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Knowledge, Attitudes And Perceptions On The Role Of Water, Sanitation And Hygiene (WASH) In Schistosomiasis Prevention Among Caregivers In Endemic Districts In Ghana

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Abstract

Background: *Access to Water Sanitation and Hygiene (WASH) facilities is a major public health problem in healthcare facilities and communities especially developing countries including Ghana. Poor WASH infrastructure increases the risk of occurrence of several infectious diseases like schistosomiasis. Schistosomiasis has negative consequences on both children's and adult growth development, pregnancy outcome, increased transmission of HIV, bladder cancer, anemia, infertility, other morbidities and mortalities. The study aimed to explore knowledge, attitudes and perception of the role of WASH in the prevention and eradication of schistosomiasis in these districts. The study also assesses the knowledge of caregivers on schistosomiasis causes, symptoms, role of WASH, transmission and prevention and recommended strategies of social behavior change for the sustained eradication of schistosomiasis in endemic districts.*

Methodology: *An explorative qualitative study using semi-structured focus group discussion interviews was conducted among caregivers comprising of 25 community level Focus Group Discussions (FGDs) with 10-12 caregivers in each group and thematically analyzed using a qualitative data analysis software; Atlas Ti. version 8.4.2. The study focused on districts with high schistosomiasis endemicity. The ethical approval was received from the Navrongo Health Research Centre, Institutional Review Board (NHRCIRB) and appropriate consent was sorted from caregivers who participated in the interview.*

Results: *The findings of the study revealed that most caregivers had limited knowledge about schistosomiasis. Only a few had an idea of the symptoms of a person with schistosomiasis and the causes of schistosomiasis. Also, caregivers understanding of the role water, sanitation and hygiene plays in schistosomiasis prevention is limited. In addition, there were varied attitudes of caregivers to undertake preventive measure; practice of preventing oneself and household from contracting schistosomiasis; challenges of WASH in the community and treatment options for schistosomiasis which were not appropriate for schistosomiasis prevention.*

Conclusion: *The study highlights limited knowledge of caregivers which can result in increased transmission of schistosomiasis. Findings from the study established that caregiver's knowledge and perceptions on the understanding of the role water, sanitation and hygiene plays in schistosomiasis prevention were limited. This implies the need for policy interventions to enhance health education and social behavior change communications among caregivers and the populace for sustained prevention of schistosomiasis while also recommending further longitudinal studies.*

Keywords: *Schistosomiasis, Healthcare Facilities, Water, Sanitation, Hygiene, Endemicity*

1. INTRODUCTION

Access to Water Sanitation and Hygiene (WASH) facilities is a major public health problem in healthcare facilities and communities especially developing countries including Ghana(Campbell et al., 2018; Grimes et al., 2015). Even though WASH is key in disease prevention and control, it remains a less prioritized sector with major challenges in low- and middle-income countries especially sub-Saharan Africa[1–3]. The lack of WASH services puts those seeking care at significant risk of infections and diseases [4]. Poor WASH infrastructure increases the risk of occurrence of several infectious diseases which includes schistosomiasis[5]. Schistosomiasis has negative consequences on both children and adult growth and development, pregnancy outcome, increased transmission of HIV, bladder cancer, anemia, infertility, other mortalities and death [6, 7]

Schistosomiasis is a neglected tropical disease caused by infection with blood flukes of the genus Schistosoma which can be controlled and prevented with access to improved WASH facilities[7–9]. The transmission and exposure to the parasite emanates from contaminated urinary or fecal in freshwater and contact with skin-penetrating cercariae[9]. Increasing access to clean water and proper sanitation and hygiene services is a key factor in addressing the issues of schistosomiasis infections and management[2, 3, 10]. Schistosomiasis is common among rural settlements especially fishing and agricultural communities where WASH is limited [7, 8]. Furthermore, communities where livelihoods,

entertainment and household activities like washing clothes and fetching water are conducted in infected water bodies subjects' women and children to infection of schistosomiasis [7]. For instance, WHO states that recreational pursuits like swimming in contaminated water bodies puts children at risk to schistosomiasis[5]. Also, like most waterborne diseases, the effective solution to control infection with schistosomiasis is ready access to clean WASH facilities[1, 2, 7]. Globally, 230 million people are infected with schistosomes and 500 million are at risk of getting infected (Grimes et al., 2015; World Health Organization, 2023). In 2020, the World Health Organization (WHO) provided a comprehensive WASH gap globally. The report highlighted that 25% of all Health Care Facilities (HCF) have no basic water service, 10% have no sanitation services, and over 30% do not have facilities for hand hygiene at the point of care[11]. These numbers are worse in many HCFs in low- and middle-income countries: 50% without basic water service levels and 60% with no sanitation facilities[11]. Ghana Statistical Service reports that, 16.17% of Ghanaians rely unimproved sources of water and 31.61% open defecate which increase the risk of transmissions of the disease especially schistosomiasis [12].

The prevalence of schistosomiasis and limited access to improved WASH services coupled with limited existing data on the role of WASH in the proposed study area justify the importance of the study. Koskisiki et al. found that the prevalence of schistosomiasis ranges from 20-50% in some regions in Ghana(Kosinski et al., 2016).Studies conducted in the Kassena Nankana district with children resident in the central and southern parts of the district revealed an overall prevalence of infection (S. haematobium+S. mansoni) at 27.1% among children[14] . Further to this, similar research conducted in Krachi East, Krachi West, and Nkwanta South along the Volta basin in Ghana have a prevalence rate of 46.5% which is requires attention [15].

Even though the prevalence of schistosomiasis is high in Ghana, there is scarcity of research on the knowledge, attitudes and perceptions among caregivers on role of WASH in the prevention of schistosomiasis especially in endemic districts in Ghana.

The purpose of the study is to explore the knowledge and perception of the role of WASH in the prevention and eradication of schistosomiasis. This provided recommendations, guidance and strategies on prevention, eradication and control the disease in these endemic districts. The study provided details on the attitudes of caregivers which will help develop social behavior change strategies and recommend interventions that will contribute to the prevention and eradication of schistosomiasis. The study benefited from the conceptual framework theories and research paradigm which can be essential for exploring and investigating into the caregiver's perceived role of WASH in the prevention and eradication of schistosomiasis which is essential for planning evidence-based interventions [15]. Constructs of the theory of Health Belief Model (HBM) in identifying the possible determinants of schistosomiasis prevention in endemic districts. The HBM postulates that individuals are likely to indulge in a health-related behavior (i.e. adopt good WASH practices in our case) to prevent a disease or a health condition (i.e., preventing and eradicating schistosomiasis) if they have a perceived susceptibility to the disease or health condition (i.e., risk of getting schistosomiasis); perceived severity of the disease or health condition are severe (i.e., perceived severity of negative effects of schistosomiasis), and perceived benefits which is the person's perception of the effectiveness of various actions available to reduce the threat of illness or disease (or to cure illness or disease) [15, 16]. Furthermore, the conceptual framework posits the perceived barriers which related to a person's feelings on the obstacles to performing a recommended health action (i.e. challenges of WASH in the communities in our case) and the cue to action being the stimulus needed to trigger the decision-making process to accept a recommended health action (i.e. attitudes towards treatment options for schistosomiasis)[15]. In addition, the model reveals self-efficacy which is a person's level of confidence or ability to successfully perform a behaviour (i.e. the attitudes of preventing oneself and household from contracting schistosomiasis) [15].

The study focuses on exploring the knowledge, attitudes and perceptions (KAP) of caregivers on of the role of WASH situation in HCFs and communities of the endemic districts. The outcome of the study is to help design plans to address gaps and social behavior change communication and advocate for central government and other WASH stakeholders to ensure improvement of the WASH situation which will contribute to reducing the transmission and the impact of schistosomiasis in Ghana.

2. Conceptual Framework/ Research Paradigm

The Health Belief Model (HBM) conceptual framework was used for the research. The HBM was developed in the early 1950s by social scientists at the U.S. Public Health Service to understand the failure of people to adopt disease

prevention strategies of disease[16]. The HBM suggests that a person's belief in a personal threat of disease together with a person's belief in the effectiveness of the recommended health behaviour or action will predict the likelihood the person will adopt the behaviour. HBM derives from psychological and behavioural theory with the foundation that the two components of health-related behaviour are the desire to avoid illness or conversely get well if already ill; and the belief that a specific health action will prevent or cure illness. Ultimately, an individual's course of action often depends on the person's perceptions of the benefits and barriers related to health behaviour.

3. METHODS

Setting

The study was conducted in 3 districts in the Oti region (Krachi West, Krachi East and Nkwanta South) and 3 districts in the Upper East region (Kassena Nankana, Kassena Nankana West and Builsa South). The districts were selected because of their high prevalence and endemicity of schistosomiasis.

Study Design

An explorative qualitative study using semi-structured focus group discussions interviews was conducted among caregivers between October and November 2023. The community level qualitative study consists of 25 community level Focus Group Discussion (FGDs) with between 10-12 caregivers in each group. Caregivers are proposed participants of the FGDs because they have the primary responsibility of water and sanitation in households in the context of the study districts, thus they provide adequate and comprehensive information in their communities. Also, the 25 FGDs comprised of interviews in one community in each area council/sub district of the study districts. Each community was selected from each area council as these districts are generally homogeneous in characteristics. Each district has an average of 5 area councils/sub districts making a total of 25 area councils/sub districts. Communities and caregivers were randomly selected to ensure each is given an equal chance of being selected. However, preference was given to communities with high schistosomiasis incidence per information from the District Health Directorates. KAP on schistosomiasis data was collected using Focused Group Discussions with women and men who are primarily responsible for water and sanitation at the household level within the context of the study area. Women are proposed because of the lead role they play in water and sanitation issues at the household level. The access to WASH is mostly associated with women and children due to the role they play in household activities in the context. Consequently, they also benefit the most from improved water, sanitation, and hygiene (WASH) services. Men were also considered because of their role as the head of the family in Ghana and their responsibility in the provision of WASH facilities. As part of community engagement protocols, the project conducted community entry process on the purpose of the study prior to Focus Group Discussions. An FGD approach were chosen because this offered us the opportunity to generate varied data on personal knowledge, attitudes, perceptions, opinions and thoughts on the role of WASH in schistosomiasis prevention which would have been difficult with a confirmatory data collection method such as structured surveys.

Study Population and Selection Criteria

The study population comprised health workers, caregivers and District Water and Sanitation Teams (DWST) who had resided in endemic communities in the districts. However, for this publication only data collected from caregivers were analyzed. They were selected based on their availability to participate in the interviews. Caregivers were selected if they or a member of their family have ever had schistosomiasis in the past 6 months.

Recruitment

Recruitment was done from the district health management teams, health facilities and communities for caregivers and health workers, and the district assemblies for the DWSMT. Prospective participants were identified at the various locations by the study team through nurses, district directors and the Public Relations Officers for the assemblies respectively. Those recruited from the health facility were identified using the hospital register to confirm any incidence of schistosomiasis. Whenever the research team met a prospective participant, they introduced themselves as researchers from the World Vision Ghana who were researching the knowledge attitude and perceptions of the role of WASH in the prevention of Schistosomiasis among health workers and care givers. Caregivers were met individually and privately by the interviewer to confirm whether they or a family member have ever fallen ill of schistosomiasis. The confirmed caregivers were asked their willingness to consent to join the research. With the recruitment of health workers, they were purposively selected form the health facilities and the district health management teams. The procedure for the interviews is face-to-face in-depth. They were then introduced in the study

and were given a day to decide whether they were willing to participate in a 1-hour interview with a knowledge attitude and perceptions.

Ethics

Ethical issues arise in the process of research and researchers must anticipate and address them as and when they arise during the process. This research followed the appropriate ethical standards and procedures. The ethical approval was received from the Navrongo Health Research Centre, Institutional Review Board (NHRCIRB) for the review of the study protocols. Data generated from this study is handled by only staff working on the study and only available to other staff with the right justification and approval. The study also collected and documented consent from all respondents. Further, the study ensured that information collected was used only for the purposes indicated in the study. Anonymity and confidentiality of respondents were ensured in this research by hiding personal identifiable attributes of respondents. Relevant institutions such Ghana Health Service and the various health care facilities related to the research were presented with introductory letters to authenticate the relevance of the research and get the necessary stakeholder support for the research. All interviews were conducted in quiet places around health facility buildings, in church or school buildings. FGDs lasted about 40 minutes-60 minutes (range, 20–60 minutes). All the interviews were recorded with a tape recorded. Before the start of every interview, study participants were given an opportunity to make enquiries and ask questions about the rights and responsibilities of study participants participating in the research. All participants were assured of anonymity (no names recorded; however, they were given unique study IDs which will prevent the possibility of relating the information to individuals). Also, all audio recordings are stored under lock and key in private locations and computers are password protected. Only the researchers and project team had access.

Participants were informed that only the analyzed and group data would be disseminated with the scientific community and conferences. Participants were informed that they are free to refuse to answer the questions they were not comfortable with or end the interview when they wish with or without explanation.

The informed consent for the interviews were read and explained to participants and they were given a written and signed consent before the start of the interviews. The most common local language (twi) was used, thus there were no cultural barriers to language. The participant was given the opportunity to choose either between Twi or English for the interview. The health workers preferred interviews in English whiles all the caregivers responded in twi. Data saturation was attained after the 24th FGD and the 25th FGD was used as a confirmation interview.

Thus, all procedures employed by the study adhered to the declaration of Helsinki and other relevant ethical and scientific principles.

Data Analysis

Qualitative data analysis largely entails grouping things, persons, and events and the features that distinguish them. Agreeing with this assertion, qualitative data collected to address objectives of this study will be cleaned, grouped into themes, patterns and groups to aid in the analysis of data collected. Data from this study will be analyzed and presented in varied ways depending on the purpose and audience. The interviews conducted in Twi (15 in total) were translated and transcribed verbatim into English by the first author. The transcribed interviews were coded and thematically analyzed using qualitative data analysis software, Atlas Ti. version 8.4.2. The code-tree was generated based on the grounded theory approach using codes based on theoretical constructions. Open coding was done through inductive reasoning. Three interviews were coded by the first and second authors independently (second author was not involved in data collection). To ensure intercoder reliability, back-and-forth discussions were done between the first and second author on the discordant codes. The final codes used for the transcripts were all agreed on by both the first and second authors. Axial coding was used to draw connections between the codes and selective coding was used to categorize codes into main and subcategories. Main categories were further grouped into possible themes. Outputs from the coding were summarized iteratively by the first and second author and are shown in the Results section. Summaries that overlapped in content were merged.

Participant Description

Of the 251 caregivers who participated in the study, 143(57%) were females and 108(43) were males. A total of 190(75%) were Christian and the remaining 64 (25%) were Muslim. Majority of them are illiterate (26%) with farming (30%) being the most common occupation. A few of the participants have water available in their households, 76 (30%) and only 58(23) have sanitation facility at home.

Table 1: Description of Study Participants

Variable *(N=251)*	Frequency *(n)*	Percentage *(%)*
Gender		
Female	143	57
Male	108	43
Religion		
Christian	190	75
Islam	61	25
Educational Qualification		
Primary	48	19
Secondary	56	22
Senior High School	58	23
Tertiary	25	10
Illiterate	64	26
Occupation		
Farming	76	30
Civil servant	42	17
Fishing	55	22
Business	46	18
Unemployed	32	13
WASH Facilities Available at home		
Water	76	30
Sanitation (toilet facilities)	58	23

4. RESULTS

The results describe caregivers' knowledge, attitudes and perception on the role of WASH in Schistosomiasis prevention.

Knowledge about Schistosomiasis

Most caregivers had inadequate knowledge about schistosomiasis. Some caregivers had a fair knowledge about what schistosomiasis is, while some had no knowledge at all on the causes of schistosomiasis; however, a few had knowledge of the disease. When asked what schistosomiasis some caregivers are mentioned urinating blood and difficulty in urinating which is almost related. Some also mention worm sickness affects your eyes and legs which are not related to the disease.

"It is a worm sickness" caregiver in FGD

There seems to be a knowledge gap among caregivers in the causes and symptoms. Some of the causes mentioned include swimming in dirty water, open defecation, malaria. Even though some caregivers were able to mention dirty water, there were some superstitious beliefs on the knowledge which include chewing raw potatoes and contact with bodies. More also some associate schistosomiasis as an eye infection of evil disease.

"In recent times some people give birth to children with eye defects, and we think it is related to the previous contact with water bodies that is now causing them" caregiver in FGD

"They initially told us that people contract it through chewing raw potatoes" caregiver in FGD

Knowledge Symptoms of a Person with Schistosomiasis

Few of the caregivers mentioned that the symptoms of schistosomiasis include bloody urine and stool, rash, itchy skin, fever, chills, cough, and muscle aches, however majority of the caregivers were unable to state the symptom appropriately which include diarrhea, scanty urine, itching eyes, blurred vision.

"Pains in genitals, Painful urination, Bloody urine and stool" caregiver in FGD

"Bloody urine, yellowish urine, difficulty urinating, blood stains on the underwear of infected females who are not yet up for menstruation" caregiver in FGD

"Diarrhea, bloated stomach, itching eyes, blurred vision" caregiver in FGD

Knowledge on Causes of Schistosomiasis

Majority of caregivers described the causes of schistosomiasis as frequently drinking untreated water, contaminated food and water, and drinking of worms infested water which were not appropriate. A few caregivers were able to state the causes appropriately which include bathing in streams and lakes, urinating and defecating in rivers and bathing in the lake

"If you eat ancestral totem" caregiver in FGD

"Eating sugar cane" caregiver in FGD

Perceptions on the Role of Water, Sanitation and Hygiene plays in Schistosomiasis Prevention

When participants were asked about what role water plays in the prevention of schistosomiasis, a few mentioned that water harbor snails for transmission of schistosomiasis; water is a medium of transmission of schistosomiasis and water serves as a breeding site for the organism. However, a majority were unable to appropriately describe the role of WASH which includes drinking hot water can prevent diseases, drinking dirty water can cause diseases, not drinking contaminated water can reduce risk of disease infection, etc.

"Drinking dirty water without treating may cause the diseases" caregiver in FGD

"If you drink contaminated water, you are likely to get infected by schistosomiasis" caregiver in FGD

More than half of caregivers were unable to appropriately state the role of sanitation in the prevention of schistosomiasis. Some mentioned that the dumping of refuse in the river pollute water to cause schistosomiasis, dirty environment can cause schistosomiasis, when waste is disposed close to water body, it pollutes the water and can cause schistosomiasis, the unclean nature of our barrel or basins can cause schistosomiasis, not clearing and sweeping the environment can cause the schistosomiasis diseases, not washing cooking utensils on time, which are related to prevention of other diseases and not schistosomiasis. A few mentioned that open defecation contaminates water bodies which can lead to schistosomiasis diseases.

"Flies from unclean environment may carry infections to your food and water thereby causing the diseases" caregiver in FGD

"Fecal matter disposed into water bodies enhances growth and spread of snails that cause schistosomiasis" caregiver in FGD

"Unkept environment can harbor mosquito's" caregiver in FGD

Majority of caregivers mentioned the role hygiene plays in schistosomiasis as fetching water into unclean basins may contaminate water and cause schistosomiasis, leaving cooking utensils unwashed may cause schistosomiasis, unable to wash hands properly before eating can cause schistosomiasis, washing and wearing of clean clothes reduce the risk of infection to bilhazia, bathing two of three times a day with clean water and soap help stop the spread of bilhazia etc. None of the caregivers were able to appropriately mention the role of hygiene in the prevention of the disease.

"Not regularly washing hands with soap and water especially after visiting the toilet can lead to schistosomiasis" caregiver in FGD

"Washing and wearing clean clothing reduces risk of the disease's" caregiver in FGD

"Unkept rooms can also harbor infectious mosquitoes'" caregiver in FGD

Attitudes towards Undertaking Preventive Measure

With regards to not been able to undertake preventive measures, all caregivers clearly expressed their inability to undertake preventive measures due to poverty, the non-availability of toilet facilities in the community, and lack of a potable drinking water source. In addition, some stated that the lack of sanitary equipment and ignorance of information on preventive measures.

"Lack of potable drinking water, no access to potable water in the community, lack of money to buy protective clothing like boots, lack of household toilet facilities to use in community" caregiver in FGD

"Travelling long distances to fetch water, no time to boil water before use and no borehole is available so the community is forced to fetch from uncovered Wells and streams" caregiver in FGD

Attitudes of Preventing Yourself and Your Household from Contracting Schistosomiasis

When asked about how to prevent yourself and your household from contracting schistosomiasis, majority of caregivers mentioned staying safe always by drinking good water, by boiling water, filtering and boiling water from dams or streams before using which are good approaches from preventing other waterborne diseases but not

schistosomiasis.

"By using clean water for house chores, wash hands before cooking, put water in a clean container and cover" caregiver in FGD

"Cooking of red sweet potatoes before eating and stop eating of raw rice" caregiver in FGD

With prevention of schistosomiasis, only a few of caregivers were able to mention appropriate prevention strategies the caregivers which includes stop using the river water, not swimming in water bodies, stopping defecating in rivers and preventing the children from bathing the lake frequently.

"Stop swimming in water bodies and stop children from playing in open water bodies" caregiver in FGD

Challenges of WASH in the Community

About half of the caregivers mentioned their WASH challenges as inadequate toilet facilities, open defecation, inadequate boreholes, no waste bins and sites.

"Poor source of drinking water, the KVIP is not in good condition and there are no materials for hand washing" caregiver in FGD

"We don't have enough toilets in this community, so we resort to free range (Open Defecation), No enough water sources and we have just few boreholes and it takes us too long and very stressful to get water" caregiver in FGD

Other study caregivers attributed the challenges of WASH to the attitude of some community members resulting from laziness and tiredness of communities' members to adopt proper WASH practices.

Attitudes Towards Treatment Options for Schistosomiasis

All caregivers clearly expressed their knowledge about treatment options and some practices and attitudes towards treatment schistosomiasis. About half of the caregivers mentioned going to the health facility for medication, visiting the clinic and pharmacy shops. However, more than half mentioned other inappropriate treatment options which include boiling water before drinking, taking of albendazole and iterating tablets, local herbs and herbal treatment.

"Boiling and drinking herbs" caregiver in FGD

"When you soak groundnut for about 24hours and drink the decoction for about 3days and Going to the herbalist" caregiver in FGD

"Mango leaves, Moringa and Neem tree leaves" caregiver in FGD

5. DISCUSSIONS

The study explored the knowledge, attitudes and perceptions (KAP) of caregivers on the role of WASH in schistosomiasis prevention in HCFs and communities of the endemic districts. We found that most caregivers had inadequate knowledge about schistosomiasis. Only a few had an idea of the symptoms of a person with schistosomiasis and the causes of schistosomiasis. More also, caregivers understanding of the role that WASH plays in schistosomiasis prevention were limited. In addition, there were varied attitudes of caregivers to undertake preventive measure; practice of preventing oneself and household from contracting schistosomiasis; challenges of WASH in this community and treatment options for schistosomiasis which were not appropriate for schistosomiasis prevention. These are discussed in detail below.

We found that most caregivers lacked adequate knowledge on schistosomiasis and some of caregivers had a fair knowledge about what schistosomiasis is, while some had no knowledge at all on schistosomiasis. The caregivers mentioned worm sickness affects your eyes and legs which are not related to schistosomiasis. There seems to be a knowledge gap and misconceptions among caregivers on the causes and symptoms. Some of the causes mentioned by the caregivers include swimming in dirty water, open defecation and malaria. Even though some caregivers were able to mention swimming in dirty water and open defecation, there were some superstitious beliefs on the knowledge which include chewing raw potatoes and contact with water bodies. The inadequate knowledge resulted in some caregivers associating schistosomiasis with several misconceptions which associate the disease with an eye infection and an evil disease. Because of the caregiver's limited knowledge on schistosomiasis, the attitudes and action of disease prevention is inhibited as revealed in HBM theoretical framework which fueled the increase in the prevalence in the endemic districts and communities. Low levels of knowledge may lead to the increased transmission of schistosomiasis which is consistent with literature [17, 18]. Gabaake et al. (2022) have also found that a lack of in-depth knowledge on the life cycle and cause of the disease leads to risky behaviors which increase the transmission of schistosomiasis putting a more population at risk [19]. Unfortunately, some of the caregivers in our study who had experienced schistosomiasis had several misconceptions about the disease and thus resorted to other inappropriate forms of treatment approaches like the herbalist and spiritualists which is consistent with studies conducted in

Uganda [20]. Perceptions that a swollen stomach was a sign/symptom of 'ekidada' (caused by witchcraft) resulted in some people rejecting free praziquantel in favor of herbal treatment from traditional healers at a fee [20]. Rassi et al. (2016) also found that Poor knowledge of the causes of schistosomiasis and how to prevent it, coupled with persisting misconceptions, continue to pose barriers to effective disease prevention and control [21]. The low-level knowledge on schistosomiasis found in this study points to the need to intensify community health education. Also, other interventions that provide full and comprehensive information on schistosomiasis should be explored such as health talks and via mass media (radio and television) [17, 19–21].

Knowledge of the symptoms of persons with schistosomiasis also influences the practices and attitudes of disease prevention. Few of the caregivers in the study were able to mention the symptoms of schistosomiasis which include bloody urine and stool, rash, itchy skin, fever, chills, cough, and muscle aches, however majority of the caregivers were unable to state the symptom appropriately which include diarrhea, scanty urine, itching eyes and blurred vision. Knowledge of symptoms of a particular disease increases the health seeking behaviors and adherence to treatments which reduces transmissions and infections in the other populace. The findings of the study are consistent with studies conducted in Uganda and Mozambique [21, 22] . The HBM theoretical framework suggests that a person's belief in a personal threat of disease together with a person's belief in the effectiveness of the recommended health behaviour or action will predict the likelihood the person will adopt the behaviour. This was confirmed in the study as caregivers were unable to adopt disease prevention behaviour due to their limited knowledge of the symptoms.

In addition to the knowledge on symptoms of the disease, majority of caregivers described the causes of schistosomiasis as frequently drinking untreated water, eating contaminated food and water, drinking of worms infested water which were not appropriate. A few caregivers were able to state the causes of schistosomiasis appropriately which includes bathing in streams and lakes, urinating and defecating in river and bathing in the lake. Similarly in other studies conducted in Uganda, Botswana and Nigeria, most of the respondents did not know the causes of schistosomiasis which indicates a limited health education in endemic communities and districts during Mass Drug Administration (MDA) [19, 22, 23]. The limited knowledge on the causes can increase the transmissions in endemic communities and increase re-infections of treated schistosomiasis cases after treatments and MDAs [21]. Irrespective of the fact that some of the participants were unable to appropriately mention the cause, others mentioned the causes correctly but could not stay away from the bathing, urinating and defecating in the lake due to their livelihoods, limited access to water and other sanitation facilities. Findings from this study confirm other studies done in Ethiopia, Namibia and Brazil which revealed that water-related activities, such as swimming, bathing, washing, and fishing practices cause schistosomiasis infection [24–26].

We also established that caregiver's knowledge and perceptions on the understanding of the role WASH plays in schistosomiasis prevention were limited. A few caregivers mentioned that water harbor snails for transmission of schistosomiasis. However, a majority were unable to appropriately describe the role of WASH in schistosomiasis prevention. Some caregivers mentioned drinking hot water can reduce risk of disease infection, etc. As was similarly reported in other studies, some caregivers are unable to adapt to good WASH practices due to the unavailability of WASH facilities and limited knowledge of the role of WASH [21, 22]. More than half of caregivers were unable to appropriately state the role of sanitation in the prevention of schistosomiasis. Some caregivers said that when waste is disposed of close to water body, it pollutes the water and can cause schistosomiasis. Others also said the unclean nature of our barrel or basins and not washing cooking utensils can cause schistosomiasis. A few mentioned that open defecation contaminates water bodies which can lead to schistosomiasis diseases. This finding is confirmed by similar research conducted in Uganda [22]. None of the caregivers were able to appropriately mention the role of hygiene in the prevention of the disease. The study found that even though WASH plays a key role in the prevention of schistosomiasis, there was limited knowledge among caregivers on the role of schistosomiasis and this affects the attitudes and perceptions to prevent the disease and increases the risk of infections. Correspondingly, other studies in endemic areas of Africa and Brazil indicated similar observations [23, 24]. This may indicate that awareness alone does not necessarily result in behavioral changes, which are often more difficult to achieve, requiring long periods of time to ensure compliance with healthier practices [23].

In our investigation, we found that with regards to not been able to undertake preventive measures, all caregivers clearly expressed their inability to undertake preventive measures due to poverty, lack of toilet facilities in the community, lack of a potable drinking water source. In addition, some stated that the Lack of sanitary equipment and ignorant of information on preventive measures which is consistent with similar KAP studies conducted in some

parts of West and South Africa (Anyolitho et al., 2022; Dawaki et al., 2015; Rassi et al., 2016).

When asked about how to prevent yourself and your household from contracting schistosomiasis, majority of caregivers mentioned staying safe always by drinking good water, by boiling water before drinking, filtering and boiling water from dams or streams before using which are good approaches to preventing other waterborne diseases but not schistosomiasis. With prevention of schistosomiasis, only a few caregivers were able to mention appropriate prevention strategies. The caregivers mentioned avoiding the use of the river water, not swimming in water bodies, stopping defecating in rivers and preventing the children from bathing in the lake frequently. About half of the caregivers mentioned their WASH challenges as inadequate toilet facilities, open defecation, inadequate boreholes, no waste bins and sites. Other caregivers attributed the challenges of WASH to the attitude of some community members resulting from laziness and tiredness to adopt proper WASH practices which can be linked to perceived risk as in the health behavior model. A strategic intervention that's specifically addressing the provision of good drinking water and latrines, especially along the lake and rivers, will make an impact the prevention and eradication of schistosomiasis. The study confirms similar common practices have been reported in another context [23, 26].

All caregivers clearly expressed their knowledge about treatment options and attitudes towards the treatment schistosomiasis. About half of the caregivers mentioned going to the health facility for medication, visiting the clinic and pharmacy shops. However more than half mentioned other inappropriate treatment options which include boiling water before drinking, taking of albendazole, local herbs and herbal treatment. Similar studies conducted by other researchers confirmed that people who perceived that schistosomiasis is caught from drinking un-boiled lake water did not seek to minimize skin contact with infected water sources [23]. The findings reveal the need to understand the different myths and misconceptions to design programs and social behavior communication targeting endemic communities for achieving tangible outcomes.

6. CONCLUSIONS AND RECOMMENDATIONS

The study highlights limited knowledge of caregivers which can result in increased transmission of schistosomiasis. Findings from the study established that caregiver's knowledge and perceptions on the understanding of the role WASH plays in schistosomiasis prevention were limited. This implies the need for policy interventions to enhance health education and social behavior change communications among caregivers and the populace for sustained prevention of schistosomiasis while also recommending further longitudinal studies. Our findings show that respondents' knowledge about the cause, transmission, symptoms and prevention of schistosomiasis was inadequate, and this could be a challenging obstacle to eradication of schistosomiasis from these communities. Besides mass drug administration, school and community-based health education regarding good access to water, personal hygiene and good sanitary practices is imperative among these communities to significantly reduce the transmission and morbidity of schistosomiasis. We recommend that social behavior change communication and advocate for central government and other WASH stakeholders is strengthened to ensure improvement of the WASH situation which will contribute to reducing the transmission and the impact of schistosomiasis in Ghana. The study recommends policy formulation and intervention strategies to enhance WASH services and infrastructure in healthcare settings, urging stakeholders to advocate for increased investment and targeted programs.

7. Limitations

The study is limited in its generalizability because it only involved a few caregivers in endemic districts who were interviewed. The study did not assess the knowledge of health workers who are expected to be delivering health education messages. Therefore, inferences based on this study should be made with caution. Also, it was a challenge to find caregivers who disclose that they have contracted schistosomiasis. This means that our results could be biased by only reflecting the voices of caregivers who are open to responding to the interview.

8. Declarations

Contributors: AQD, RLW and JRB led the drafting, ISK prepared the tables and prepared the supporting information. BB & DM conceptualized the consensus project, BDM supervised data collection and PAO supervised the data analysis. All authors contributed to the interpretation and writing of the paper. AQD provided overall leadership and technical guidance in the authorship, peer-reviewing process and paper finalization. All authors approved the final version.

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Data Availability

The data used by this study can be accessed free of charge from the websites of the World Health Organization. Global Progress Report on Wash in Health Care Facilities (https://www.who.int/publications/i/item/9789240017542), WHO / UNICEF Water and Sanitation for Health Facility Improvement Tool (WASH FIT) and WASH FIT: A practical guide for improving quality of care through water, sanitation and hygiene in health care facilities. Second edition(https://www.who.int/publications/i/item/9789240043237)

Readers should kindly consider when the authors accessed these datasets as detailed in the reference list.

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Ethics Approval and Consent to Participate

The ethical approval for this study was granted by the Navrongo Health Research Centre, Institutional Review Board (NHRCIRB) in Ghana. The clearance certificate is ETHICS APPROVAL ID: NHRCIRB46l

All procedures employed by the study adhered to the declaration of Helsinki and all other relevant ethical and scientific principles.

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Appendices

Health Belief Model