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Tailoring interventions for impact: implementing evidence-based strategies for female genital schistosomiasis knowledge gaps in selected districts in Ghana

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Background: Addressing the knowledge gaps for female genital schistosomiasis (FGS) among healthcare professionals and community members in endemic areas to improve early detection and management is crucial. In Ghana, limited knowledge, entrenched socio-cultural beliefs, and inadequate healthcare resources hinder effective FGS management. This study utilized a systematic intervention mapping (IM) approach to design targeted health promotion interventions in Ghana's Lower Manya-Krobo and Shai Osudoku Municipalities.

Methods: The five IM steps are as follows:1) Conducting needs assessment and identifying implementation adopters; 2) developing program objectives and outlining the desired outcome and performance objectives; 3) selecting theoretical methods and designing implementation strategies; 4) developing implementation materials, and tools, and protocols; and 5) evaluate implementation outcome. During the needs assessment, surveys and focused group discussions with 856 women and 252 healthcare workers and discussions with community members highlighted widespread misinformation and gaps in knowledge, attitudes, and practices related to FGS. Stakeholders' engagement then guided the mapping of context-specific interventions and the development of program objectives. Intervention materials, including FGS posters, jingles in four languages, screening tools, and reporting forms, were created and distributed through accessible local channels. Training sessions were also conducted to build healthcare workers' diagnostic and management capacities.

Results: The study revealed that Implementation mapping (IM), grounded in needs assessment and stakeholder involvement, facilitated the creation of tailored, evidence-based strategies. These strategies reached the intended population and improved awareness and attitudes among healthcare workers and community members. The findings emphasized the need for adaptive intervention that accounts for varying healthcare settings and community contexts to effectively address FGS knowledge gaps. It also revealed that the provision of adequate system support and needed logistics enhances FGS case diagnosis and management.

Conclusion: The intervention in Lower Manya-Krobo Municipal enhanced public health outcomes by improving community awareness, case detection, and management of FGS, demonstrating its potential for broader application in endemic regions. The study highlighted the need for tailored approaches to address varying healthcare dynamics and resource constraints. Continued monitoring and evaluation are crucial to ensure the long-term sustainability and effectiveness of such interventions, offering valuable insights for policymakers, clinicians, and public health practitioners.

KEYWORDS

female genital schistosomiasis, implementation mapping, Ghana, knowledge, attitudes, practices

Introduction

Female genital schistosomiasis (FGS) is a neglected tropical disease caused by the parasitic trematode, *Schistosoma haematobium (S. haematobium)*, which poses a significant yet often overlooked threat to women's reproductive health, particularly in sub-Saharan Africa (SSA) (1, 2). Over 100 million women of childbearing age are at risk, and an estimated 56 million are infected with FGS in the SSA (3, 4). Women and young girls become infected when the larval forms of the parasite, released by freshwater snails, penetrate the skin during contact with infested freshwater (1, 5). FGS is characterized by grainy, sandy patches in the mucosa, homogenous yellow sandy patches, abnormal blood vessels, and rubbery papules on the cervix of the female reproductive system (6–8). These changes occur when dead or viable ova of *S. haematobium* lodges in the genital tissues, resulting in lesions (2, 6–9). Infected women experience irregular vaginal bleeding often combined with purulent discharge (which can be stigmatizing), pelvic discomfort, genital itch, and dyspareunia (coital pain/general discomfort and pain during sex), often misdiagnosed as a sexually transmitted infection (STI) (6–8, 10, 11). Subfertility or infertility, ectopic pregnancy, spontaneous abortion, premature birth, low birth weight, and maternal death become the resulting outcome if FGS is left untreated (2, 6, 7, 10, 11).

Ghana is endemic for 14 of the 20 neglected tropical diseases (NTDs) that overlap geographically across the country. The country is ranked among the first five schistosomiasis-endemic countries in SSA, with approximately 20 million people at risk (12–15). The national prevalence of schistosomiasis is estimated at 23% but ranges between <1% and >50%, despite three decades of implementation of schistosomiasis mass drug administration (MDA) interventions among the at-risk population (15). Continuous transmission is attributed to localized drivers such as dam construction and irrigation, agricultural practices, and contact with surface water for domestic chores or economic gains, among others (14, 15). Currently, 18 districts with over 400 communities along the Volta Lake are classified among the highly endemic areas in the country (16, 17). The current FGS burden in Ghana is unknown, but a study conducted along the Volta Lake reported an estimated 10% prevalence (18).

The complexity of FGS lies not only in its complicated pathophysiology but also in the pervasive knowledge gap surrounding its causes, transmission, diagnosis, and management among healthcare professionals and community members (19–23). A study by Kukula et al. demonstrated a gross lack of FGS knowledge among healthcare workers and community members in Ghana, which poses a challenge to case detection and management (22). Similar findings were reported by Yirenya-Tawiah et al. in a study conducted in the Afram basin of Ghana (23). These findings align with what Mazigo et al. discovered in Tanzania among community members and healthcare professionals (19–21). Most respondents knew about schistosomiasis or bilharzia that affects boys but did not know of FGS. Some respondents believed FGS was transmitted sexually. Thus, infested adolescents were mocked by their peers (19–22).

As studies have acknowledged the urgent need for targeted interventions to address these identified FGS gaps, this study explores the application of Implementation Mapping (IM) using Intervention Mapping (IM) as a robust framework for developing and implementing context-specific strategies (24–27). By combining evidence-based research, stakeholder engagement, and a tailored approach to diverse settings (24, 26–30), Implementation Mapping and Intervention Mapping provides a systematic methodology to bridge the knowledge gap of FGS. Intervention Mapping has been employed in immunization and different disease areas such as non-communicable diseases, cancer, and NTDs, and

Abbreviations: CIC, Community information center; FGD, Focused group discussion; FGS, Female genital schistosomiasis; IM, Implementation Mapping; IM, Intervention Mapping; KAP, Knowledge, attitudes, and practices; KII, Key informant interview; MDA, Mass drug administration; NTD, Neglected tropical diseases; OPD, Outpatient department; *S. haematobium, Schistosoma haematobium;* SSA, sub-Saharan Africa; STI, Sexually transmitted infections.

has proven its usefulness and robustness in addressing complex issues (28, 30). As our baseline study has revealed the knowledge, attitudes, and practices (KAP) gap and the influencing factors, Implementation mapping (IM) emerges as a promising avenue to design interventions that are not only grounded in scientific rigor but are also sensitive to context. Hence, we advocate for a targeted and evidence-driven approach to empower communities, healthcare professionals, and policymakers in addressing this often-neglected aspect of women's health.

For Ghana to advance towards the 2030 roadmap to end NTDs (31, 32), improving the knowledge, attitudes, and practices towards schistosomiasis and FGS through context-specific improvement strategies in endemic areas cannot be overlooked (31). This study aims to underscore the process of selecting context-specific strategies that are designed and implemented to improve FGS knowledge and awareness among healthcare workers and community members in the Lower Manya-Krobo Municipal in the Eastern region of Ghana.

Methods

Study design

A cross-sectional study based on a mixed-method approach was conducted at baseline involving 432 women of reproductive age from 10 communities and 126 healthcare professionals from 14 health facilities reported elsewhere. The study assessed FGS knowledge, attitudes, and practices among community members and healthcare professionals. Based on our reported findings, we employed the Implementation mapping (IM) framework to inform the intervention content/package, design, implementation, and evaluation to address the knowledge gaps identified.

Study area and settings

The Lower Manya-Krobo Municipality (LMK) is one of the 18 schistosomiasis-endemic districts along the Volta Lake in the eastern region of Ghana. It covers an area of 1,476 square km, and Odumase Krobo is the district capital (33). Geographically, parts of the district stretch along Volta Lake while the other areas have streams, ponds, and rivers within the municipality that serve as the common source of water for inhabitants (33). Most inhabitants are farmers and traders, predominantly engaged in fishing and fish farming on Volta Lake, predisposing them to a high risk of schistosomiasis (33).

Sampling strategy

A purposive sampling strategy was employed to recruit 40 frontline healthcare workers (HCWs) involved in sexual and reproductive health (SRH) and health promotion (HP) services from 14 health facilities in the Lower Manya-Krobo Municipality (Appendix Table 1).

Implementation mapping using intervention mapping

Merging the insights from the field of implementation science and Intervention Mapping results in Implementation Mapping (27). This framework incorporates and builds on step 5 of Intervention Mapping by adding four tasks. Intervention mapping (IM) is a systematic process or framework for developing a concept and evidence-based health promotion interventions and establishing their implementation (24–28, 30). The Intervention Mapping (IM) process is a valuable tool that has been proven to increase behavioral change, cancer screening, vaccination uptake, and uptake of MDA for lymphatic filariasis across the globe (24–30). Here, the Implementation Mapping (IM) framework consists of five iterative steps with distinct tasks that direct the modification of significant personal characteristics and environmental factors into the health promotion program (25, 27, 34). The process is practical based on the stakeholder engagements and the theories employed to formulate context-based interventions and strategies to address identified health problems. The steps are: 1) conduct needs assessment and identify implementation team and adopters, 2) develop program objective and outline the desired outcome and performance objectives, 3) select theoretical methods and design implementation strategies, 4) develop implementation material, tools and protocols, and 5) evaluate the implementation outcomes (27). We briefly describe each step of the Implementation Mapping (IM) as follows.

Step 1 - Conduct needs assessment and identify implementation teams and adopters

Program designers often lack adequate understanding of the context and implementation requirements from the outset (27, 35, 36). Planners perform a needs assessment as part of task 1 of Implementation mapping (IM) to determine the facilitators and bottlenecks that affect program implementation. This step is required to carry out the program successfully and comprehend the factors influencing its success, hence, it entails involving all stakeholders, including adopters, implementers, and those in charge of maintaining the intervention (28, 37, 38). This step of Intervention Mapping (IM) is like Intervention Mapping Step 1.

Step 2 - Develop program objectives and outline the desired outcome and performance objectives

Adoption and implementation outcomes, performance goals, determinants, and change objective matrices are all defined by implementation planners (27, 35). The result explicitly outlines the objectives pertaining to adoption, implementation, or maintenance and is customized for adopters and implementers. For participants to successfully adopt, implement, and maintain the program, performance objectives specify "who has to do what" in order to accomplish these goals (24, 27, 35). These goals are focused on action, proposing specific actions for the duties and tasks required to guarantee the program's effective implementation and ongoing viability.

Step 3 - Select theoretical methods and design implementation strategies

This step employs the use of theory-based methods aimed at influencing implementation determinants (24). These theoretical methods can influence both individual or organizational level change that fosters commitments. The impulse of this step is further explained by Elderege et al. and Fernansez et al. (24, 27).

Step 4 – Develop implementation materials, tools, and protocols

This stage requires program planners to design and produce implementation materials, tools, and protocols that will address the expected change (24, 27, 30). These materials go through team reviews of the draft content, pretest, refinement, and final product. The material development takes into account the purpose of the material, intended audience, determinants, and change objectives.

Step 5 – Evaluate the implementation outcome

This step ensures that the implemented strategies to address identified gaps are evaluated to assess the adoption and effectiveness of the implemented health promotion strategies.

Theoretical underpinning of the study

The need to identify the bottlenecks associated with the FGS intervention and gain an in-depth understanding of participants' knowledge, attitudes, and practices towards FGS was based on the literature. Afterwards, the Reach Effectiveness Adoption Implementation and Maintenance (RE-AIM) framework was adopted for the design and evaluation of the intervention outcome (39). Using the RE-AIM framework we identified and addressed the reach, effectiveness, adoption, implementation, and maintenance, which will be fully addressed in another article (40).

Data analysis

Descriptive statistics and content analysis were computed using the data gathered for this study.

Results

Background characteristics

Among HCWs, there were 112 (88.9%) and 107 (84.9%) female participants in the Lower Manya-Krobo and Shai Osudoku, respectively. The majority of the participants in Lower Manya-Krobo Municipality were younger than 31 years (71, 56.4%), and 85 (67.5%) had practiced for less than 5 years. In contrast, in the Shai Osudoku District, 29 (23.0%) were younger than 31 years, and 94 (74.6%) had practiced for more than 5 years (Table 1A).

As shown in Table 1B, the mean age of the women was 29.4 (± 7.2) years. Furthermore, 225 (52.6%) and 238 (55.6%) respondents had received a primary education in the Lower Manya-Krobo and Shai Osudoku districts, respectively. Moreover 175 (40.9%) and 179 (41.8%) respondents had resided for more than 10 years in the LMK and SOD districts, respectively.

Step 1 (Needs assessment): An initial needs assessment of knowledge, attitude, and practices towards FGS among healthcare workers and women of reproductive age using a mixed-method approach was conducted in the Lower Manya-Krobo Municipality and the Shai Osudoku District. We interviewed 856 women of reproductive age and 252 healthcare workers, with 8 focused group discussions (FGD) with women and adolescent girls, 20 key informant interviews (KIIs) among opinion leaders, and 36 KIIs among healthcare workers in 14 health facilities and 2 NTD focal persons from the district and regional health directorate respectively. The background characteristics of these healthcare workers have been described in Tables 1A and B.

The complexities of FGS and the influencing factors were discovered, gaining understanding and insight into the poor knowledge, attitudes, and practices among the service providers and women of reproductive age. Moreover, we engaged stakeholders from the national, regional, and district levels. The assessment revealed the lack of systemic support, skills, capacity, tools, and resources to diagnose and manage FGS in both districts, but these were worse in the Lower Manya-Krobo. The choice to implement an intervention in the Lower Manya-Krobo municipality was based on the outcome of the survey (Tables 2A, B), where a total score was generated for knowledge, attitudes, and practices. Correct responses were scored 1 point and 0 for a wrong response, with the responses summed upon completion. Knowledge, attitudes, and practices were categorized as "poor" if the score was below the mean and "good" if above the mean score.

Based on the outcome of the needs assessment, we identified the program adopters (physicians, clinical and public health nurses, and community members), implementors (nurses, health promotion officers, disease control officers, and opinion leaders), and other stakeholders (head of the facility, administrators, and NTD focal person at different levels) (24, 26, 27).

Step 2 (Develop program objective and implementation outcomes): After exploring the FGS KAPs through the needs assessment, the aim was to develop the program objective and outline the desired outcome and performance objectives required for behavior changes. Stakeholders were engaged at this stage of the Implementation mapping (IM) process to discuss the findings of the needs assessment. The included stakeholders were the 2 regional NTD focal persons (Greater Accra and Eastern regions), 2 District Directors of Health Services (Lower Manya-Krobo and Shai Osudoku Districts), 2 District Health Promotion Officers, 2 District Disease Control Officers, 2 District Public Health Nurses, 12 clinicians (Head of sub-districts), and 2 Health Information Officers. We also engaged two local government representatives, six community leaders, and a journalist from a television and radio station. During the session, specific contextual gaps identified during the needs assessment were discussed and addressed by developing evidence-based, context-specific strategies in concert with one another. Involving stakeholders in the process guarantees that the implementation techniques are

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TABLE 1A Characteristics of healthcare workers in the Lower Manya-Krobo and Shai Osudoku districts.

Variable	Lower Manya (n=126)		Shai Osudoku (n=126)		Total (n=252)	
	Frequency	%	Frequency	%	Frequency	%
Sex						
Male	14	11.1	19	15.1	33	13.1
Female	112	88.9	107	84.9	219	86.9
Age group						
21–30 years	71	56.4	29	23.0	100	39.7
31–40 years	48	38.1	59	46.8	107	42.5
Above 40 years	7	5.6	38	30.2	45	17.9
Educational level						
Certificate	71	56.4	53	42.1	124	49.2
Diploma	50	39.7	46	36.5	96	38.1
Degree	5	3.9	27	21.4	32	12.7
Years of practice						
Less than 5 years	85	67.5	32	25.4	117	46.4
More than 5 years	41	32.5	94	74.6	135	53.6
Cadre						
Med. Officer/ Physician assistant	2	1.6	2	1.6	4	1.6
General nurse	35	27.8	70	55.6	105	41.6
Community health nurse	44	34.9	22	17.5	66	26.2
Midwife	25	19.8	23	18.2	48	19.1
Other	20	15.9	9	7.1	29	11.5

TABLE 1B Characteristics of women of reproductive age in the Lower Manya-Krobo and Shai Osudoku districts.

Variables	Lower Manya-Krobo Municipality (n= 428)		Shai Osudoku District (n= 428)		Total respondents (n=856)	
	Freq	%	Freq	%	Freq	%
Mean age (Sd)	29.2 (± 6.9)		29.2 (± 6.9)		29.4 (± 7.2)	
Age group						
<20 years	38	8.8	53	12.4	91	10.6
21–30 years	202	47.2	198	46.3	400	46.7
31–40 years	151	35.3	141	32.9	292	34.1
41–50 years	37	8.6	36	8.4	73	8.5
Educational level						
No formal education	75	17.5	56	13.1	131	15.3
Primary	225	52.6	238	55.6	463	54.1
Secondary	121	28.3	131	30.6	252	29.4
Tertiary	7	1.6	3	0.7	10	1.8

(Continued)

TABLE 1B Continued

Variables	Lower Manya-Krobo Municipality (n= 428)		Shai Osudoku District (n= 428)		Total respondents (n=856)	
	Freq	%	Freq	%	Freq	%
Occupation						
Artisan	29	6.8	53	12.4	82	9.6
Trader	234	54.7	153	35.8	387	45.2
Farmer	68	15.9	70	16.4	138	16.1
Government worker	9	2.1	3	0.7	12	1.4
Unemployed	80	18.7	108	25.2	188	21.9
Others	8	1.9	41	9.6	49	5.7
Years of residence in the community						
0–5 years	121	28.3	122	28.5	243	28.4
6–10 years	132	30.8	127	29.7	259	30.2
More than 10 years	175	40.9	179	41.8	354	41.4

applicable, realistic, and tailored to the requirements of the situation. The stakeholders then defined the program components, connected objectives, and created practical applications to implement the methods. Stakeholders were divided into three groups to brainstorm, discuss, and develop context-specific strategies to address the identified gaps (Table 3). An implementation team comprising seven members of district and sub-district staff was instituted. The team then identified the determinants for the implementers, adopters, and facilitators and the barriers to the project (41–43). Metrics of change objectives were then created across performance objectives and determinants to achieve the desired change objectives (Table 4) (35).

Step 3 (Select theoretical methods and design implementation strategies): The implementation team consolidated the ideas into two broad categories based on the target population, i.e., healthcare workers and community members, to develop the implementation strategies, addressing the mode of delivery and implementers (Table 5) (24, 44). The team considered both individual and organizational level expected changes for the implementation of the project and the role of facility leadership (44).

Step 4 (Develop implementation materials, tools, and protocols): The research team mobilized resources and consulted the National NTD program for FGS educational materials and the WHO FGS Pocket Atlas. The team developed a training package by adopting a training manual developed by Liberia (31). The FGS intervention included a training workshop for 40 healthcare workers from 14 facilities at different levels and the directorate team. The topics covered included general information on FGS, symptoms and risk factors, screening and examination, treatment guide, and clinical pathway. Based on the WHO FGS Pocket Atlas, diagnosis of FGS in this intervention was done through visual

TABLE 2A Description and categorization of mean score for healthcare workers' (HCWs) knowledge, attitude, and practices towards FGS.

Variable	Lower Manya-Krobo n= 126 (%)		Shai Osudoku n=126 (%)		Total respondents n= 252 (%)		P-value
Healthcare workers							
Knowledge M(Sd)	41.4 (±17.1)		55.9 (±9.8)		48.6 (±15.7)		
Poor knowledge	88	69.8	13	10.3	101	40.1	0.00*
Good knowledge	38	30.2	113	89.7	151	59.9	
Attitude M(Sd)	63.4		63.3 (±6.2)		63.3 (±7.1)		
Poor attitude	65	51.6	73	57.9	138	54.8	0.31
Good attitude	61	48.4	53	42.1	114	45.2	
Practices M(Sd)	31.1 (±14.7)		33.5		32.3 (±13.1)		0.00*
Poor practice	88	69.8	55	43.7	142	56.8	
Good practice	38	30.2	71	56.4	109	43.3	

p-value <0.05 (*).

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TABLE 2B Description and categorization of the mean scores for women of reproductive age's knowledge, attitude, and practices towards FGS.

Variable	Lower Manya-Krobo n= 428 (%)		Shai Osudoku n= 428 (%)		Total respondents n= 856 (%)		P-value
Knowledge M(Sd)	44.6 (±13.9)		46.4 (±11.8)		45.5 (±12.9)		
Poor	245	57.2	205	47.9	450	52.6	0.00*
Good	183	42.8	223	52.1	406	47.4	
Attitude M(Sd)	48.8 (±3.8)		50.2 (±5.8)		49.5 (±4.9)		
Poor	331	77.3	262	61.2	593	69.3	0.00*
Good	97	22.7	166	38.8	263	30.7	
Practices M(Sd)	24.4 (±7.3)		26.6 (±7.7)		25.6 (±7.5)		
Poor	258	60.3	199	46.5	457	53.4	0.00*
Good	170	39.7	229	53.5	399	46.6	

p-value <0.05 (*).

TABLE 3 Outcome of stakeholder group discussion to address gaps identified during the needs assessment.

Gap identified	Challenge	Opinion leaders/ community members	Healthcare workers/head of facilities	District/Regional/ National health officers
1.Lack of FGS advocacy communication and social mobilization (ACSM) among HCWs and community members	Majority of HCWs and community members have not heard of FGS before and were not aware of the disease.	1. Community education on the disease and how to prevent it. 2. Introduce chemicals into the lake that can kill the causative organism. 3. Introduction of creams that can prevent the penetration of the skin when smeared before one enters the water body. 4. HCWs should educate about FGS during home visits and community programs. 5. Use the media available in the communities to announce the possible spread of the disease through the water bodies. 6. Community members should be educated on the importance of the schistosomiasis MDA	1. FGS flyers, posters, pamphlets on FGS are to be made available in health facilities. 2. More awareness creation on FGS at the OPDs, CWCs, and ANCs for patients in health facilities 3. More awareness creation in communities to promote FGS case reporting	1. Enhance awareness creation through existing services and programs such as school health services and community durbars. 2. Sensitization and education of community members especially along the Volta Lake through radio panel discussions and announcement. 3. Community engagement to emphasize the importance of the MDA program towards schistosomiasis prevention. 4. Collaborate with the regional health promotion unit to create IE&C materials on FGS and mount them in health facilities and communities.
2. Lack of HCW skills and capacity to manage FGS	HCWs have not been trained on FGS diagnosis and case management.	Stakeholders, including opinion leaders and drug store operators, should be educated on FGS to enable them use community platforms available to educate community members.	Formation of sub-municipal FGS management teams in the municipality to address issues related to FGS.	1. Training of health staff on FGS diagnosis, management, and prevention. 2. Identify and train community-based surveillance volunteers on FGS to enhance case reporting and management.
3. Lack of health facility capacity (screening tools, SOPs, equipment for case identification/diagnosis, and drugs for case management)	1. There are no basic tools, such as an FGS atlas and screening tool, to enhance case detection and management. 2. No existing monitoring and evaluation system for FGS in the health service	1. Mass screening of women and girls in the community for FGS. 2. Drugs (praziquantel) should be available in health facilities to treat people who experience blood in urine and FGS early.	1. There should be a provision of a case definition and SOP for case management. 2. There should be availability of screening tools and basic diagnostic tools for FGS cases in health facilities 3. Active FGS case search in communities. 4. Improve documentation on cases, referral and reporting of	1. Ensure proper documentation of referral of suspected cases from the lower-level facilities to the district hospital for management. 2. Adapt existing screening FGS screening tool and pilot in facilities using the PDSA cycle to refine it. 3. Mount active case search through community CWC services and home visits. 4. Provide reporting forms to promote proper documentation

(Continued)

TABLE 3 Continued

Gap identified	Challenge	Opinion leaders/ community members	Healthcare workers/head of facilities	District/Regional/ National health officers
			FGS cases in health facilities.	of reported suspected cases. 5. Include FGS indicators in quarterly supervision and monitoring visits to health facilities.
4. Lack of motivation of HCWs	Low motivation among HCWs to look for FGS cases		1. Encourage and motivate all health workers in FGS case management. 2. Reward scheme for HCWs who detect FGS cases	
5. Provision of portable water	Water bodies in communities are infected with the organisms that cause FGS	There should be provision and access to pipe-borne water and boreholes in communities with water bodies to reduce their contact with the lake and other water bodies		Lobby and collaborate with the district assembly to advocate for portable water for communities along the Volta Lake.

ACSM, advocacy, communication, and social mobilization; ANC, antenatal clinic; CWC, child welfare clinic; FGS, female genital schistosomiasis; HCW, healthcare worker; IE&C, information, education, and communication; MDA, mass drug administration; OPD, outpatient department; PDSA, Plan-Do-Study-Act cycle; SOP, standard operating procedure.

inspection of the genital tract using a speculum and flashlight, since there was no colposcopy in the district (6, 7, 45).

The training was facilitated by a member of the National Schistosomiasis Expert Committee, a medical doctor, a health information officer, and a health promotion expert within the municipality.

Through iteration, the team developed an FGS poster that presented basic information about FGS that was to be posted in consulting rooms, outpatient departments, and the communities. The team developed a synopsis and produced FGS educational messages in four local languages (Krobo, Ewe, Twi, and English), which were aired on 16 community information centers at dawn and dusk from February to April 2024 in the Lower Manya-Krobo Municipality. Screening, reporting, and monitoring forms were developed to ensure proper documentation of every activity. This was to ensure that the adoption, implementation, and maintenance were considered at every stage of the Implementation Mapping process. Every intervention package was piloted to ensure it achieved the intended purpose.

Step 5 (Evaluate the implementation outcomes): We completed steps 1 to 4 with our target population in mind and conducted monitoring and evaluation of the FGS KAP intervention, which helped us to assess both the process and implementation outcomes (46). A common social media platform, WhatsApp, was used by the implementation team to enhance information sharing,

TABLE 4 Implementation outcomes and performance objectives to improve FGS KAP among healthcare workers and community members in the Lower Manya-Krobo Municipality.

Target	Implementation and maintenance outcome	Performance objectives
Health facility: Clinical team (Doctors, general nurses, midwives, physician assistants)	a) Facility management teams are trained and adopt the improving FGS KAP project b) The team educates, counsels, and screens for FGS as part of routine reproductive health services and reports every month c) Used tools and SOPs provided to manage and document treated FGS cases and reported every month d) The project team ensures the participation of implementers in the evaluation and ensures that facility leadership maintains the FGS KAP project as part of standard practice.	a) Train and equip primary healthcare givers to suspect, diagnose, and manage FGS cases b) Agree to educate, counsel, and screen the general outpatient clients and reproductive health service attendees for FGS c) Agree to use and reference tools and SOPs (FGS Atlas) to manage and document all treated FGS cases and report every monthly d) Agree to participate in the evaluation of the intervention and discuss the continuation and maintenance of the FGS project with stakeholders.
Community: Public health team (Public health nurses, community health nurses, Disease Control Officers, Health Promotion Officers)	a) The public health team identifies and uses appropriate community-based channels and tools to deliver and educate women on FGS b) Public Health Team refers suspected FGS cases to a facility for screening and management. c) Monitor and report on the frequency and reach of FGS education to adolescents and women of reproductive age	a) Agree to use appropriate community-based channels and tools (posters) to educate on FGS b) Refer suspected cases to a health facility for screening and management c) Monitor the frequency and reach of FGS jingles played at the Community Information Centers d) Agree to educate and counsel adolescent girls on FGS as part of school health services

TABLE 5 Consolidated intervention package, implementation strategies, and persons responsible.

Context	Target pop.	Suggested package	Strategy/mode of delivery	Persons responsible
Health system	Clinical setting: MD, PA, Midwives PH setting: General nurses, CHNs, DCOs, HPO	Capacity building/skills acquisition Logistics: Posters, FGS Pocket Atlas, FGS screening tool, forms	Training workshop FGS epidemiology, diagnosis, management, prevention, control, and reporting Distribution and usage of IE&C materials Screening of suspected clients with FGS screening tool at reproductive service delivery points FGS Atlas (SOP) in consulting rooms to guide case management	Research team Implementation Team (Sub-district heads, HPOs, DCO, PHN, In-service coordinator)
Community level	Community-Based Surveillance Volunteer (CBSV) School children (upper primary and Junior High School) General community members	Capacity building in community sensitization and reporting Awareness creation and sensitization Awareness creation and sensitization	Training workshop FGS epidemiology, prevention, control, and reporting School health services – FGS health talk, posters Health facility health talk – OPD, ANC, FP, CWC, Home visit etc. Media – radio discussion Community information center. Other events e.g. durbar, campaigns	Research team Implementation Team (Sub-district heads, HPOs, DCO, PHN, In-service coordinator, opinion leader, community member)

MD, Medical doctors; PA, Physician assistant; CHN, Community Health Nurses; DCO, Disease Control Officers; HPO, Health Promotion Officers.

review bottlenecks, and reinforce adherence to the intervention. A weekly meeting allowed sub-district representatives to present implementation reports. The implementation team also conducted monthly visits to facilities using a checklist, which helped to reinforce adherence to the protocols of intervention. Avenues included the outpatient departments (OPDs), schools, and the community information center (CIC).

Figure 1 shows the start of screening, which yielded suspected cases that were examined, and four positive FGS cases that were treated. Females who reported to the OPD, antenatal care, and the family and reproductive care unit with symptoms related to FGS were screened using the FGS screening tool and examined if required. The channels used for awareness creation included one-on-one education, OPD health talks, group meetings, community information center (CIC) publicity, durbar, home visits, school health services, child welfare clinics, family planning services, antenatal services, and market visits. By the end of June 2024, 17,002 women, 6,349 men, and 3,234 adolescents were reached with FGS education and awareness creation across the district.

The evaluation of KAP after the intervention implemented in the Lower Manya-Krobo Municipal will be assessed and the results shared in the future. Between January to June 2024, the progressive

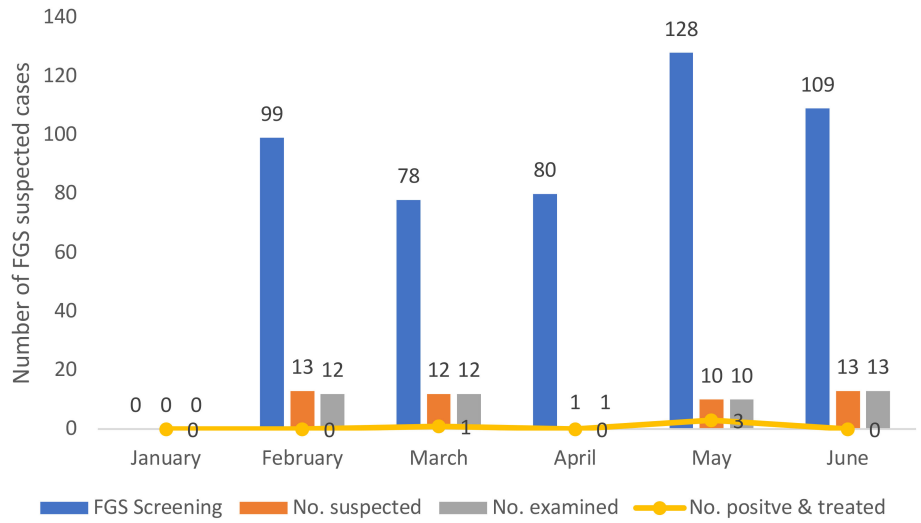

FIGURE 1
Screening outcome of suspected FGS cases in the Lower Manya-Krobo District from February to June 2024.

outcome of the screening, management, and community sensitization are presented in Figure 1.

Discussion

This article presents an intervention plan to improve the awareness, case detection, and management of FGS among healthcare workers and women of reproductive age in the Lower Manya-Krobo Municipality. It also provides a foundation for addressing the FGS gaps identified through the needs assessment and provides future researchers with an intervention plan for FGS in endemic areas. Given the complications that could arise from FGS among affected populations, it is crucial to address the poor knowledge, attitudes, and practices towards FGS among healthcare workers and women of reproductive age. Therefore, the adoption of Implementation Mapping to systematically design and implement interventions in the Lower Manya-Krobo Municipal to address gaps in knowledge, attitudes, and practices regarding FGS showed potential benefits across several key areas. Since the implementation is ongoing, step five (evaluation of the intervention) will be described separately after completion of the intervention implementation.

Improved knowledge and awareness of FGS

The initial needs assessment revealed significant gaps in knowledge, attitudes, and practices about FGS among both healthcare workers and women of reproductive age, with poor knowledge, attitudes, and practices rates, especially in the Lower Manya-Krobo Municipality. The intervention targeted capacity building, skill development, and resource provision for healthcare workers and awareness creation among women of reproductive age to address the gaps. By engaging stakeholders at multiple levels and launching community awareness campaigns, including CIC broadcast in four local languages and educational materials such as posters, health talks at school services, and OPDs, the intervention aimed to raise awareness and encourage early reporting. Additionally, the provision of the FGS Pocket Atlas by the National NTD program and training of healthcare workers built capacity to detect and manage FGS cases. These efforts reached over 26,000 individuals, including women, men, and adolescents, suggesting that the initiative may have significantly expanded the community's and healthcare workers' understanding of FGS symptoms, transmission, and prevention and the need to detect and manage FGS early.

Reach and effectiveness—integration with community services and stakeholder engagement

The use of the various community-based channels, such as school health services, child welfare clinics, and local media, facilitated widespread dissemination of FGS information. By involving opinion leaders, local government representatives, and community members, the intervention ensured that educational activities were tailored to the specific needs and context of the Lower Manya-Krobo community. This participatory approach likely enhanced the acceptability and sustainability of the interventions.

Adoption—enhanced healthcare capacity and skills

The lack of healthcare workers trained to diagnose and manage FGS was identified as a critical challenge. Through training workshops that covered FGS epidemiology, diagnosis, management, prevention, and control, the intervention equipped healthcare workers with the necessary skills. This training was supplemented with logistical support, including screening tools, protocols, and educational materials, ensuring that health facilities were better prepared to identify and manage FGS cases.

The intervention led to the screening of 494 individuals for FGS over a 5-month period, identifying 48 suspected cases and confirming four positive diagnoses. This suggests that increased awareness and training may have directly contributed to a higher rate of case detection, which is critical for managing and reducing the prevalence of FGS.

Limitation and future evaluation

Due to the step-by-step insight this article revealed and its applicability in other primary healthcare and low-resource settings, the Implementation Mapping and implemented interventions showed improvement in FGS case detection, management, and awareness creation. While the intervention successfully laid the groundwork for addressing FGS, the full impact on long-term changes in KAP remains to be assessed. Due to resource constraints, the intervention could not include the radio program and training of community-based surveillance volunteers. Furthermore, due to time constraints, the researchers were not able to extend the implementation of the intervention beyond the time used in this study. Future evaluations will determine if the observed improvements in awareness and case detection translate into sustained behavior changes and a reduction in disease prevalence.

Conclusion

The implementation of the intervention in the Lower Manya-Krobo Municipal using Implementation Mapping demonstrated significant public health benefits, including enhanced community awareness, improved case detection, and better management of FGS cases. This finding underscores the feasibility of adapting this approach in other FGS-endemic areas guided by localized needs assessments. Scientifically, the study provides valuable insights into the adaptability and challenges of implementing interventions across varied healthcare settings.

Clinicians and healthcare policy makers are informed of the necessity to customize intervention packages to fit the unique dynamics and resource availability of each setting. For facilities with high patient load, the intervention highlighted the critical need for additional workforce and logistical support to prevent overburdening existing staff and to minimize patient waiting time. From a public health perspective, this work emphasizes the importance of sustained monitoring and evaluation to ensure long-term impact and sustainability of such interventions. These insights serve as a resource for public health practitioners, healthcare administrators, and researchers aiming to enhance the control and management of neglected tropical diseases such as FGS in resource-constrained settings.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical clearance was given by the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal (BREC/00005309/2023) and the Ethics Review Committee of the Ghana Health Service (GHS-ERC:008/02/23). Participants consent was sort and information sheet given before commencement of the study.

Author contributions

CT: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. TG: Conceptualization, Methodology, Supervision, Writing – review & editing, Validation. JN: Conceptualization, Methodology, Supervision, Writing – review & editing, Validation. AM: Conceptualization, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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Appendix

TABLE 1 Description of training participants who carried out the FGS intervention.

Variable	Frequency (n=40)	Percentage (%)
Cadre		
Medical officer	3	7.5
Physician assistant	3	7.5
Midwife	10	25.0
General nurses	10	25.0
Public health nurse	3	7.5
Community health nurse	6	15.0
Disease Control/Health Information Officer	2	5.0
Health Promotion Officer	3	7.5
Type of facility		
Hospital	8	20.0
Medical center	4	10.0
Health center	9	22.5
Community-Based Health Planning and Services (CHPS)	14	35.0
Municipal Health Directorate	5	12.5
Sex		
Male	8	20.0
Female	32	60.0