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COMMUNITY PERCEPTIONS OF SCHISTOSOMIASIS TRANSMISSION, PREVALENCE AND CONTROL IN RELATION TO AQUATIC HABITATS IN THE LAKE VICTORIA BASIN OF KENYA
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ABSTRACT

***Background*: Intestinal schistosomiasis caused by *Schistosoma mansoni* and urinary schistosomiasis caused by Schistosoma haematobium are widely distributed parasites in several localities of the Lake Victoria basin of Kenya, the former being more prevalent. In Kenya, transmission of the intestinal form of bilharzia (*S. mansoni*) tends to be closely confined to narrow zones along the shores of large bodies of water such as Lake Victoria where it is endemic and the intermediate host is found. The prevalence of *S. mansoni* along the Kenyan Lake Victoria basin ranges between 40% and 80%.**
***Objective*: To assess the community's knowledge and perceptions of schistosomiasis prevalence, transmission and control in relation to aquatic habitats in the Lake Victoria basin of Kenya.**
***Design*: Community-based cross-sectional study.**
***Setting*: The Kenyan Lake Victoria basin.**
***Subjects*: Two hundred and forty three individuals (both women and men residing in the beaches and surrounding areas) were interviewed about their knowledge and perceptions regarding schistosomiasis.**
***Results*: The community regarded schistosomiasis as a naturalistic disease not caused by supernatural forces but by an agent of contamination in water. Knowledge on schistosomiasis transmission and control was low, with 42% of the respondents having no idea on how schistosomiasis is contracted, while 22% and 18% of the respondents mentioned contact with contaminated water and drinking / eating dirty water / food, respectively. Most respondents were familiar with the snails' habitats, but had poor knowledge on aquatic plants harbouring snails, as 57% of the respondents did not know about aquatic plants being associated with schistosomiasis snails. Only 3% of the respondents associated snails with schistosomiasis transmission. Sixty percent (60%) of the respondents mentioned use of tablets and injections as means of treating schistosomiasis, while 38% had no idea how it is treated and 2% mentioned use of local herbs and services of medicine men.**
***Conclusion*: Majority of Kenyan Lake Victoria basin inhabitants had little awareness about schistosomiasis despite high prevalence of the disease in the region. There is need to adapt prevention and control strategies to the people's livelihoods. There is also need to target the less advantaged members of the community such as women, uneducated and subsistence farmers for intense health education strategies aimed at increasing participation in the control of schistosomiasis. Study to elicit divergence between biomedical and local understandings of schistosomiasis/bilharzia is suggested.**

INTRODUCTION

Schistosomiasis (Bilharzia) continues to be a major public health and socio-economic problem for several millions of people living in the rural areas of the tropics (1-3). Seven hundred million people are at risk in 74 countries, and 240 million are already infected. Schistosomiasis ranks second only to malaria as the most common parasitic disease, and is among the most important neglected tropical diseases (NTD), killing an estimated 280,000 people each year in the African region alone (4). Through a full consideration of the amount of end-organ pathologies to the liver (in the case of *Schistosoma mansoni* and *S. japonicum* infections), and to the bladder and kidneys (in the case of *S. haematobium* infection) (5) together with the chronic morbidities associated with impaired child growth and development, chronic inflammation, anemia, and other nutritional deficiencies, accounts for up to 70 million disability-adjusted life years (DALYs) lost annually (6). This global burden estimate exceeds that of malaria or tuberculosis, and is almost equivalent to the DALY s lost from HIV/AIDS (6). Furthermore, almost 300,000 people die annually from schistosomiasis in Africa (7) and there is evidence that female genital schistosomiasis caused by*S. haematobium* may significantly increase the likelihood of contracting HIV / AIDS (7).

Severe worm infections can lead to consequences including iron deficiency anemia, protein energy malnutrition, stunting (a measure of chronic under nutrition), wasting (a measure of acute under nutrition), listlessness, and abdominal pain. Studies show that the prevalence and intensity of schistosomiasis is inversely related to distance from the lake (8).

In Kenya, Uganda and Tanzania, studies have shown that most transmission of the intestinal form of bilharzia (S. mansoni) tends to be closely confined to narrow zones along the shores of large bodies of water such as Lake Victoria where it is endemic and the intermediate host is found (8-11).

The 54th World Health Assembly (WHA) resolved to regularly administer anthelminthic drugs to at least 75% and up to 100% of all school-aged children in target communities at risk of morbidity due to schistosomiasis and soil-transmitted helminthiasis by 2010 (12). Such control measures are aimed at reducing morbidity and mortality using chemotherapy rather than preventing infection itself (13). However, a number of studies have emphasized the importance of having detailed information on what the community knows about the infection and socio-cultural factors that influence community's perception of the disease, to make the control of schistosomiasis more effective and sustainable in endemic areas (8, 14-19). In its report, the World Health Organization noted that prevention of transmission of the trematode can be greatly improved if local communities are aware of processes by which schistosomiasis eggs are transmitted (19). Recent studies support that both individual and community perceptions and attitudes of parasitic worm infections and their preventions and treatment are important factors (10, 20). Health education and promotion campaigns are therefore essential for any change in behavior to be realised in areas where schistosomiasis is prevalent.

Since community (the word community has largely been used to refer to a homogenous group of people with same cultural practices) members may have wrong perceptions on aspects of transmission of water-related and vector-borne diseases, this study was conducted to assess the level and accuracy of community members' knowledge and perceptions on schistosomiasis transmission, prevalence and control in relation to aquatic habitats in the Lake Victoria basin of Kenya. In the study area Luo ethnic group comprise more than 95% of the inhabitants. But even homogeneity can be segmented with minor variations within the same group, and this could be an important consideration when applying health communication in any context.

The data from this study will help in awareness creation of schistosomiasis transmission in relation to aquatic habitats and assist in designing effective control programmes in the region and beyond.

MATERIALS AND METHODS

This cross-sectional study was carried out within the Lake Victoria waters of the Nyanza gulf and the adjacent terrestrial areas within the basin, in Western Kenya. The entire Lake Vitoria shoreline was recently described (27). The population surrounding the Nyanza gulf is approximately one million and the major economic activities being small scale framing and fishing (23, 34-35).

The survey was carried out in 14 beaches along the shoreline. The beaches were chosen because of their proximity to the lake and likely exposure of schistosomiasis (bilharzia) transmitting snails to the beach communities who are often frequently in direct contact with the water. A pre-tested structured questionnaire schedule (translated into Luo and Kiswahili languages) was administered to 243 respondents during the survey. The number of bilharzia episodes among children and adults between the year 2008 and 2010 were also evaluated. Health records on prevalence of bilharzia in different districts of Lake Victoria basin, Kenya from health facilities with well-equipped laboratories supplemented the data. Private hospitals were however excluded because, although they have well-furnished laboratory equipment and adequately trained medical staff, cost of seeking health care in such facilities are prohibitive for the local population in general and those of the beaches in particular.

The collected data was entered in Microsoft Excel spread sheets, cross-checked and transferred to SPSS for Windows software version 12.0 (SPSS, Atlanta. GA, USA) for statistical analysis. Descriptive statistics were carried out to tabulate percentages, averages and relative frequencies of variables. Chi-square test ($\chi 2$) was used to determine the association between level of education, age, occupation, and gender, while correctness of responses of the study participants with $p<0.05$ was considered statistically significant.

Ethical approval: Clearance to conduct this study was obtained from the former Nyanza Provincial Health Department through the Director of Public Health and Sanitation, Kenya. The objectives of the study were fully explained to community members and study participants before the interviews. Full verbal explanation of the study was also given to participants and verbal consent obtained before commencement of the interviews.

RESULTS

Out of the 243 respondents, 165 (67.9%) had attained primary level of education, 63 (25.9%) had attained secondary level of education, 3 (1.2%) had tertiary level of education, while 12 (4.9%) were uneducated. The occupation or economic activities of the respondents were mainly fishing, fish trading, food vending and farming (Table 1). Majority (69.5%) of the household population were aged between 18-37 years, while those above 50 years of age constituted only 10.5% across the entire study region (Table 2).

Table 1
Number of Respondents' per Beach and Education level

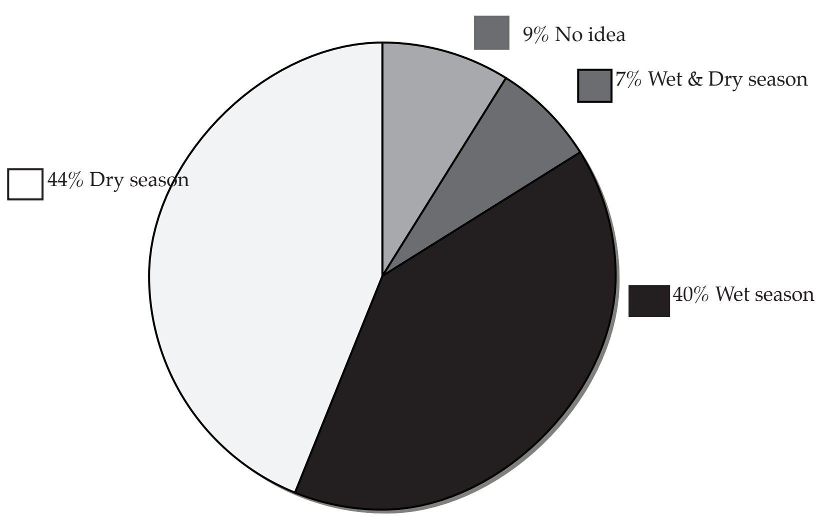
		Education level			
Site/Beach	N	Primary	Secondary	Tertiary	Uneducated
Dunga	21	10	9	1	1
Ogal	21	17	1	0	3
Asembo Bay	30	20	6	0	4
Kaugege	22	13	9	0	0
Homa Bay	24	13	11	0	0
Kendu Bay	20	15	4	0	1
Kusa	19	13	4	1	1
Singida	21	18	2	0	1
Kisian Junction	10	7	3	0	0
Kodoyo Junction	5	3	2	0	0
Kolweny	9	3	6	0	0
Ahero market	10	7	2	0	1
Kendu Bay junction	11	8	2	1	0
Kombewa	20	18	2	0	0
Total	243	165	63	3	12
Percentage (%)	100%	67.9%	25.9%	1.2%	4.9%

Table 2
Number of Respondents' per Beach and Age

		Age				
Site/Beach	N	18-27	28-37	38-47	48-57	58-67
Dunga	21	9	7	4	0	1
Ogal	21	7	5	8	1	0
Asembo Bay	30	5	12	5	4	4
Kaugege	22	13	6	3	0	0
Homa Bay	24	7	13	2	2	0
Kendu Bay	20	10	4	3	0	3
Kusa	19	2	8	3	3	3
Singida	21	4	8	5	4	0
Kisian Junction	10	1	6	3	0	0
Kodoyo Junction	5	2	1	2	0	0
Kolweny	9	3	4	1	1	0
Ahero market	10	1	6	3	0	0
Kendu Bay junction	11	6	4	1	0	0
Kombewa	20	8	7	2	2	1
Total	243	78	91	45	17	12
Percentage (%)	100%	32.1%	37.4%	18.5%	7.0%	4.9%

The study sought to find out from the 243 respondents the most probable season for contracting schistosomiasis or bilharzia. A total of 106 (44%) of the respondents had no idea, while 98 (40%) believed that schistosomiasis was common during the wet season. Twenty one (9%) respondents thought that it was during the dry season while 7% of all the respondents felt that schistosomiasis could be transmitted both during the wet and dry season, (Figure 1).

Figure 1
Season when schistosomiasis is most common



The number of Bilharzia episodes among children between the year 2008 and 2010 was also investigated. According to the respondents, out of a total of 25 of their children who suffered from bilharzia, 9 (36%) children each were reported to have had one and two episodes of bilharzia cases between 2008 and 2010, while 3 (12%) and 4 (16%) had three and four episodes of bilharzia, respectively, between the year 2008 and 2010, (Figure 2).

A total of 19 (79.2%) out of 24 respondents reported having had one episode of bilharzia between 2008 and 2010, while 5 (20.8%) respondents had two episodes of bilharzia between the year 2008-2010, (Figure 3).

Figure 2
Schistosomiasis episodes among children between 2008-2010

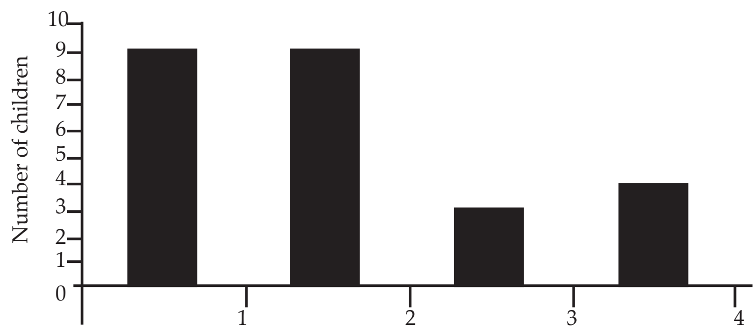
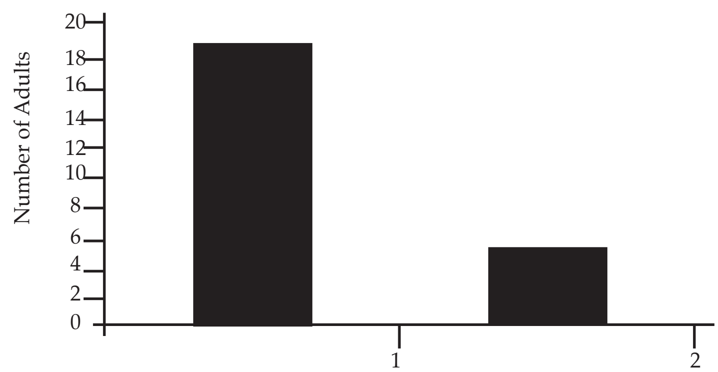


Figure 3
Number of bilharzia episodes among adults between 2008-2010



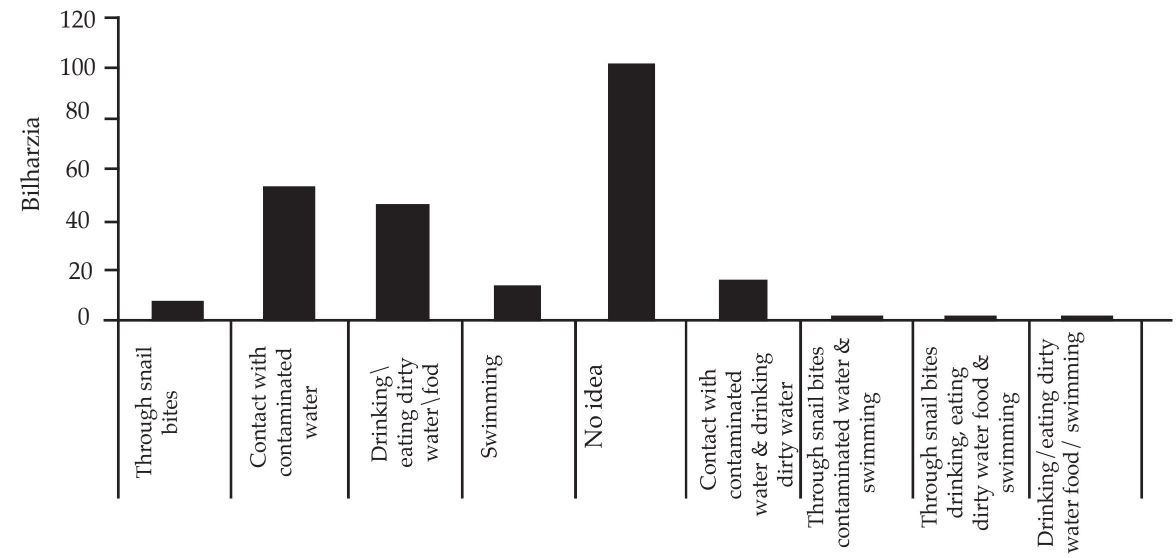
Education level seemed to influence knowledge or ignorance of the symptoms of bilharzia. Over 50% of the uneducated or primary level educated respondents had no idea of the symptoms of bilharzia compared to 29.5% of secondary level educated respondents. Also, 66.7% of those with tertiary level, and 47.5% of those with secondary level of education correctly mentioned bloody stool/urine as the common symptom of bilharzia compared to 16.7% of the uneducated and 31.8% of those with primary level of education, $p<0.001$, $\chi2$ test.

Significantly more respondents 44 (68.8%) who engaged in other occupations (retail shop, bicycle repair, food vendor, stage agent, hotel operator, security guard, etc), did not know how bilharzia is contracted, compared to fishermen 19 (29.7%), fish traders 22 (27.2%) and farmers 10 (32.3%). Only few 6 (9.4%) of those engaged in other occupations knew correctly that bilharzia is contracted through contact with contaminated water compared to 26 (40.6%) of fishermen, 17 (21.0%) of fish traders, and 10 (32.3%) of farmers, $p<0.001$, χ^2 test.

Averagely, over 147 (76%) of respondents with different occupations; fishermen, fish traders, farmers, and others, said that most snails are found in the lake, compared to rivers 17 (8.8%), ponds 8 (4.1%), wells 2 (1%) and other habitats 18 (9.3%), $p=0.07$, $\chi2$ test.

A large number 103 (42.4%) of the 243 respondents had no idea of how bilharzia is contracted. However, a few respondents gave different responses on bilharzia contraction. Over half (54, 22.2%) of the respondents mentioned contact with contaminated water, while 45 (18.5%) of the respondents cited drinking/eating dirty water/food as the most common way in which Bilharzia is contracted. Snail bites, swimming and contact with contaminated water, and drinking/eating dirty water/food was also mentioned by 8 (3.3%), 14 (5.8%) and 16 (6.6%) of the respondents, in that order, (Figure 4).

Figure 4
How bilharzia is contracted

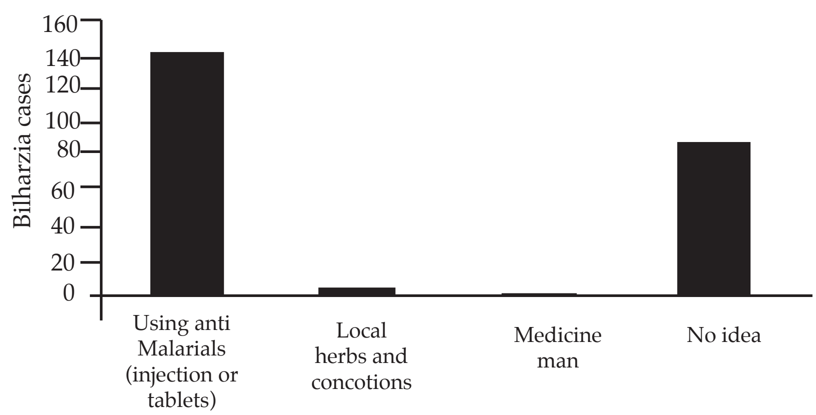


Sixty two (45.3%) of females compared to 33 (32%) of males did not know how bilharzia is contracted while more female respondents 13 (9.5%) compared to only one male respondent (1%), correctly associated swimming with contraction of bilharzia, p = 0.06, $\chi 2$ test.

Education level seemed to influence knowledge or ignorance on bilharzia contraction. Up to 79 (48.8%) of respondents with primary level of education did not know how bilharzia is contracted compared to 10 (16.1%) of respondents with secondary level of education. Also, those with secondary education (38.7%) associated contraction of bilharzia with contact with contaminated water compared to 18.5% of those with primary level of education. These associations were statistically significant, p=0.012, χ^2 test.

On treatment of bilharzia, a majority of respondents 145 (59.9%) out of 243 indicated that bilharzia was treatable using conventional methods (injections or tablets), while three (1.2%) of the respondents cited the use of local herbs and concoctions. Two respondents mentioned the use of medicine men in bilharzia treatment while 92 (38%) of the respondents had no idea of how bilharzia can be treated, (Figure 5).

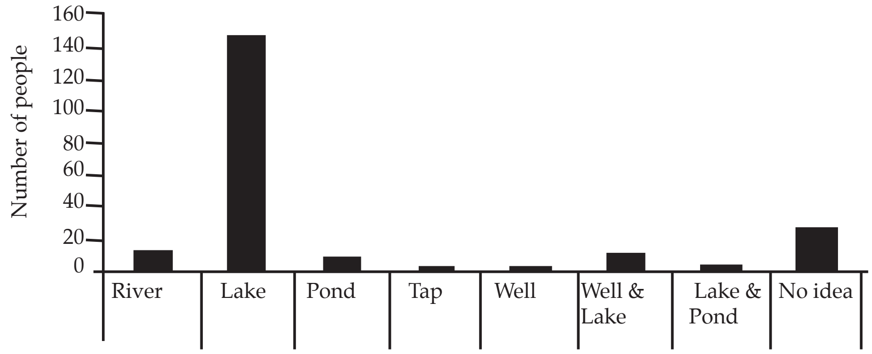
Figure 5
Showing treatment seeking behaviour



Education level seemed to influence knowledge on how bilharzia is treated. Over 82% of those with secondary and tertiary education compared to 55.6% and below of those with primary level of education, and the uneducated, correctly mentioned that bilharzia is treated using tablets and injections in hospital. In addition, more of the uneducated respondents or those with primary level of education (over 38.5%) had no idea how bilharzia is treated compared to only 14.5% of those with secondary level of education. These associations were statistically significant, p<0.001, Chi-square test.

A large number 147 (70.3%) out of 209 respondents cited the lake as the most common snail habitat. River, pond, tap and well were also mentioned by 12 (5.7%), eight (3.8%), one (0.5%) and two (1%) of respondents, respectively, as the most likely places where snails can be found. A combination of river and lake habitats were also mentioned by 11 (5.3%), while two (1%) respondents mentioned lake and pond as the most likely habitats for snails. However, 92 (38%) of all the respondents had no idea where snails are found, (Figure 6).

Figure 6
Showing habitats where most snails are found



A larger percentage (57.2%) of the respondents had no idea of any aquatic plants which can harbor more snails. However, water hyacinth, hippo grass, ambatch tree, reeds and papyrus reeds were mentioned by 38 (15.6%), 18 (7.4%), 18 (7.4%), 14 (5.8%) and 6 (2.5%) of the respondents, respectively, as having more snails. A combination of ambatch tree and papyrus reeds (1.2%) and ambatch tree and hyacinth (0.4%) were also mentioned. Water hyacinth and hippo grass (2.5%) was also mentioned, (Figure 7). All respondents regardless of their education level associated abundance of snails with aquatic plants, p>0.32, χ^2 test.

Questions were asked on water contact behaviours, that is, drinking water, bathing, working in (running or standing) water, harvesting hippo grass which could give an indication of their risk of contacting bilharzia. As regards the source of drinking water, one third of the study respondents (33.7%) reportedly relied on well water for drinking while 64 respondents (26.3%) used tap water as their major source of drinking water. However, 48 (19.8%) and 30 (12.3%) reported using lake and river water, respectively, as the main source of drinking water. Five respondents (2.1%) used pond water for drinking, while 2.9% of the respondents relied on either tap or well water, (Figure 8).

Figure 7
Aquatic plants that have more snails

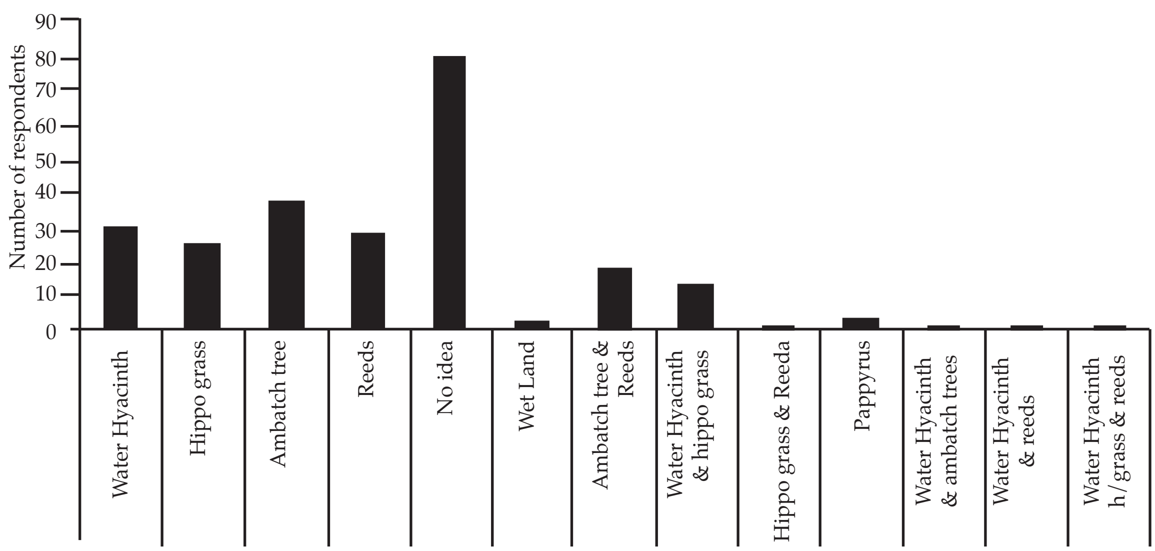
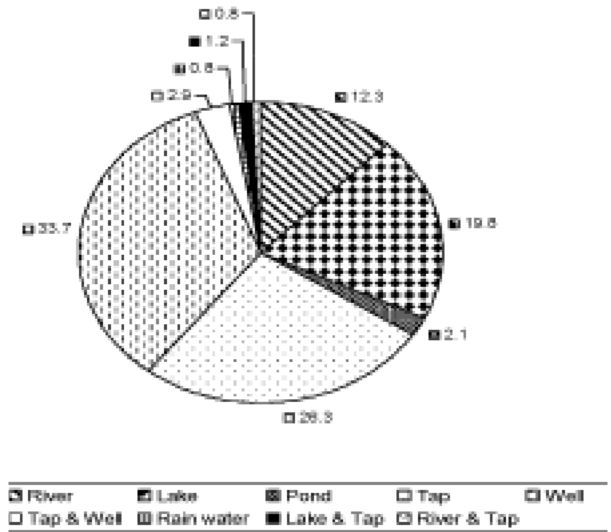
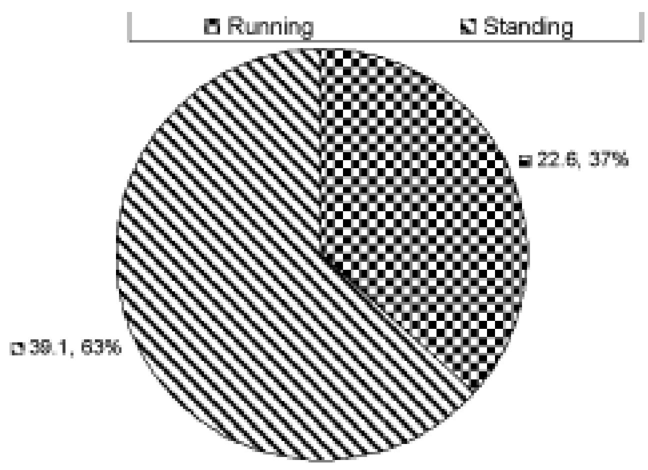


Figure 8
Sources of drinking water



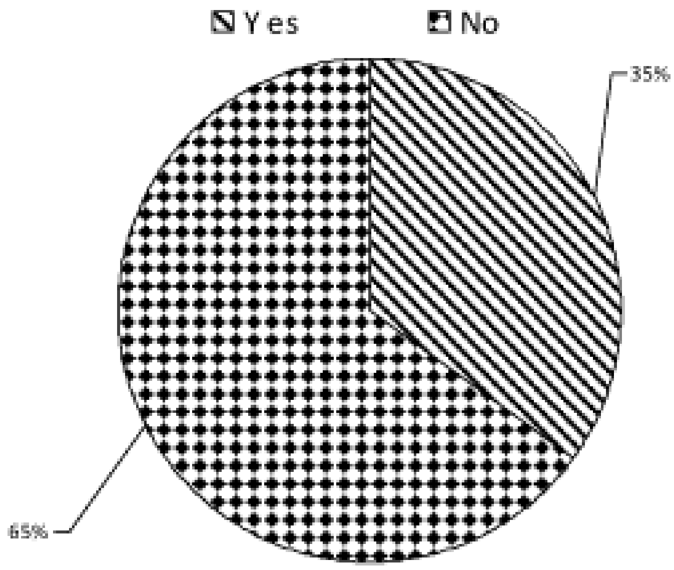
Most of the respondents 153 (63%) worked in or had contact with standing water while 90 (37%) of the respondents worked in or had contact with running water, (Figure 9). The most common water bodies were lake and ponds for standing waters and rivers and streams for running waters. Most activities that were carried out in standing and running waters included, harvesting hippo grass, fishing, washing clothes, washing utensils, bathing and many other household chores.

Figure 9
Working in standing or flowing water



Forty two (40%) of male respondents and 30 (21.7%) of female respondents took their bath in the lake. Only six (5.7%) of male respondents reported taking bath in the river, while ten (7.2%) of the female respondents took their bath in the river. These gender differences and exposure (bathing) in the lake or river water were statistically significant, p=0.0322 test. As regards the use of hippo grass as fodder, a total of 84 (35%) out of 243 respondents reported using hippo grass; normally harvested from the shore of the lake as fodder for their animals, while a larger percentage 158 (65%) did not. Those who reported using hippo grass as fodder for animals were also asked to state how they harvested the hippo grass. 55 (65%) respondents reported harvesting the hippo grass while standing in the water, while 29 (35%) of the respondents reported harvesting hippo grass while standing at the shore. 12 (22%) and 10 (18%) of the respondents reported harvesting hippo grass with their bodies submerged a half and three quaters in the water, respectively. Plate 1 shows a woman harvesting hippo grass while ½ of the body is submerged in water. One respondent reported harvesting hippo grass along the river while another reported that he allowed animals to graze on hippo grass along the shores of the lake, (Figure 10).

Figure 10
Whether the respondents use hippo grass as fodder for animals



Of the respondents who reported using hippo grass as fodder, 33 (39.8%) took between one to two hours harvesting hippo grass. A considerable number of respondents 25 (30.1%) took between 30 minutes and one hour, while 15 (18.1%) of the respondents reported taking about 10 to 30 minutes to harvest hippo grass for their animals. Nine respondents reported taking between two to four hours while a smaller percentage (1.2%) took more than five hours to harvest hippo grass, (Figure 11).

More female respondents 46 (56.1%) reported that they spent one to two hours working in areas covered with or in contact with water compared to 21 (37.3%) of male respondents, who worked for one to two hours, and 24 (31.2%) males who spent or worked for three to four hours in contact with water, $p<0.01$, Chi-square test. Also, all different age group categories interviewed worked or had some contact with water though majority 98 (63.6%) worked or had contact with standing water compared to running water 56 (36.4%), $p=0.183$, χ^2 test.

Figure 11
How hippo grass is harvested

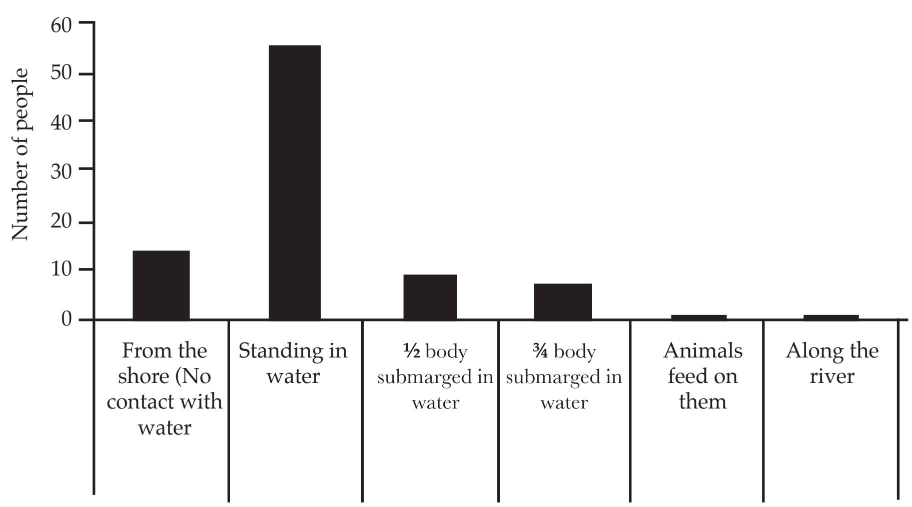


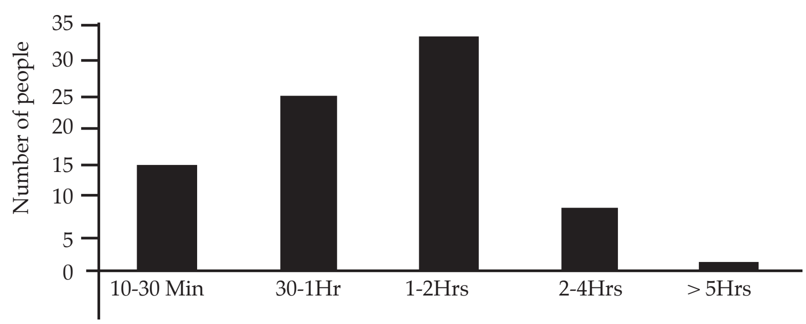
Table 3 shows a summary of health records on prevalence of schistosomiasis (bilharzia) in different districts of Lake Victoria basin, Kenya. Only one case of bilharzia was reported in Kombewa for children under five years of age and none for those over five years of age in 2008. A total of 85 cases of bilharzia were reported in Nyando District in 2008 in children under five years and only 21 for children over five years of age in the same year. In the year 2009, only 16 cases were reported among children aged less than five years in Rarieda District while all the other riparian districts did not have any bilharzia cases. A total of 11, 1, 14, and 1 cases were reported in Rarieda, Kombewa, Homabay and Nyando districts, respectively, among children over five years old during the year 2009. These results therefore indicate that Nyando District had the highest prevalence of bilharzia both among the under and over five years old children in the year 2008. However, in the year 2009, Rarieda District reported higher prevalence of bilharzia both among the under and over 5 year olds. There were no records (NR) of bilharzia cases for Rarieda district for the year 2008, Table 3.

Table 3
Prevalence of schistosomiasis in different districts of lake Victoria Basin, Kenya

	2008 Under 5-bilharzia	2008 Over 5-bilharzia	2009 5-bilharzia	2009 Over 5-bilharzia
Rarieda	NR	NR	16	11
Kombewa	1	0	0	1
Nyakach	0	2	0	0
Homa Bay	NR	NR	0	14
Nyando	85	21	0	1

NR- No Records

Figure 12
Time taken to harvest hippo grass



DISCUSSION

The study emphasised the knowledge gap in shistosomiasis aetiology and infection mechanism in habitats along Lake Victoria, western Kenya. *Schistosoma haematobium* and early stages of *S. mansoni* are regarded as a naturalistic disease not caused by supernatural forces but by an agent of contamination in water. The study showed that along the Kenyan Lake Victoria basin, local community members demonstrated poor or superficial knowledge of transmission, prevalence and control of schistosomiasis. Forty two percent (42%) of the respondents had no idea of how schistosomiasis is contracted. This is more or less similar to what has been observed in Uganda (24). Fifty five percent (55%) of the respondents in Busia, Uganda did not know disease caused by water snails and, community reported mode of transmission of bilharzia as being through drinking dirty water, eating contaminated food or through a wound when one steps in water. Similarly, in Panyimur, northwestern Uganda, earlier research found that biomedical signs were similar yet local understandings of aetiology was different (25). For example, ideas circulating about the aetiology of schistosomiasis in Panyimur, northwestern Uganda include drinking dirty water, swimming in contaminated water or treading on faeces. The current study results (in which forty two percent (42%) of the respondents had no idea of how schistosomiasis is contracted are also in agreement with a study done in Ethiopia (26) where those from intestinal schistosomiasis endemic areas showed low awareness and knowledge of the disease.

Seventy percent (70%) of the respondents correctly mentioned lake as the most common habitat for schistosomiasis snail intermediate host. The respondents were from fish landing beaches, where their level of exposure to lake water was high because some of them were fishermen and some fish traders who buy fish from the boats and wash them in the lake or using lake water. Some also wash utensils, clothes and other things in the lake leave alone bathing by the lake's shoreline. Other habitats that were cited included rivers, ponds, wells and even taps; clearly indicating that some of the respondents were either guessing or unaware of snail habitats. This could be attributed to low level of education among these communities as a larger percentage (68%) of the respondents were only educated up to primary school level while the numbers of the uneducated were five times higher than that of tertiary level respondents.

The respondents demonstrated poor or superficial knowledge of the vectors' habitats in association with aquatic vegetations, as 57% of the respondents, had no idea about aquatic plants harbouring snails, despite of, water hyacinth, ambatch tree, reeds, and papyrus being well known in the study area. Only a small percentage of respondents 15, 7.4, 7.4, 5.8 and 2.5%, respectively, associated different aquatic vegetation with schistosomiasis snail-intermediate hosts. This lack of knowledge is unfortunate because previous reports showed that aquatic vegetation particularly water hyacinth and hippo grass harbour schistosomiasis snails along the Kenyan Lake Victoria basin (27).

In this study, a retrospective analysis of hospital data found that a total of 85 cases of schistosomiasis among the under fives were reported in Nyando District in 2008 and 21 cases among children above five years of age in the same District in 2008. In humans, *Schistosoma* parasites reach maturity in six to eight weeks, at which time they begin to produce eggs (28). It is therefore not unrealistic that children under five years were reported to have schistosomiasis in Nyando district, as children from three years onwards are known to play in the water bodies. The high number of schistosomiasis cases in Nyando can also be attributed to the rice paddies and canals which are known in this particular area to be suitable habitats for schistosomiasis snails (29).

The total duration taken in contact with infected water is likely to determine if the person gets infected with schistosomiasis or not. This study found that most of the respondents (63%) worked in standing waters while 37% of the respondents worked in running water. 35% of the respondents reported using hippo grass as fodder for livestock, which they harvested from the shores of the lake or river. A considerably higher number (65%) of the respondents however, did not use hippo grass as fodder. The findings are consistent with earlier studies which found that the commonly undertaken activities in the region included harvesting hippo grass, fishing, washing clothes, washing utensils, bathing and many other domestic chores which can expose community members to schistosomiasis infection (27). The findings are also consistent with studies done in Uganda, which, found that the commonly undertaken activities in Busia, Uganda, included: washing clothes, washing utensils, bathing and playing in lake water (24). Such risky behavior should therefore be strongly discouraged as public health strategy against schistosomiasis.

The most common used source of drinking water within the riparian districts studied was well water followed by tap water, lake and river water in that order. While majority of the respondents reported taking a bath at home, slightly below half (36%) took their bath in the lake. A smaller percentage (6%) admitted to taking a bath in the river while an even smaller number (2%) reported taking a bath next to a well.

More than half of the respondents (59.9%; n=243) mentioned conventional treatment by using injections or tablets from hospital as the best way of treating bilharzia. The results of this study are fairly consistent with those done in a neighboring country which reported that schistosomiasis was perceived to be a treatable disease and modern medicines were said to be effective (24). However, a considerably higher number of respondents (38%) had absolutely no idea of how bilharzia is treated. A few respondents cited the use of local herbs and concoctions and medicine men as the best way of treating bilharzia. These findings are also consistent with those from other earlier studies in Africa (30, 10), with regard to health seeking behaviour for schistosomiasis.

Since schistosomiasis transmission tends to be focal, focal mollusciciding, improvements in local sanitation and hygiene as well as public health awareness, would be advocated to complement chemotherapy in reducing transmission and reinfection in such settings. There is also need for enforcement of existing public health legislations along Kenya's Lake Victoria riparian districts.

The provision of detailed information about the aetiology, signs and symptoms of infection with, *S. haematobium; S. mansoni* and soil-transmitted helminths, as well as the rationale for an intervention and its relationship to prevention more generally, is crucial, but this needs to be conveyed in ways that can be locally understood (31). During our hospital visits in the riparian districts, we did not come across any printed health education materials in the local language. There were materials in English in just a few health facilities. Our data did not permit an understanding of the dynamics of illness reinterpretation and, to a lot of extent, does not explain the sequential use of biomedical and traditional health care services for bilharzia and bilharzia-like symptoms.

The study findings show that there is need to adapt prevention and control strategies to the people's livelihoods. There is also need to target the less advantaged members of the community such as women, uneducated and subsistence farmers for intense health education strategies aimed at increasing participation in the control of schistosomiasis along the Kenyan Lake Victoria Basin. The extent to which health education will reduce transmission may be unclear. Ideally, the extent to which health communication can reduce transmission is not well articulated and it may not be an end in itself. However, the epidemiology and transmission of schistosomiasis depends to a large extent on the level of pollution of the snail habitats. Hopefully, the impact of education will lead to greater understanding of this link, which might lead to less water pollution. In this sense, transmission would be interrupted and water use even among those who have no choice like fishermen will be safer. Improving health education material alone, however, will not be sufficient to reverse the gains of National and Control Programme in Kenya and within the study area. There needs to be in place more integrated control strategies (including enforcement of existing environmental and public health laws) and promotion of behavioral change in socially appropriate ways (24,31).

Majority of Kenyan Lake Victoria basin inhabitants had low awareness about schistosomiasis despite high prevalence of the disease in the region. There is, therefore, need to adapt prevention and control strategies to the people's livelihoods. There is also need to target the less advantaged members of the community such as women, uneducated and subsistence farmers for intense health education strategies aimed at increasing participation in the control of schistosomiasis. Control measures based on the socio-ecological settings of Kenyan Lake Victoria basin is required while emphasis on further research on the divergence between biomedical and local understandings of schistosomiasis/bilharzia is strongly suggested.

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