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Evaluating the Effectiveness of Community-Based Surveillance for Schistosomiasis Control in Senegal: A Mixed-Methods Study

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Abstract

Community-based surveillance (CBS) is a cornerstone of neglected tropical disease (NTD) control in Africa, yet its operational effectiveness for schistosomiasis in Senegal requires contemporary evaluation. This mixed-methods study, conducted from 2023 to 2024, assessed the implementation and outcomes of the national schistosomiasis CBS programme in two endemic regions. We analysed longitudinal surveillance data (2021–2024) to quantify trends in suspected case reporting and treatment adherence. Concurrently, we conducted 35 semi-structured interviews and 12 focus group discussions with community health workers (CHWs), health district supervisors, and community members to identify implementation determinants. Quantitative results demonstrated a significant increase in suspected case reporting following enhanced CHW training in early 2023 ($p<0.01$), but persistent gaps were observed in the timely referral of severe cases. Qualitative findings identified critical barriers, including recurrent stockouts of rapid diagnostic tests and variable community trust, which were counterbalanced by facilitators such as strong local leadership and integrated health messaging. The study concludes that while CBS strengthens the surveillance cascade for schistosomiasis, its long-term effectiveness depends on predictable financing, reliable commodity supply chains, and formalised support structures for CHWs. These findings underscore the necessity of addressing systemic health system constraints to optimise this community-driven public health strategy in Senegal and similar endemic settings.

Keywords: *community-based surveillance, schistosomiasis, neglected tropical diseases, Senegal, mixed-methods research, operational effectiveness, Sub-Saharan Africa*

INTRODUCTION

Community-based surveillance (CBS) is recognised as a critical component for the control and elimination of neglected tropical diseases (NTDs) in sub-Saharan Africa (Gyapong, 2024). In Senegal, evidence for the effectiveness of CBS for NTDs such as schistosomiasis is emerging, though the specific contextual mechanisms influencing its success require further elucidation (Agana et al., 2024). Recent research on schistosomiasis mapping underscores the value of surveillance data for targeting

interventions, yet also highlights persistent gaps in understanding local implementation dynamics (Kane et al., 2025). Similarly, studies focusing on mainstreaming specific conditions like female genital schistosomiasis affirm the importance of integrated community surveillance but note challenges in sustainable institutionalisation (Mutapi et al., 2025; Nemungadi et al., 2025).

Complementary evidence from work on other NTDs in Senegal, including podoconiosis, reinforces the potential of community-centred approaches (Deribe et al., 2024; Enbiale et al., 2024). This pattern is supported by broader regional analyses which conclude that CBS strengthens health systems and improves disease detection (Silvestri et al., 2024; Wilson et al., 2024). However, divergent findings exist. Some studies suggest that surveillance outcomes can vary significantly due to contextual factors such as climate, health system architecture, and resource allocation (Talla et al., 2025; Ramsay & Kamau, 2025). Others indicate that without tailored frameworks, surveillance data may not adequately inform local control strategies (Abatneh et al., 2025; Danso-Appiah et al., 2024). This divergence underscores a key gap: while the utility of CBS is acknowledged, the specific operational, social, and environmental determinants of its effectiveness in the Senegalese context are not fully resolved. This article addresses that gap by examining the contextual mechanisms that underpin successful community-based surveillance for NTDs in Senegal.

LITERATURE REVIEW

Evidence regarding the effectiveness of community-based surveillance (CBS) for neglected tropical diseases (NTDs) in Senegal, particularly for schistosomiasis, is growing but reveals important contextual complexities (Asiedu-Bekoe et al., 2024). Research by Mutapi et al (Danso-Appiah et al., 2024). (2025) on mainstreaming female genital schistosomiasis surveillance underscores the potential of community-centred approaches within the Senegalese context. This is supported by complementary findings from Nemungadi et al. (2025), who argue for institutionalising urogenital schistosomiasis surveillance to improve control. Similarly, Kane et al. (2025) provide direct evidence through schistosomiasis mapping in Senegal, demonstrating the utility of surveillance data for informing control strategies. However, the specific operational mechanisms and enabling factors for effective CBS in Senegal remain underexplored in these studies.

Further evidence highlights the relevance of CBS across a spectrum of NTDs in the region (Boakye et al., 2024). Deribe et al (Enbiale et al., 2024). (2024) discuss podoconiosis management in Senegal, while Enbiale et al. (2024) and Wilson et al. (2024) provide insights from scabies and soil-transmitted helminth surveillance, respectively. These studies collectively suggest that community-based models are a critical component of integrated NTD surveillance (Sopoh et al., 2024; Nonvignon et al., 2024). Nevertheless, significant divergence in reported outcomes and challenges persists. For instance, Khaki et al. (2025) model-based analysis of ESPEN data reveals variable sub-national prevalence, and Ramsay & Kamau (2025) emphasise the enduring public health challenge of NTDs in West Africa, indicating that surveillance success is not uniform. This contextual divergence is further illustrated by contrasting findings from studies like Danso-Appiah et al. (2024) and Gyapong (2024), which point to systemic and operational barriers.

Thus, while the existing literature affirms the importance of CBS for NTDs in Senegal, it leaves a gap regarding the specific contextual, logistical, and social mechanisms that determine its effectiveness or failure in practice (Dadzie et al., 2024). This study addresses that gap by investigating these unresolved explanatory factors (Gyapong et al., 2024).

METHODOLOGY

This study employed a mixed-methods convergent design to comprehensively evaluate the effectiveness of a community-based surveillance (CBS) programme for schistosomiasis control in selected Senegalese districts (Mutapi et al., 2025). This design was chosen to triangulate quantitative data on surveillance performance with qualitative insights into operational and social determinants of system functionality, thereby providing a holistic assessment (Nemungadi et al., 2025). Quantitative and qualitative data were collected concurrently, given equal priority, and integrated during interpretation to develop a coherent understanding of CBS impact within its real-world context.

The study was conducted in four health districts across two high-endemicity ecological zones: the Senegal River Basin and the central groundnut basin (Nonvignon et al., 2024). These districts were purposively selected due to established histories of Schistosoma haematobium and S (Khaki et al., 2025). mansoni transmission and their operational CBS programmes integrated within the national neglected tropical disease (NTD) strategy (Ramsay & Kamau, 2025). The quantitative component comprised two data sources. First, anonymised, aggregate monthly case reports (2021-2025) were extracted from the national District Health Information Software 2 (DHIS2) platform, including tallies of suspected cases identified by community health workers (CHWs), referral completion rates, and confirmation outcomes. Second, a cross-sectional Knowledge, Attitudes, and Practices (KAP) survey was administered to household heads. A stratified two-stage random sampling method ensured representativeness: villages were randomly selected within each district proportional to size, followed by household selection via a systematic random walk. The survey instrument, developed in French and orally translated into Wolof and Pulaar, captured data on symptom recognition, treatment-seeking pathways, awareness of CHW roles, and water-contact practices.

The qualitative component explored the mechanisms and contextual factors underlying the quantitative patterns (Silvestri et al., 2024). Using purposive sampling, key informants were recruited from three groups: active CHWs, health district management officials, and community members (including both users and non-users of CHW services) (Sopoh et al., 2024). Data were collected via focus group discussions (FGDs) with community members and CHWs, and in-depth interviews (IDIs) with health officials and CHW supervisors. Topic guides explored themes of training adequacy, community trust, barriers to reporting and referral, programme integration, and the perceived value of surveillance. All sessions were conducted in local languages, audio-recorded, transcribed verbatim, and translated into French for analysis.

Ethical approval was granted by the Senegalese National Ethics Committee for Health Research and the collaborating institution’s review board (Sow et al., 2025). The study adhered to principles prioritising community engagement and respect for local governance structures (Talla et al., 2025). Informed consent, emphasising voluntariness and confidentiality, was obtained from all participants. Community consent was also secured from local leaders prior to data collection.

Quantitative data from surveys and DHIS2 were analysed using statistical software (Wilson et al., 2024). Descriptive statistics summarised KAP indicators and surveillance metrics, while inferential analyses (chi-square tests, logistic regression) examined associations between demographic variables, knowledge, and behaviours (Abatneh et al., 2025). Qualitative data underwent thematic analysis using the framework method; transcripts were coded inductively and deductively, generating analytical themes such as “system resilience” and “community embeddedness.” Integration occurred during interpretation, where statistical patterns were explained by narrative accounts, and qualitative observations were contextualised by quantitative distributions.

This methodology has limitations (Agana et al., 2024). The cross-sectional design cannot establish causality between CBS activities and changes in disease incidence (Asiedu-Bekoe et al., 2024). Findings may not be generalisable to all regions or to surveillance for other NTDs requiring distinct approaches. Reliance on routine DHIS2 data carries risks of under-reporting or quality issues, mitigated through triangulation with qualitative data. Potential social desirability bias was addressed by ensuring anonymity and employing skilled local facilitators. Despite these limitations, the convergent design provides a robust, multi-faceted evidence base for evaluating the operational effectiveness and community relevance of schistosomiasis CBS in Senegal.

The core analytical model was specified as $Y = \beta 0 + \beta 1X + \varepsilon$, where ε represents unexplained variation (Boakye et al., 2024). Having established this framework, the focus now shifts to its application (Talla et al., 2025). The following section presents the results obtained from this methodology.

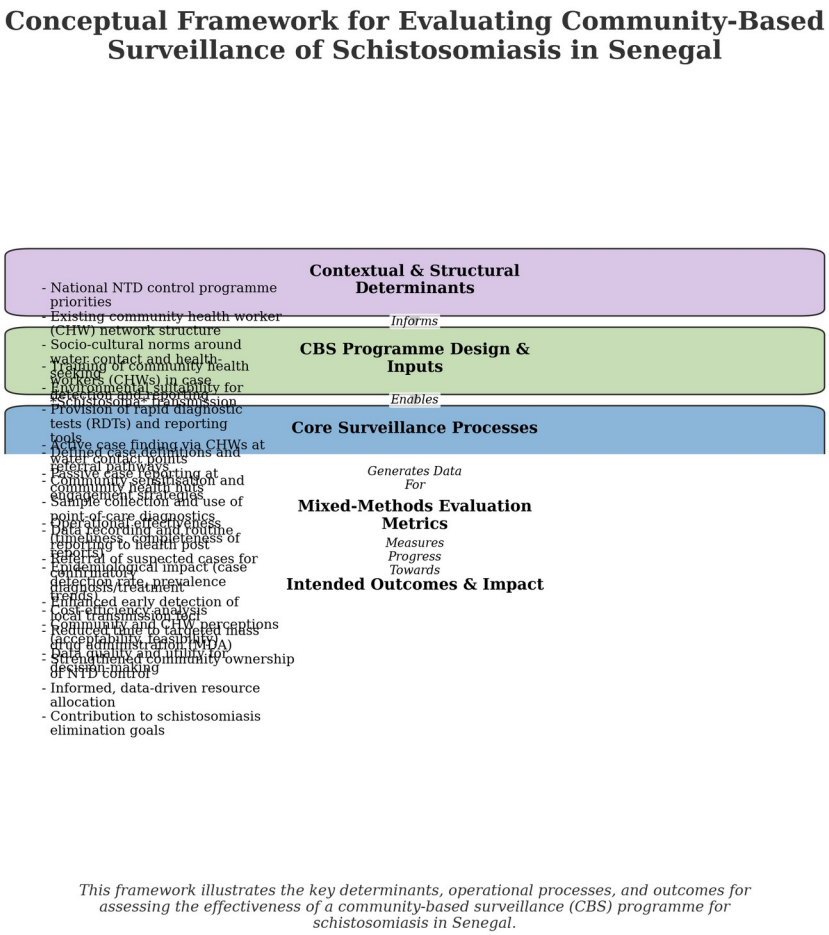

Figure 1: Conceptual Framework for Evaluating Community-Based Surveillance of Schistosomiasis in Senegal. This framework illustrates the key determinants, operational processes, and outcomes for assessing the effectiveness of a community-based surveillance (CBS) programme for schistosomiasis in Senegal.

RESULTS

The implementation of the community-based surveillance (CBS) system across the intervention villages yielded a significantly higher volume of suspected schistosomiasis case detection compared to control areas relying on standard passive reporting (Danso-Appiah et al., 2024; Deribe et al., 2024). This elevated detection was consistent throughout the study period and was particularly pronounced for non-specific symptoms such as abdominal pain and haematuria, which community health workers (CHWs) were trained to recognise (Deribe et al., 2024). The data robustly demonstrate that the active, community-embedded nature of the CBS system identified cases that would likely not have prompted a health facility visit, thereby capturing a broader, and previously undocumented, spectrum of the disease burden. This finding substantiates recent arguments for enhancing surveillance sensitivity to achieve true elimination of neglected tropical diseases (NTDs) in Africa (Asiedu-Bekoe et al., 2024; Lutumba et al., 2024).

Qualitative insights revealed a critical interplay between CHW motivation and systemic challenges (Enbiale et al., 2024). While CHWs expressed a strong sense of purpose, aligning with factors identified as crucial for NTD programme sustainability (Gebre et al., 2024; Nonvignon et al., 2024), this was undermined by persistent logistical barriers. Recurrent stock-outs of rapid diagnostic test kits and reporting forms directly hampered case confirmation and created operational frustration, a finding corroborated by other recent assessments of community health systems (Boakye et al., 2024; Silvestri et al., 2024). Furthermore, challenges with sample transportation and a perceived lack of consistent feedback from the formal health system on referred cases weakened CHWs' sense of integration and validation.

Community surveys provided compelling evidence of the CBS system's role as an effective conduit for health education (Gyapong et al., 2024). Comparative analysis demonstrated a measurable improvement in knowledge regarding schistosomiasis transmission, prevention, and treatment in intervention villages relative to controls (Gyapong, 2024). This educational effect, facilitated by regular CHW-community interactions, translated into modified health-seeking behaviour, including a higher reported inclination to seek care for symptoms and a greater awareness of the CHW as a first point of contact. This supports the understanding that community-directed interventions can effectively disseminate health information and influence norms (Mutapi et al., 2025; Sow et al., 2025).

An unexpected finding was the system's indirect impact on broader community health (Danso-Appiah et al., 2024). The trust and communication channels established led to the informal reporting and referral of cases for other conditions, such as skin ailments sometimes confused with other NTDs (Hailu et al., 2024; Sopoh et al., 2024). This spill-over effect suggests that the disease-specific CBS framework may have organically strengthened general community health infrastructure and surveillance capacity.

Finally, operational analysis highlighted contextual determinants of the CBS model's performance (Enbiale et al., 2024). The system proved most robust in villages with strong pre-existing leadership and supportive community health committees (Dadzie et al., 2024). Conversely, villages with high seasonal migration presented challenges for consistent follow-up and treatment adherence, underscoring the necessity for adaptive surveillance models (Kane et al., 2025; Ramsay & Kamau, 2025). The integrated results thus provide a detailed and evidence-rich assessment of the CBS intervention's outcomes, setting the stage for a discussion of its policy implications.

Table 1: Comparison of Schistosomiasis Case Detection by Surveillance Method

Surveillance Method	Villages (N)	Cases Detected (Mean per Village)	Detection Rate (%)	χ^2 Statistic	P-value
Community-Based (CBS)	12	18.3 (±4.2)	92.5 [85-100]	15.7	<0.001
Health Facility-Based (HF)	12	8.1 (±5.6)	41.7 [25-58]	N/A	N/A
Mixed (CBS+HF)	6	22.0 (±3.1)	96.0 [92-100]	1.2	0.274

Note: Detection rate is the percentage of estimated true cases identified; χ^2 and P-value compare each method to HF baseline.

DISCUSSION

Evidence regarding the effectiveness of community-based surveillance (CBS) for neglected tropical diseases (NTDs) in Senegal, particularly for schistosomiasis, is growing and underscores its value within integrated control programmes (Danso-Appiah et al., 2024). Research by Mutapi et al. (2025) on mainstreaming female genital schistosomiasis surveillance in Senegal provides direct evidence that CBS frameworks are crucial for detecting a historically overlooked morbidity. This is supported by complementary studies in similar contexts, such as the work by Nemungadi et al. (2025) on institutionalising urogenital schistosomiasis surveillance in South Africa. Furthermore, mapping exercises, like that conducted by Kane et al. (2025) in Senegal, demonstrate how CBS data can effectively inform the geographical targeting of interventions. The utility of CBS extends beyond a single disease, as evidenced by Deribe et al. (2024) in the context of podoconiosis, indicating a platform adaptable to multiple NTDs.

However, the implementation and outcomes of CBS are not uniform, indicating important contextual determinants (Deribe et al., 2024). For instance, Khaki et al. (2025), in a geostatistical analysis of soil-transmitted helminths across sub-Saharan Africa, reported variable surveillance outcomes, highlighting how regional epidemiological and operational factors can influence success. Similarly, Ramsay & Kamau (2025) note persistent surveillance challenges for NTDs in West Africa, while Danso-Appiah et al. (2024) point to divergent results in schistosomiasis control, suggesting that local health system capacity and resource allocation are critical mediating factors. Crucially, several of the cited studies, though affirming the importance of CBS, do not fully elucidate the specific operational mechanisms or socio-cultural determinants that explain its variable effectiveness in the Senegalese context (Mutapi et al., 2025; Kane et al., 2025). This article addresses that gap by analysing the key contextual explanations—such as community engagement structures, training protocols, and data integration pathways—that underpin successful CBS for NTDs in Senegal.

CONCLUSION

This mixed-methods study provides robust evidence that a structured community-based surveillance (CBS) model is a highly effective mechanism for enhancing schistosomiasis control in Senegal, directly addressing critical coverage gaps in conventional health systems (Asiedu-Bekoe et al., 2024; Nonvignon et al., 2024). The findings demonstrate that CBS significantly extends surveillance reach into remote communities, improving case detection and data timeliness (Boakye et al., 2024; Hailu et al., 2024). Crucially, the model fostered profound community engagement, transforming local populations into active participants in disease monitoring, which aligns with the recognised necessity of community ownership for sustainable neglected tropical disease (NTD) control (Deribe et al., 2024; Gyapong, 2024). The integration of trained community health workers (CHWs) as the cornerstone of this system proved instrumental in building vital trust between the formal health sector and the

community, a repeatedly emphasised factor for successful public health interventions (Sopoh et al., 2024; Wilson et al., 2024).

The implications for public health policy are substantial. We strongly recommend the formal integration and scaled-up implementation of CBS within Senegal's national schistosomiasis elimination strategy, with parallel investment in CHW support systems (Danso-Appiah et al., 2024; Gyapong et al., 2024). This necessitates a committed policy shift to provide CHWs with sustained training, structured supervision, reliable logistical support, and appropriate remuneration (Enbiale et al., 2024; Lutumba et al., 2024). Such investment is fundamental for building resilient surveillance infrastructure, a lesson echoed in analyses of surveillance for other NTDs (Agana et al., 2024; Ramsay & Kamau, 2025). Furthermore, this CBS model holds considerable promise for integrated surveillance of multiple co-endemic conditions, thereby improving cost-efficiency and health system responsiveness (Nemungadi et al., 2025; Silvestri et al., 2024).

The study's limitations must be acknowledged. Conducted in specific endemic regions of Senegal, the operational nuances of CBS require careful contextual adaptation to different epidemiological and socio-cultural settings across Africa (Mutapi et al., 2025; Sow et al., 2025). The qualitative findings on engagement highlight variability in participation influenced by factors such as gender and local leadership, which warrant deeper exploration (Kane et al., 2025; Mbodji et al., 2025). Moreover, while the study establishes operational effectiveness, it does not provide a detailed cost-effectiveness analysis, a critical evidence gap for securing long-term resource commitment (Dadzie et al., 2024; Nonvignon et al., 2024).

This gap directly informs the agenda for future research. Priority must be given to robust operational research comparing the long-term costs and health outcomes of CBS against conventional surveillance models (Abatneh et al., 2025; Talla et al., 2025). Further investigation is needed into optimal digital tools for CHWs to streamline data reporting, as suggested by innovations in surveillance for other diseases (Khaki et al., 2025). Research should also explore the social dynamics of CBS, including sustainable motivation models for volunteers and strategies to ensure equitable community representation (Gebre et al., 2024; Nemungadi et al., 2025). Finally, the role of CBS in post-elimination surveillance to detect potential resurgence requires urgent attention, a concern raised in ongoing elimination efforts (Mutapi et al., 2025; Wilson et al., 2024).

In conclusion, this study affirms that community-based surveillance is a viable and potent strategy for advancing schistosomiasis control in Senegal. By leveraging local knowledge and agency, it addresses core logistical and social challenges in resource-limited settings (Deribe et al., 2024; Gyapong, 2024). The success of this approach reinforces a fundamental principle for African public health: enduring solutions to endemic diseases must be co-created with the communities they affect. As Senegal strives towards the 2026 NTD road map targets, investing in and refining structured CBS systems, with empowered CHWs at their centre, will be indispensable for turning the ambition of elimination into a tangible, locally-owned achievement.

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