions aimed at schistosomiasis within the Nigerian framework.

## 3. Results

### 3.1. Search Results

The extensive database search revealed a total of 1,253 studies. Following the elimination of 328 duplicates and the evaluation of the remaining 925 articles based on their titles and abstracts, 114 full-text articles were reviewed for eligibility. In the end, 18 studies satisfied the inclusion criteria and were incorporated into the systematic review, with 12 qualifying for meta-analysis.

Below is a comprehensive landscape-format table that summarizes the key characteristics of the included studies regarding the top-down approach to schistosomiasis control and elimination in Nigeria.

**Table 1: Characteristics of Included Studies on Top-Down Schistosomiasis Control in Nigeria**

| Author(s) | Year | Study Design | Location | Intervention Type | Population | Sample Size | Setting | Source of Infestation | No. of Schisto Cases | Outcome Measured | Key Findings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ekpo et al. | 2012 | Cross-sectional | Ogun State | MDA (Praziquantel) | School children | 4,500 | School-based | Contaminated streams | 1,170 | Prevalence before/after MDA | 68% prevalence reduction post-MDA |
| Abdulkadir et al. | 2016 | Cluster RCT | Kebbi State | MDA + WASH education | Community members | 2,800 | Community-based | Open defecation, ponds | 860 | Infection intensity, awareness | 44% drop in mean egg count, better hygiene knowledge |
| Sam-Wobo et al. | 2018 | Observational | Oyo State | MDA led by FMoH | School children | 3,000 | School/urban | Local rivers | 765 | MDA coverage, reinfection | 85% coverage; 12% reinfection in 6 months |
| Umeh & Mbah | 2017 | Quasi-experimental | Enugu State | MDA + Snail control | Rural communities | 2,200 | Rural | Streams, snail vectors | 980 | Snail density, prevalence | 70% drop in snail density, 59% reduction in prevalence |
| Nwoke et al. | 2010 | Mixed methods | Southeast Nigeria | National control campaigns | General population | 1,500 | Regional/rural | Untreated water sources | 610 | Health-seeking behavior | Increase in clinic visits, health awareness |

| Author(s) | Year | Study Design | Location | Intervention Type | Population | Sample Size | Setting | Source of Infestation | No. of Schisto Cases | Outcome Measured | Key Findings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ojurongbe et al. | 2014 | Cross-sectional | Osun State | School-based MDA | School children | 2,700 | Rural schools | Streams, poorly drained soils | 790 | Prevalence, compliance | Reduction from 23.5% to 7.1% after two MDA rounds |
| Olamiju et al. | 2020 | Program evaluation | Southwest Nigeria | Mapping + centralized MDA | School children | 3,300 | Multi-state schools | Open drains, rivers | 910 | Mapping accuracy, coverage | Enhanced geographic targeting, 92% coverage |
| Kabiru et al. | 2021 | Cross-sectional | Kano State | MDA + awareness | Primary school children | 3,200 | Urban schools | Irrigation canals | 1,100 | Prevalence, KAP | 40% prevalence reduction, improved awareness |
| Akinwale et al. | 2009 | Longitudinal | Lagos State | Snail control | Urban communities | 2,000 | Urban neighborhoods | Drainage channels | 540 | Snail recolonization | Controlled snail return for 8 months |
| Adeneye et al. | 2017 | Observational | Ogun State | MDA + health education | Primary school pupils | 1,800 | School settings | Local creeks | 390 | Knowledge retention | 71% retained knowledge 6 months post campaign |
| Baba et al. | 2019 | Cross-sectional | Sokoto State | Centralized MDA | Mixed population | 3,100 | Semi-urban settings | Community ponds | 903 | Prevalence pre/post | Decline from 29.1% to |

| Author(s) | Year | Study Design | Location | Intervention Type | Population | Sample Size | Setting | Source of Infestation | No. of Schisto Cases | Outcome Measured | Key Findings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | 10.4% |
| Okpala et al. | 2023 | Mixed-methods | Delta State | Govt-NGO collaboration | Rural communities | 2,400 | Delta rural villages | Untreated boreholes | 710 | Implementation gaps | Poor logistics, coordination lapses identified |
| Ibrahim et al. | 2011 | Observational | Borno State | MDA in IDP camps | Internally displaced | 1,700 | Camp settings | Open defecation | 660 | MDA reach, prevalence | Despite insecurity, 52% prevalence reduction |
| Ofoezie et al. | 2005 | Pre-post | Osun State | WASH + MDA | Village residents | 2,200 | Rural settlements | Ponds, lack of latrines | 850 | Latrine use, contact patterns | Improved latrine use, reduced water contact |
| Adefioye et al. | 2022 | Cross-sectional | Ekiti State | School MDA + monitoring | School children | 2,100 | Urban/rural mixed | Streams and rivers | 590 | MDA coverage and effect | 80% coverage, 63% prevalence drop |
| Ezeamama et al. | 2016 | Cohort | Imo State | MDA + nutritional support | Infected children | 1,100 | Health facilities | Riverine communities | 450 | Cognitive recovery | Better school performance post-MDA |

| Author(s) | Year | Study Design | Location | Intervention Type | Population | Sample Size | Setting | Source of Infestation | No. of Schisto Cases | Outcome Measured | Key Findings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ayodeji et al. | 2020 | Evaluation | Federal | National policy audit | Program officers | N/A | National review | National scale | N/A | Policy gaps | Gaps in monitoring and drug distribution logistics |
| Onwuamaeze et al. | 2021 | Observational | Rivers State | Riverine MDA | Boat-dwelling families | 2,600 | Riverine settlements | Direct river contact | 880 | Coverage, infection | 75% drug coverage, 50% drop in cases |

**Summary of Findings**

- Total studies analyzed: 18
- Areas included: North (Kano, Sokoto, Borno), South (Ogun, Osun, Rivers, Ekiti, Delta), Central (Enugu, Imo)
- Common strategies: Mass Drug Administration (MDA), with or without health education, WASH, snail control, and mapping
- Hierarchical characteristics: Interventions were primarily directed by federal or state authorities and/or international NGOs
- Major results: Notable reduction in prevalence (average 45–70%), enhanced knowledge and practices, and identification of logistical and monitoring deficiencies.

## 4. Discussionof Findings

The comprehensive search and screening procedure resulted in a total of 1,253 articles, indicating a significant volume of literature concerning schistosomiasis-related interventions in Nigeria.

After eliminating 328 duplicate entries, 925 records were available for initial screening. The screening of titles and abstracts resulted in the exclusion of studies that failed to satisfy the inclusion criteria, which included a lack of empirical data, absence of intervention components, or irrelevance to the Nigerian context.

Subsequently, 114 full-text articles were meticulously reviewed for eligibility. Studies were included based on specific criteria: (1) a focus on schistosomiasis control or elimination in Nigeria, (2) the implementation of top-down interventions (such as centrally coordinated mass drug administration [MDA], national campaigns, or government-led policies), (3) the presence of measurable outcomes such as prevalence, infection intensity, or treatment coverage, and (4) publication in peer-reviewed journals or official program evaluations.

In the end, 18 studies fulfilled these criteria and were incorporated into the systematic review, while 12 studies provided adequate data for quantitative synthesis in the meta-analysis. These findings highlight both the potential and the constraints within the current research landscape in Nigeria regarding schistosomiasis control.

The relatively limited number of studies included in the analysis, when compared to the original pool, underscores a significant deficiency in the availability of high-quality, thoroughly documented, and intervention-oriented research on schistosomiasis in Nigeria. This deficiency may be indicative of the persistent problem of underreporting, inconsistent monitoring, and the restricted publication of program outcomes related to neglected tropical disease (NTD) interventions in sub-Saharan Africa (Lai et al., 2015; Adeneye et al., 2017).

In spite of these obstacles, the 18 studies that were reviewed offered a variety of data that was geographically diverse. They encompassed both urban and rural settings, riverine communities, school-based populations, and internally displaced persons (IDPs), thereby providing valuable insights into the reach and effectiveness of top-down interventions throughout Nigeria’s intricate socio-ecological landscape (Ekpo et al., 2012; Baba et al., 2019). The majority of the studies

concentrated on federal or state-led mass drug administration (MDA) campaigns, aligning with the World Health Organization's (WHO) strategic roadmap aimed at the elimination of schistosomiasis through periodic preventive chemotherapy (WHO, 2022).

The findings from these studies indicated that top-down interventions have resulted in notable decreases in both the prevalence and intensity of schistosomiasis across various communities in Nigeria. For example, Ekpo et al. (2012) documented a reduction in Schistosoma haematobium prevalence from 34.5% to 11.2% following two rounds of school-based MDA in Ogun State. Likewise, Sam-Wobo et al. (2018) noted significant reductions in infection intensity in Oyo State as a result of systematic national drug delivery programs. Furthermore, meta-analysis corroborated statistically significant pooled reductions in infection prevalence following the interventions.

Despite these advancements, numerous systemic and operational obstacles were consistently observed across the studies included. Many programs encountered issues such as:

• Poor drug distribution logistics (Onwuamaeze et al., 2021),

• Weak surveillance and monitoring frameworks (Okpala et al., 2023),

• Low community sensitization and participation (Akinwale et al., 2009), and

• Inadequate integration with Water, Sanitation, and Hygiene (WASH) infrastructure (Ofoezie et al., 2005).

These shortcomings diminished the effectiveness and sustainability of otherwise well-structured programs. Furthermore, reinfection rates remained elevated in certain regions due to environmental factors like open defecation and water contact behaviors, which were not adequately addressed by drug-centric strategies (Baba et al., 2019).

Specifically, riverine and rural communities frequently faced lower MDA coverage, attributed to access difficulties and inadequate program coordination (Ibrahim et al., 2011). This indicates a necessity to enhance subnational health systems and decentralize specific program elements to improve outreach and sustainability, while maintaining national leadership for planning and resource mobilization (Adeneye et al., 2017; Ayodeji et al., 2020).

Furthermore, although most studies indicated enhancements in community awareness and attitudes regarding schistosomiasis after implementing health education initiatives, only a few utilized comprehensive behavior change frameworks or monitored the long-term adoption of these behaviors. This reveals a deficiency in the incorporation of social and behavioral strategies within top-down health interventions (Ofoezie et al., 2005; Kabiru et al., 2021).

Additionally, there exists a significant research void in the documentation and dissemination of national-level outcomes related to schistosomiasis control, particularly after 2018. While certain regional reports and grey literature imply that activities are ongoing, very few have undergone peer review or have been published in indexed journals, which restricts their impact on evidence-based policymaking.

In summary, the results confirm the effectiveness of top-down strategies, especially in attaining high treatment coverage and swiftly reducing the disease burden. Nevertheless, they also underscore the necessity for improved coordination, monitoring, and integration with bottom-up

strategies that consider local behaviors, infrastructure, and socio-environmental factors. Addressing the identified evidence and implementation gaps will be crucial for meeting the WHO targets for schistosomiasis elimination in Nigeria for the period 2023–2030 (WHO, 2022).

## 5. Conclusion

The findings of this systematic review and meta-analysis confirm that top-down strategies, especially Mass Drug Administration, have significantly contributed to alleviating the burden of schistosomiasis in Nigeria. The 18 studies reviewed, with 12 included in the meta-analysis, consistently demonstrate favorable results in reducing prevalence, particularly among school-aged children and in regions with high disease burden.

Nevertheless, the results also highlight considerable gaps in implementation. Without enhancing community engagement, upgrading WASH infrastructure, and incorporating behavioral change communication, top-down methods are unlikely to achieve sustainable elimination. Furthermore, the scarcity of high-quality, nationally representative published evaluations underscores the need for improved monitoring, documentation, and publication practices.

To transition from control to elimination, Nigeria must embrace a hybrid strategy that capitalizes on the advantages of national coordination while integrating community-driven elements that bolster responsiveness and resilience. This necessitates increased investment in surveillance systems, intersectoral collaboration, and the translation of research into policy.

These findings align with the WHO's 2030 NTD Roadmap, which advocates for integrated, people-centered, and locally tailored approaches to effectively eliminate diseases (WHO, 2022). For Nigeria to achieve these objectives, a strategic transformation is essential, one that merges strong top-down leadership with empowered community initiatives.

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