ASSOCIATION OF SCHISTOSOMIASIS ENDEMICITY WITH SOCIODEMOGRAPHIC FACTORS IN GIKONKO AND KIBINGO HEALTH CENTRES, KIGALI - RWANDA

ICYIZANYE Norbert, TWAHIRWA Gervais and WABWIRE Paul Francis

ICYIZANYE Norbert, Clinical Officer, Department of Clinical Medicine, SHS, CMHS- University of Rwanda. Tel: +250789716419, Email noreicbert@gmail.com

TWAHIRWA Gervais, Clinical Officer, Department of Clinical Medicine, SHS, CMHS- University of Rwanda. Tel: +250781036615, Email: gervaist34@gmail.com

WABWIRE Paul Francis, Assistant Lecturer, Dept: Clinical Medicine, SHS-CMHS, University of Rwanda. Tel: +250787902276 / +256772654659, Email: wabwirepaulfrancis@yahoo.com

Affiliation: Department of Clinical Medicine, School of Health Sciences, College of Medicine and Health Sciences, University of Rwanda- Kigali Rwanda

Country – Kigali Rwanda

Date: August 2018

Key words: Associations, Schistosomiasis, Factors in Rwands

Abstract

Schistosomiasis also known as bilharziasis is among the major endemic parasitic communicable disease commonly found in developing countries including Rwanda and world over. The research aimed at determing the correlation between schistosomiasis with socio-demographic factors and water contact behaviors.

It was a descriptive, cross-sectional study that adopted mainly quantitative data collection and analysis approach in purposively selected population of "391" patients attending health services. Data was collected and analyzed using SPSS. Cross-tabulation and chi-square were used to determine the association between independent and dependent variable. Findings indicated a high prevelance of 32% being highly associated with none use of shoes among females (p-value = 0.029: CI 95), agriculture activities - in swamps (p-value =0.001: CI 95%), Swimming (p-value=0.001: CI = 95) and bathing in water sources (p-value=0.001 : CI = 95.

Conclusivelly, this study indicated that demographic, social and water contact behaviors are among the contributing factors to schistosomiasis endemicity in the research areas.In this case management planners need to include all age groups in mass treatment of the disease, have continuous Health education and community mobilization about the endemicity and morbidity of schistosomiasis in the study areas and country at large.

Study background

Schistosomiasis is one of the most widespread of all human parasitic diseases with the global prevalence at around 240 million among which children are mostly affected (4). It ranks second only to malaria in terms of its socioeconomic and public health in tropical and subtropical areas considered as most important Neglected Tropical Disease(NTD) (3). Over 700 (10%) millions of overall population worldwide are at risk of becoming infected, 20 million disabled by schistosomiasis (5) and kills 280,000 each year (6). It is highly prevalent in Sub Saharan African countries where Rwanda is located (7) .

In Sub-Saharan Africa, approximately 120 million individuals have schistosomiasis related symptoms while 73.9% of them undergo hardship as a result of chronicity and complications of the disease (2) . In addition, WHO estimate 80% of the morbidity attributable to schistosomiasis occurring in poor communities and households of Sub-Saharan Africa countries alone (7).

In East Africa, Tanzania remains to be the country that has the highest burden of schistosomiasis in the region with national prevalence rate of 51. 5 %. A single approach of preventive chemotherapy by using Praziquantel alone was found to be ineffective in Tanzania. To overcome this, integrated control programs acting beyond one to three rounds of chemotherapy was implemented. Furthermore , deliberate efforts to enforce health education and improving access to clean water supply and adequate sanitation especially the use of toilets has shown to be a contributing factor for its reduction (8) .

A recent study done in Rwanda estimates a prevalence of schistosomiasis at 36.6% of a focal population. However, that report was derived from a focal study rather than a national survey of the country , this is why some literatures indicates 2.5% of the total population (9) . The overall prevalence of "*Schistosoma mansoni*" among school children of Nkombo island was found to be the highest in Rwanda with about 62.1% due to being an island as well as prone to use lake Kivu as a source of water (10) .

Recent studies done in 2015 indicate that 23.1 % and 38.9% have no access to improved drinking water and improved sanitation respectively (9) . This makes Schistosomiasis to continue to be a major public health and socio-economic problem for a number of people living countrywide (6) .

According to MOH research, children (5-10 years old) were with high risk potential of transmission compared to adult in Rwanda. The main transmission areas were found around Lakes Ruhondo, Burera, Kivu, Rweru, Mugesera and some swampy areas in Nyagatare district where infected snails of the genus Biomphalaria have been found around the lakes (3) .

Problem statement

Schistosomiasis is the most common parasitic diseases behind malaria particularly in Sub-Saharan Africa causing 240 million cases worldwide and was estimated to cause 280,000 deaths yearly in Africa alone (6). Schistosomiasis is still endemic in Rwanda at prevalence rate ranging between 2 - 5% and 36.6% of overall and focal population respectively affecting School Age Children than adults (9). In higher prevalent regions, schistosomiasis is among the common cause of poor health such as anemia, malnutrion that worsens production, hence continuation of poverty, long term illnesses and impaired development.

Literature Review

Introduction

Schistosomiasis also known as bilharziasis or snail fever is a major parasitic disease commonly found in Africa, Asia and South America. It has three main species for human being. Schistosoma haematobium known to cause urinary Schistosomiasis; Schistosoma mansoni known to cause intestinal schistosomiasis and Schistosoma japonicum known to cause oriental schistosomiasis. It has been suggested that the infection evolved around the river Nil and the first schistosome eggs founded by Ruffer in Egyptian mummies (12).

Leading cause of Schistosomiasis in Rwanda

Different studies done in Rwanda identified the freshwater snails Biomphalaria species as the intermediate hosts involved in the transmission of Schistosoma mansoni in Rwanda. This was found in research done in 2012 from the Eastern Province. In that research, a great number of Biomphalaria species were infected by Schistosoma cercariae (13). However, there is no information regarding distinct species of Biomphalaria snails which involve in the transmission of Schistosoma mansoni in Rwanda. On the other hand, one report indicated Biomphalaria Pfeifferi as the main species transmitting the parasite around Lake Ruhondo (11). Furthermore, the presence of Bulinus species (freshwater snails that are intermediate hosts for Schistosoma

haematobium) were noted in 2012, but none of the snails observed were infected with cercariae (13).

Epidemiologic distribution in Rwanda

Even though, the first case of schistosomiasis was reported in 1972, historical epidemiological surveys on schistosomiasis had been conducted since 1940, where the report from 1947 indicated that Lake Burera and Ruhondo in Northern Province were the main sources of infections. Later, ongoing surveys in the mid-1970 and early 1980, indicated that the transmission of intestinal schistosomiasis were spreading commonly in children ranging from 5 to 10 years old in many areas of the country (13).

Although the first national mapping survey which had been done in 2008 had revealed that Rusizi district had the lowest prevalence rate of Schistosoma mansoni compared to other districts, a recent study has shown a higher increase in this district where the prevalence rate done around Nkombo Island in January 2011 from this district was at around 62.1% among 311 SACs ranging between 10-19 years old basing on Kato- Katz procedure. This was varying from one school to another, from 28.6 % to 77.9 %. In addition, a recent epidemiological survey done by MOH in early 2016 indicated that in the catchment areas of lakes Ruhondo, Burera , Kivu, Muhazi, Rweru , Mugesera, and the swampy areas of Nyagatare district were the most favorable location for the transmission of Schistosoma mansoni and breeding sites for the snail intermediate hosts of infectious agents which contributes to its transmission (11).

Sociodemographic factors associated with Schistosomiasis

The continuous transmission of schistosomiasis is attributable to various Sociodemographic factors which continue to be a public health concern. These include the following:

1. **Gender**

Schistosomiasis is influenced by many factors including demographic factors such as gender. A study done in Uganda indicated males to be affected compared to females in each age groups, where the overall prevalence among screened peoples was 91 % and 90 % among males and

females respectively across all ages (14). However , women and girls are at higher risks due to being exposed to daily activities such as laundry, plate washing, water fetching for their domestic use and bathing in which they can get infected (2) . On the other hand, the research conducted in Nigeria in Hausa community, indicated that the % of males who had history of infection was significantly higher than the one in females where it was 49.1% and 22.3% in males and females respectively (15). Comparing the above studies, we can see that there is a big difference in prevalence based on gender and this may be due to other different factors such as water contact behaviors, occupation and other factors.

2. Age group

A study done In Uganda showed that, being child or adult influence the risks of being infected by schistosomiasis.

The epidemiological analysis of data from a community of Uganda indicated that adults are at higher risks of being infected by schistosomiasis than children due to being exposed to infections through different activities such as fishing , farming , working in hydro electrical settings and other economic activities (15).

On the other hand, Children spent their recreational time in stagnant water than adults as well as other activities such as water fetching , animals drinking's put them to be at higher risk of infections to schistosomiasis (14). In Rwanda , epidemiological survey done by MOH in early 2014 indicated that the transmission of intestinal schistosomiasis were spreading commonly in children ranging from 5 to 10 years old in many areas of the country than in adult (13).

3. Occupation

Occupational activities which expose people on repeated contact with contaminated water such as fishing, agricultural as well as hydro electrical activities and farming have shown to be the most risk factors for the transmission of infections (16) . Working in constructions, irrigation schemes, reservoirs, hydro- electrical dams and agricultural activities remain the contributing factors for the spreading of infections (8). Electricity generation construction in SSA countries such as Senegal, Ghana, Mali, Namibia and other countries led to an increase of schistosomiasis. According to Steinmann and co-workers, around 13.6% (106 million) of people

are at risks of schistosomiasis in SSA because of irrigation schemes, agricultural purposes and large dam reservoirs expositions(2) .

4. Water contact behaviors

For the transmission of schistosomiasis to take place, it requires a direct contact between intermediate snail host and final human host (17). For instance, it has been indicated that over 76% of the SSA population live in close contact to various open water bodies which are the breeding site for intermediate snail hosts, this makes SSA where there is a high contact with contaminated water to be the highest prevalent region in the world (2) .

A research done in Uganda around Lake Victoria basing on four variables: an estimated distance from houses to Lake Victoria, whether the persons had contact with the Lake in previous weeks, estimated duration and number taken to contact with the water, concluded that contact with permanent and temporal water bodies such as lakes, rivers and ponds existing in the country were the potential contributing factors for the transmission of infection (7) .

Many countries in SSA have a limitation on access to clean water for their domestic use. However, they prefer to use natural water bodies such as ponds, lakes, rivers, and other stagnant water which may sometimes contain schistosome parasites. This is consistent with the study done in northern Nigeria where the rate of urinary schistosomiasis was 88.57% in community with ponds as source of water for their domestic use compared to 0. 57% of their neighbors whose borehole (12).

Methodology

Study area

The study area was the first two health centres among ten health centres with the highest numbers of cases of schistosomiasis reported (RBC and MOH) since 2016 to 2017. The two staudy sites were Gikonko and Kibingo health centres of Gisagara and Rutsiro district respectively. The listing indicate the two most affected health centre among the first ten in Rwanda (RBC and MOH HMIS report 2017).

Geographically the two study areas are different with Gikonko health centre being located in Southern while Kibingo health centre is in Western province. The catchment area of Kibingo health centre connects to the border of Lake Kivu, as opposed to that of Gikonko health centre which is a large swampy areas hence different human activities.

Study design

Descriptive cross-sectional study design with both qualitative and quantitative data collection and analysis. Secondary data was used as gathered from patients' medical records of health centre to identify age groups, gender and villages mostly affected over a period of two years (2016 and 2017). The data which were not available in health centres were obtained from the community using questionnaire through interviews and observational methods. The participants interviewed were those coming from the mostly affected villages obtained from health centre records of 2016 and 2017.

Study population

The study population was 391 including 291 files (quantitative) of clients diagnosed with schistosomiasis between 2016 and 2017 and residing in the catchment areas of research area. A 100 residents including both gender and over miner of the highly affected villages were interviewed for qualitative data

Study sample

Rwanda Biomedical Center and Rwanda Ministry Of Health 2017 reports were the reference sources of the affected / infected population sizes. The under indicated formular was used to determine the sample size with 95% CL Openepi.com" (18).

Sample size *n* = $\frac{[\boldsymbol{DEFF}\times\boldsymbol{Np}(\mathbf{1}-\boldsymbol{p})]}{[(\mathbf{d2/Z21}-\boldsymbol{\alpha}/\mathbf{2}*(\mathbf{N}-\mathbf{1})+\mathbf{p}*(\mathbf{1}-\mathbf{p})]} = \mathbf{391}$

Sampling strategy

Household and individuals to participate in this study were selected found from villages mostly affected by schistosomiasis as evidenced by records available in health centres and identified by community health workers and village leaders respective areas. The number of participants to be interviewed from each health facility catchment area were calculated by proportionate distribution leading to 37% and 67% from Gikonko and ibingo health centres respectively.

Result presentation

The study involved 391 cases diagnosed with schistosomiasis using **"Kato Katz"** procedure in two health centres during the period from 2016 to 2017. Among the cases, n=145 (37.1%) were from Gikonko whereas n=246 (62.9%) from Kibingo. From a total of 391 cases, n=190 (48.6%) participants were interviewed from their respective communities. Among 190 participants, n=57 (30.0 %) and n=133 (70.0 %) were from Gikonko and Kibingo health centre catchment areas respectively.

Distribution of cases by time in health centres

Fig 4-1 shows the trends of schistosomiasis diagnosed since 2016 to 2017 at Gikonko and Kibingo Health Centres. There is a remarkable increase in number of cases diagnosed at Kibingo health centre than at Gikonko. The increment is noted to be more than three time from 26.4% cases diagnosed in 2016 to 73.6% in 2017. On the other hand, there is a decrease in number of cases diagnosed in Gikonko from 69.0% to 31.0% in 2017.

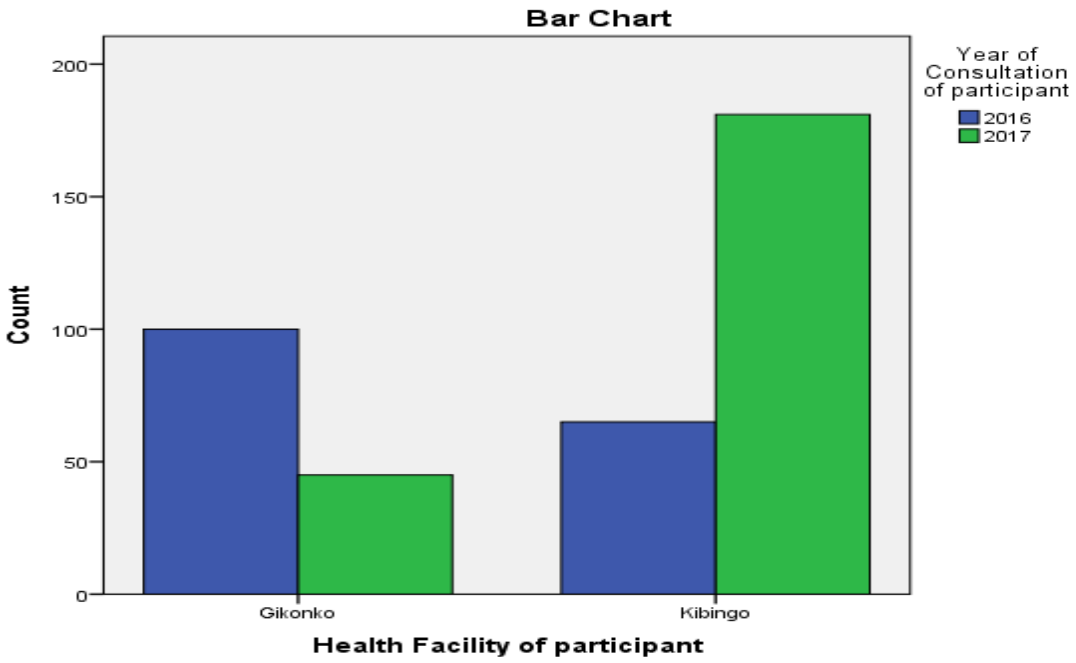

Figure 4.1: Trends of schistosomiasis in 2016-2017

Demographic factors associated with schistosomiasis

The assessed demographic factors include: Gender, Age group and Marital status. Results showed that females are more affected than males in both health centres with n=80 (55.2%) and n=168 (68.3%) in Gikonko and Kibingo health centres respectively.

Considering age group, results indicate 6-12 years old had the highest prevalence n=58 (40.0%) in Gikonko Health Centres compared to Kibingo health centre with n= 23 (9.3%). On the other hand, adults above 19 years old 70.7% from Kibingo are more affected than others compared to Gikonko where adults are only 21.4%.

Further more, the distribution of marital status across the study indicates that singles, n=112 (77.2%) are more affected than others in Gikonko compared with Kibingo where married people are n= 150 (61.0%).

Social factors associated with schistosomiasis

The social demographic variable included: Education, Occupation, Shoe wearing, Main source of water and Availability of Latrines. Results indicate that populations with primary education, n=31 (54.4%) and n=63 (47.4%) from Gikonko and Kibingo respectively are more affected than others, least to state are university population with only n=1(1.8%) and n=0 (0.0%) were diagnosed with schistosomiasis since 2016 and 2017 from Gikonko and Kibingo health centres respectively.

Regarding occupation, results indicate that farmers are mostly affected than others in both catchment area with n= 50 (87.7%) and n= 94 (70.7%) in Gikonko and Kibingo respectively. Besides agriculture, fishermen are only available in Kibingo at 10.5% due to the presence of lake Kivu.

Further more, about social factors, 70.2% in Gikonko as well as 72.9% in Kibingo reported not wearing shoes during their respective activities especially agriculture. The main source of water for domestic use is water pipe 73.7% in Gikonko compared to Kibingo where Lake Kivu 41.4% is their main source of water for domestic use.

Water contact behaviors associated with schistosomiasis

Variable under this included: Reasons for water contact, water proximity and water bodies exposure. Results here indicate that n=51 (89.5%) and n=100 (75.2%) from Gikonko and Kibingo respectively had different reasons for water contact. Water proximity reveals n=55 (96.5%) live in less than 1000 meters from swampy areas in Gikonko whereus n=119 (89.5%) live in less than 1000 meters from Lake Kivu and nearby swampy area. Among them, 41.4% fetch water from Lake Kivu.

However, n=50 (37.6%) and n=38 (28.6%) of respondents from Kibingo swim and bathe in the lake waters respectively, additionally, n=77 (57.9%) fetch water from Lake Kivu the most indentified area of the parasite.

Association of gender with exposures to water contact

Results about gender with exposure to water indicates reduced habit of wearing shoes (gumboots) by female from Gikonko n=24 (72.7%) and n=46 (49.5%) from Kibingo suggestive of high association with the disease (P-value = 0.029, 95 CI). Furthermore results about laundry activities among females indicate n= 28 (82.4%) and n= 73 (78.5%) from Gikonko and Kibingo respectively (P-value = 0.003, 95% CI) are exposed to water by laundry.

Reasons for water contact

The results indicate that agriculture in Gikonko is linked with schistosomiasis as the main reason for exposure to water contact n=35 (61.4%), (P-value = 0.001, 95% CI) compared to Kibingo. In Kibingo swimming n=50 (37.6%) and bathing n=38 (28.6%), are significantly associated with schistosomiasis with (P-value=0.001, CI=95%) and (P-Value 0.001, CI=95%) respectively, However, there are no noted significance of bathing and laundry in both catchment areas, (P-value > 0.05).

Discusion of results

The aim of this study was to determine the association of Sociodemographic factors with endemicity of schistosomiasis through assessment of factors that contribute to endemicity of the disease in mostly affected areas in the country.

Gender: In this study, the gender of participant has an impact on transmission of schistosomiasis since it is obvious that females are more affected than males with 55.2% and 68.3% in Gikonko and Kibingo health centers respectively. It is due to the fact that 77.0% of females do not have habits of wearing shoes especially when they are in daily activities. This is consistent with a research done by Fatimah in 2015 in SSA which has shown that women and girls are at higher risks due to being exposed to daily activities such as laundry, plate washing, water fetching for their domestic use and bathing in which they can get infected (2) .

Age of participants is very significant in transmission of schistosomiasis since water contact activities are in close relationship with age. Children aged between 6-12 years are the most affected in Gikonko with 40.0% which is in agreement with MOH- Rwanda research, which has shown that children (5-10 years) were with high risk potential of transmission compared to adult in Rwanda (19). 70% of all participants in Kibingo are adults, which makes them the most affected group. This is consistent with a research done in Uganda showing epidemiological analysis of data from community of Uganda which indicated that adults are at higher risks of being infected by schistosomiasis than children due to being exposed to infections through different activities such as fishing , farming , working in hydro electrical settings and other economic activities than children (15). There has been a decline in number of cases since 2016 to 2017 in Gikonko which can explain a great impact of MDA targeting children while there has been an increase in number of cases in Kibingo where adults are more affected than children.

Occupations of participants is significantly important in transmission of schistosomiasis since it is or are the most cause expose of participants to water in both catchment areas. Farming is the leading occupation in both catchment areas with 87.7% in Gikonko and in 70.7% in Kibingo catchment areas and it is the most common reason of exposure to water contact in the catchment area of Gikonko.

In addition to this, fishing was found to expose people to contact with water from Lake Kivu a 10.5% of participants are fishers in the Lake Kivu. This is consistent with different researches for instance 2017 WHO report which indicates that occupational activities which expose people on

repeated contact with contaminated water such as fishing, agricultural as well as hydro electrical activities and farming are the most risk factors for the transmission of infections (16).

Educational background of participants in both catchment areas is associated with schistosomiasis. In fact, most of infected participants have only attained primary education or are uneducated. In Gikonko, participants who have a primary educational level are 54.4%, 24.6% are illiterate, 5.3% have a secondary level of education, 14.0% have studied vocational studies and 1.8% have a university level of education. In Kibingo health center 42.1% are uneducated, 47.2% have only primary level of education, 9.8% have studied vocational studies and only 0.8% percent have secondary level of education while no body has attained university studies. A high level of education would contribute to a high level of knowledge about mode of transmission of schistosomiasis and its mode of prevention. Educational results are consistent with the study done by Karanja 2014 indicating that educational level influence knowledge of schistosomiasis so as to increase infections among those with lower level of education compared to educated people (6).

In this study, different **water contact behaviors** have been found to be associated with schistosomiasis endemicity. Among them there are recreational activities such as swimming, laundry, water fetching from lakes and water bodies and use of unsafe water in household activities such as laundry and bathing. Swimming is specific activity done in the catchment area of Kibingo health center because it is located on the border of Lake Kivu where 37.6% of participants used to swim from Lake Kivu, and 57.9% fetch water from the lake which is very significant in transmission of schistosomiasis. Reasons above are consistent with the study done in Uganda by Muhumuza around lake Victoria basing on four variables: an estimated distance from houses to Lake Victoria, whether the persons had contact with the Lake in previous weeks, estimated duration and number taken to contact with the water, concluded that contact with permanent and temporal water bodies such as lakes, rivers and ponds existing in the country were the potential contributing factors for the transmission of infection (7).

Conclusion and Recommendation

Conclusion

This study indicates a high prevelance of about 32% among the research population in the research area. The sociodemographic (independent variables) that include Age group, Occupation, Education factors are seen to be in close association with the transmission of schistosomiasis due to different living conditions in both catchment areas of control intervention.

The high prevelance of 32% is seen to be highly associated with water contacted related behavoiur that any other variable as follows : none use of shoes among females (p-value = 0.029: CI 95), agriculture activities - in swamps (p-value =0.001: CI 95%), Swimming (p-value=0.001: CI = 95) and bathing in water sources (p-value=0.001 : CI = 95.

Other related variable include: **Age** is associated with transmission of schistosomiasis in that it affects adults (age group above 19 years of age), this is attributed to by the fact that adults are involved in activities such as agriculture, fishing, swimming and others.

Gender is also associated with schistosomiasis endemicity since it is obvious that schistosomiasis affect females more than males, it being due to involvement of women in activities such as agricultural that expose them to water contact without protection than males. Activities that lead to exposure are not only agricultural activities but also fishing and daily activities such as swimming, fetching water, laundry and others.

Occupation that include: Agriculture activities - in swamps (p-value =0.001: CI 95%), Fishing and laundary work has also a great significance in endemicity of schistosomiasis. Farming is the leading occupation for communities living in catchment areas of Gikonko and Kibingo health centres, it contributes to transmission of schistosomiasis because most of participants do not wear shoes when they are in farms and yet, they are in close proximity with water bodies, lakes and swampy areas.

This study does not show knowledge, attitudes and practices about schistosomiasis among the population living in Gikonko and Kibingo catchment areas, this can be an important area for further research.

Conclusivelly, this study indicated that demographic, social and water contact behaviors are among the contributing factors to schistosomiasis endemicity in the research areas.

Recommendation

1. After this study, we are recommending RBC and MOH to strengthen MDA program in these areas, targeting people of all age groups since this study indicate that all people regardless of the age are exposed to schistosomiasis.
2. We are recommending Rutsiro district to plan for clean water in the area around Lake Kivu since insufficiency of clean water is among reasons to fetch water from the lake
3. Population should be educated about risk factors associated with schistosomiasis
4. Population should be encouraged to wear shoes especially when they are going in activities that expose them to be in contact with water bodies
5. Source of water for domestic use should be investigated and emphasized through a multidisciplinary team

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