Human Behavioural Risk Factors of Urinary Schistosomiasis in Cross River State, Nigeria

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Abstract
Urinary schistosomiasis is one of the most prevalent waterborne diseases and water contact behaviours have led to alarming rates of prevalence in endemic communities. Previous studies of schistosomiasis focused on discriminating the schistosomiasis infected and non-infected persons using parasitological approach. However, studies that examine the effects of human behavioural risk factors on prevalence have not been adequately carried out. This study examined the prevalence of urinary schistosomiasis and human behavioural risk facotors of the disease in order to understand the epidemiological situation in Cross River State. Seven endemic communities were purposively selected for the study. A set of 800 copies of the questionnaire designed for the study were distributed to respondents in endemic communities. Logistic regression analysis was used to identify the most important behavioural risk factors that influenced prevalence of schistosomiasis among endemic communities at P 0.05. The prevalence of Urinary schistosomiasis in endemic communities was 74.7%. However, the prevalence of shistosomiasis varies widely among the endemic communities. A large proportion of 81.0per cent cases were reported in Okwel-Obudu. Utukwang I had a percentage prevalence of 78.0. Assiga and Utukwang 11 reported 76.5per cent and 75.0per cent prevalence of urinary schistosomiasis respectively. Prevalence of schistosomiasis was 74.5per cent in Adim and Abini recorded 71.0per cent infections. Ijiman had a prevalence of 67.0 per cent cases of urinary schistosomiasis. Farming in swampy areas exerted the most influence on prevalence of schistosomiasis in endemic communities (Odd ratio: 1.58, $p<0.05$). Therefore, farming in swampy areas serves to highlight the behavioural factor of Human Ecology of Disease responsible for the prevalence of urinary schistosomiasis in endemic communities. Socio-economic empowerment and health education are needed to reduce the prevalence of the disease.
Keywords: Schistosomiasis, Prevalence, Perception, Endemic communities

1.0 INTRODUCTION

Urinary schistosomiasis is one of the most prevalent parasitic diseases in the world and water contact behaviours are responsible for different levels of prevalence in different socio-cultural settings. About 120 million people infected with schistosomiasis were estimated to be symptomatic and 20 million developed several related diseases (WHO, 2002). Estimates further suggest that sub-Saharan Africa bears a disproportionately high burden of the disease, with 80 percent of all schistosomiasis cases occurring in the region (Standod, *et al*., 2009; Surtherst, 2004). Also, in sub-Saharan Africa, prevalence levels, particularly of *Schistosoma heamatobium,* have increased due to water resources development projects, population increase, displacement, migration and competing priorities in the health sector.

The disease is prevalent in Nigeria. Approximately 22 million Nigerians, including 16 million children are infected with schistosomiasis, making the country the most endemic in the world (Agi and Awi-waadu, 2008; Anosike et al., 2006). In Cross River State, a prevalence of 31 percent was reported in 2012, an indication that the disease is prevalent in the area (CRMoH, 2012). The disease is endemic in some of the communities. In 2003, a prevalence of 91 per cent was reported in Otukwang (Okun and Omeche, 2003). A retrospective study of *Schistosoma haematobium* infection in Ukwelo-Obudu community in 2006 recorded 35.5 per cent prevalence, whereas the year 2004 recorded no infection (Inyang-Etoh *et al*, 2004). Ekanem (2013) reported prevalence rates using questionnaires to be 33.4 percent, reagent sticks 34.7 per cent and parasitological technique 30.5 per cent in Adim. Various factors, including human behaviour, are known to be important in the transmission of the disease. Human activities, especially fishing, fetching of water, swimming, washing, and others, play a role in the prevalence of the disease (Gazzinelli, 2006; Wagatsuma *et al.,* 2003; Useh and Ejezie, 1999). Houmsou *et al.* (2010) reported that the inhabitants in the endemic communities perceived risky behavior such as swimming, bathing, playing, fishing among others to cause schistosomiasis to become manifest, rather than such behaviour increasing the likelihood of infection by an external germ. Although the mechanism of schistosomiasis transmission via water contact behavior is fairly clear, few studies have attempted to accurately analyze exposure to water and its relationship to infection (Watts, 1987). In fact, recent studies have not found a relationship between water contact and infection (Watts, 2008). One reason for this may be that water contact alone does not completely account for risk. Instead, it may be necessary to consider the specific water contact activities, and how these relate to infection (Kloos *et al*., 2006). This study therefore seeks to determine the influence of human behavioural risk factors on the prevalence of schistosomiasis in Cross River State, Nigeria.

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2.0 STUDY AREA

2.1.1 LOCATION AND EXTENT

Cross River State is located at the south eastern margin of Nigeria. It lies between longitude 7˚ 50 and 9˚28' east of the Greenwich and latitude 4˚28' and 6˚ 55' north of the equator. It shares common boundaries with the republic of Cameroon in the east, Benue State in the north, Ebonyi and Abia States in the west, Akwa Ibom State in the south west and the Atlantic Ocean in the south (Fig 1.1). It has a total landmass of about 23,000 sq km.

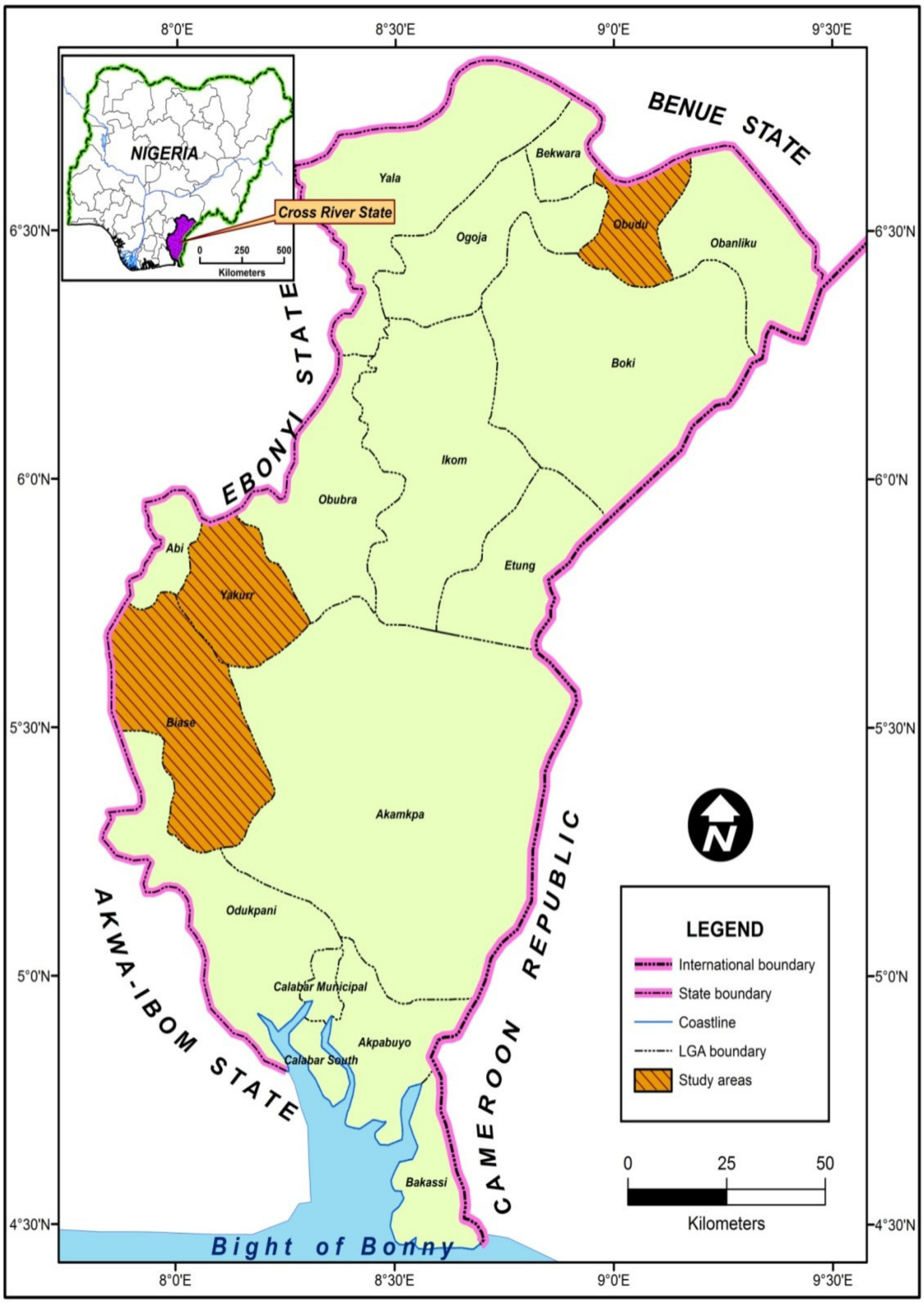

Fig. 1.1: Cross River State showing the study areas
Source: Cross River State Ministry of lands and Surveys, 2013

2.1.2 PHYSICAL ENVIRONMENT

Arising from its location, the State enjoys a tropical humid climate with distinct wet and dry seasons. The State records annual rainfall between1300 – 3000mm (Uwem, 1997). Temperature is high throughout the year (not less than 27^{o}c). The Obudu Plateau at an altitude of 1, 595.79 meters above sea level enjoys a temperate climate. In view of its north – south orientation, there are at least four distinct ecological zones in the State ranging from mangrove and swamp forests towards the coast, tropical rain forests further inland, and savannah woodlands in the northern parts of the state. The area is occupied partly by fresh water, mangrove and rain forests. The freshwater swamps around the area are surrounded by different species of trees, shrubs, swamp lilies, ferns and grasses which provide suitable breeding ground for water snails. Thus, the area is dominated by *Rhizophora* in association with the Avicennia tree, stilt-rooted *Rhizophora, Raphia spp*, *Elaesis guinensis,* etc. The vegetation in Obudu is mostly the disturbed highland rainforest formation. However, the favourable climate of tropical, humid, dry and wet seasons gives rise to rich agricultural lands, thus encouraging both perennial and annual crop cultivation.

Cross River State is a coastal state in southeastern Nigeria, bordering Cameroon to the east. Cross River State has bodies of water from the tributaries of the Cross River, including streams, swamps, rivers and the Atlantic Ocean (Fig. 1.2). Two-thirds of Cross River State is covered by mangrove and tropical rain forests, with incised streams, smaller rivers and swamps. Schistosomiasis depends on a snail intermediate host to complete its life cycle. Therefore it is confined to ecological niches that are suitable for freshwater snail vector. A variety of water bodies in the state provide suitable breeding ground for the snail, thereby influencing the endemism and distribution of the disease. The intermediate snail host of schistosomiasis generally inhabits shallow muddy sediments of lentic, still water and slow flowing water, freshwater systems such as swamps, streams, rivers, ponds, lakes, irrigation canals, and heavily irrigated agricultural fields in the area. Both natural parameters (e.g water temperature and stream ecology) and anthropogenic activities shape snail habitat and the distribution of potential snail vectors in the area. Given the drainage system of the area which provides suitable breeding ground for the snail vectors of schistosomiasis, the occurrence and endemicity of the disease is expected.

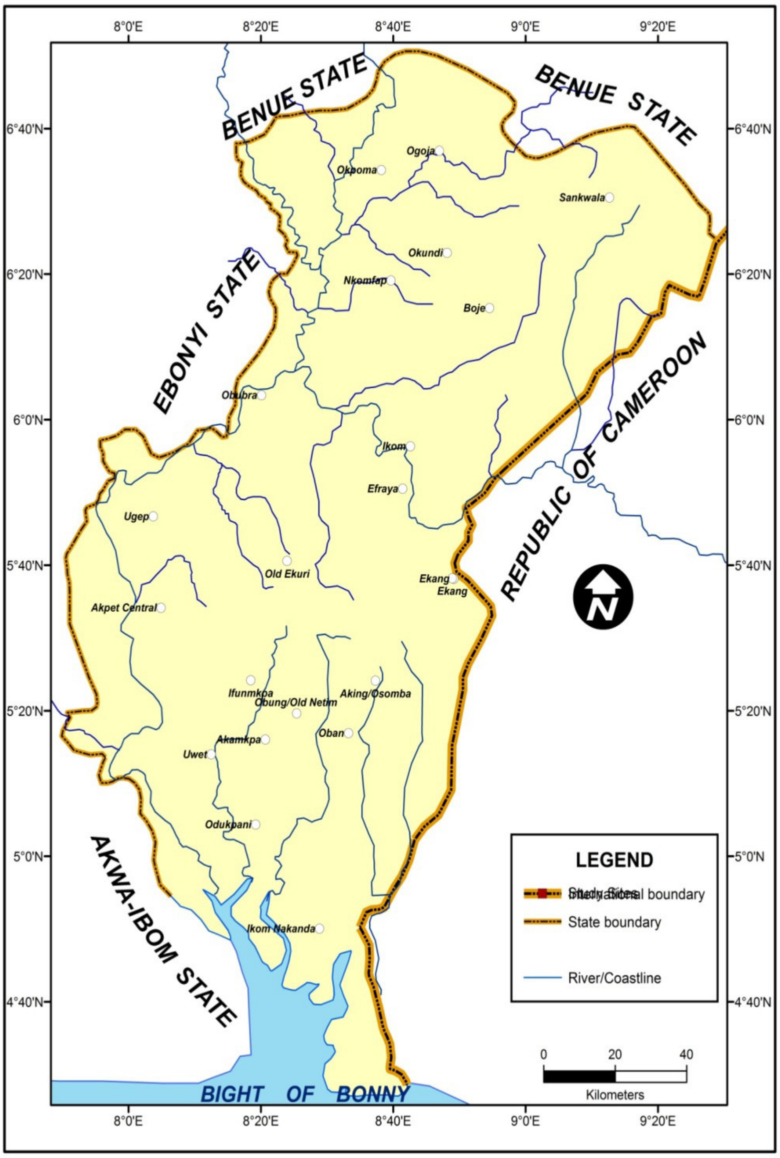

Fig. 1.2: Drainage system of Cross River State
Source: Cross River State Ministry of Lands and Surveys, 2013

The moist soil type creates conducive environment where the snail intermediate host vectors can thrive effectively. The secondary forest is capable of trapping and retaining rain water which invariably helps in ground water recharge and retention of soil moisture suitable for snail vector survival (Eze & Abua, 2002). Soil-transmitted helminths (STHs) infection is common in the area due to warm and moist climates. These STHs inflict tremendous disability and suffering on the people in the area. Many people in endemic communities practice out-door defecation. If an infected person defecates outside (near bushes, in a garden, or field) or if the feces of an infected person are used as fertilizer, eggs are deposited on soil. Schistosomiasis worm eggs become infective as they mature in the soil. Some of these worm eggs are washed into nearby ponds or swamps. Water worm eggs hatch in swamps or soil, releasing larvae (immature worms) that mature into a form that can penetrate the skin of humans. Worm infection is transmitted primarily when there is cantact between human population and contaminated water or soil. People are infected when eggs are ingested. This happens when hands or fingers that have contaminated dirt on them are put in the mouth or by consuming vegetables and fruits that have not been carefully cooked, washed or peeled or when water is not treated.

2.1.3 POPULATION AND SOCIOECONOMIC ACTIVITIES

Cross River State has a population of 2.889 million people according to the 2006 population census (NPC 2006). This gives a population density of 125 persons per sq. km. It is referred to as a miniature Nigeria because of its diversity in ethnic composition (SEED, 2005). Apart from Calabar and a few other towns like Ikom and Ogoja, rural settlements continue to be the dominant type of settlements and they have little or no sanitation facilities. However, in recent years, the State has experienced remarkable social, infrastructural and economic changes which have brought about phenomenal increases in the total urban population, and infrastructural developments, like houses, roads, electricity and portable water supplies (SEEDS 2005). Nevertheless, despite the provision of these infrastructures, some endemic communities still lack basic sanitation facilities, thereby becoming vulnerable to schistosomiasis.

Cross River State is basically an agrarian state with a preponderance of the population (over 75%) engaged in subsistence farming and living in rural communities. In spite of the emergence of large scale private and public plantation farming, peasant agriculture still dominates. Farming can be differentiated on the basis of the ecological zones, with rice cultivation being practised across the state. The predominant water-related activities of the people usually bring them in close contact with snail vectors, hence, the prevalence of urinary schistosomiasis in the area.

3.0 METHODOLOGY

The study utilized primary data only. Primary data was collected through the use of questionnaire. The study employed the multi-stage sampling technique involving three steps. In the first step, twelve local government areas that were sampled during the Cross River State Ministry of Health Baseline/parasitological survey on schistosomiasis prevalence were identified across the three Senatorial Districts that make up the state. In the second step, in each of the three Senatorial Districts, one endemic Local Government Area each with the highest prevalence rate was purposively selected for the study due to the focal distribution of the disease. Apart from the fact that these LGAs are endemic LGAs where schistosomiasis has been confirmed higher through a prevalence survey by the Cross River State Ministry of Health, the endemic communities were selected based on the criteria that its inhabitants and communities: i) mostly rely on river, stream, ponds and spring water for their water source (these are water points which have been identified by relevant local people as the most frequented water-contact points for domestic, recreational and agricultural purposes); ii) mostly cultivate rice, including those hosting government owned rice farms and small-scale water projects (dams); iii) are endowed with abundance of schistosome intermediate host vectors (snail population); and iv) are near the vector environment, i.e. the nearest likely infection source. Therefore, the three sampled LGAs are Biase, Yakurr and Obudu.

In the third step, in each of these three LGAs, seven endemic communities were selected for questionnaire survey. These endemic communities were Abini, Adim, Ijiman, Assiga, Okwel- Obudu, Utukwang I and Utukwang II (Utukwang is a double settlement consisting of Utukwang I and Utukwang II). However, a two- stage sampling method was used in determining the sample size for i) estimation of study population and ii) administration of questionnaire in endemic communities.

A total of eight hundred questionnaires were distributed to respondents. In the second stage, purposive sampling technique was applied. Communties with population less than 10,000 were purposively given 100 copies of questionnaire each, whereas those above ten thousand persons were given 200 copies of questionnaire. This benchmark was established to ensure that endemic communities with more population but have been confirmed to have less prevalence by the Cross River Minstry of Health are not given more questionnaires. A set of one hundred copies of questionnaire each was purposively administered in six endemic communities, whereas a set of two hundred copies of the questionnaire was distributed in one community. The idea is to distribute more questionnaires in communities with more prevalence irrespective of their population sizes in order to reveal the real situation of schistosomiasis.

The systematic random sampling technique was adopted in the distribution of questionnaire. This sampling method was applied using table of random numbers. All the houses were listed and numbered based on the population and sample size for the respective communities. The table of random numbers was then used to select each house and in each house (building) only a family was sampled. The numbers randomly selected from the table of random numbers were 0056 and 0061. From the outcome, in each road transect, the third building or household was chosen after which the eighth was sampled in that order. In otherwords, sampling using this approach was such that the interval between each sampled household was 5, hence, the administration of questionnaire to the respondents involved sampling the 61th, 66th, 71th, 76th, 81th, 86th, 91th and so on. This technique was chosen because the population of study is largely homogenous and the study population was large. Also, this sampling technique was employed as a result of the poor numbering of houses in the respective communities. The fieldwork was conducted at the same time of the year for all sampled communities to control for seasonal variation and data were collected during the months of March, April and May 2013, when vector point contact was high due to reduced water levels and when snail vectors are mostly confined to suitable breeding grounds. Out of the 800 copies of questionnaire distributed to respondents, a total of 798 were successfully returned and used for analyses.

A number of statistical techniques were used to analyse the primary and secondary data collected from the field. Descriptive statistics such as frequency distribution, tables, simple percentages were used for data analyses and presentation, whereas, inferential statistic, specifically, Logistic Regression Analysis was employed to determine the influence of swimming, fetching, bathing, washing, farming in vector environment, sand mining, fishing, snail gathering, eating of snails, defecation into river, number of dam and irrigation projects, number of government owned rice farms on the prevalence of schistosomiasis. In this analysis, number of respondents reporting blood in urine in the endemic communities is the dependent variable (Y) and the independent variables (x) are:

x_1 = Swimming in infective water;
x_2 = Fetching infective water;
x_3 = Bathing in infected water;
x_4 = laundry at the water source;
x_5 = Farming in swampy areas;
x_6 = Engaged in sand mining;
x_7 = Engaged in fishing;
x_8 = Engaged in snail gathering;
x_9 = Engaged in eating of snails;
x_{10} = Defecate in the water source;
x_{11} = Number of dam and irrigation projects in endemic community;
x_{12} = Number of government owned rice farms in endemic community;

In order to effectively carryout this test, respondents were asked if they engaged in predisposing activities (items 1 to 10) in the last one month and the variables were transformed into dummy variables. For instance, questions like if they swam in the river were transformed or recoded into two dummy variables with 'yes' response recorded as 1 and 'no' recorded as 0; fetched water from the river source, if yes=1, no=0; bathed in the river, if yes=1, no=0; laundry at the water source, if yes =1, no=0; farmed in swampy areas (vector environment) if yes= 1, no=0; engaged in sand mining, if yes=1, no=0; engaged in fishing If yes=1, no=0; engaged in snail gathering, if yes=l, no=0; eaten snails, if yes= 1, no=0; defecated in the water source, if yes= 1, no=0; number of dam and/or irrigation projects provided by government in the community, none=0, if any=l; number of government owned rice farms, none=0, if any=l.

4.0 RESULTS AND DISCUSSION OF FINDINGS

4.1 PREVALENCEAND RISK FACTORS OF URINARY SCHISTOSOMIASIS IN ENDEMIC COMMUNITIES

The assessment of respondent's blood urine history shows that 596(74.7per cent) of the respondents confirmed to have experienced blood in urine and 202(25.3 per cent) of the respondents had not experienced blood in urine. Table 1 further shows the proportion of respondents that reported blood in urine (urinary schistosomiasis) across endemic communities. The table shows that Okwel-Obudu had the highest number of respondents (81.0per cent) that reported cases of urinary schistosomiasis, followed closely by respondents in Utukwang I with a percentage prevalence of 78.0. Respondents in Assiga and Utukwang 11 reported 76.5per cent and 75.0per cent prevalence of urinary schistosomiasis respectively, whereas those in Adim and Abini recorded 74.5per cent and 71.0per cent infections respectively and respondents in Ijiman had 67.0 per cent cases of urinary schistosomiasis. This result implies that urinary schistosomiasis is highly prevalent in the communities and the high proportion of respondents reporting the disease points to the fact that infection is closely linked with blood in urine. This is in agreement with the result of Gazinelli *et. al* (2006) that reported a highly significant association between blood in urine and infection of schistosomiasis in North-east Brazil. The seemingly similar prevalence values may be due to a common pattern of behavior and susceptibility in the communities. This observation corroborates the findings of Anosike (2006). Given the high prevalence of urinary schistosomiasis in endemic communities, strategies need to be implemented that inform inhabitants in endemic communities of ways to protect themselves from infection.

Table 1 : Prevalence of urinary schistosomiasis in endemic communities

Indicator/ variable	Abini No. (%)	Adim No. (%)	Ijiman No. (%)	Utukwang I No.(%)	Utukwang II No.(%)	Okwel-Obudu No. (%)	Assiga No. (%)	Total
Blood in Urine	71(71.0)	149(74.5)	67(67.0)	78(78.0)	75(75.0)	81(81.0)	75(75.0)	596(74.7)
No blood in urine	29(29.0)	51(25.5)	33(33.0)	22(22.0)	25(25.0)	19(19.0)	23(23.0)	202(25.3)
Total	100(100.00)	200(100.00)	100(100.00)	100(100.00)	100(100.00)	100(100.00)	98(100.00)	798(100.00)

Source: Author's fieldwork, 2013.

The prevalence of 81.0 per cent of urinary schistosomiasis recorded in Okwel-Obudu, compared to 35.5 per cent prevalence reported in 2003 shows that the disease has increased over time. This seems to be a statement of fact as a previous study by Inyang-Etoh *et al*., 2004 found no infection. However, nine years after the report, urinary schistosomiasis has been confirmed in the area (CRSMoH, 2012 and Adie et al, 2013). From this study, it appears that urinary schistosomiasis is particularly common in this area. It is possible that the prevalence recorded in the previous study was an under-estimation of the true value, given that it was based on the results of the examination of just one urine sample per subject (WHO, 2002). The high prevalence of urinary schistosomiasis in Okwel-Obudu could be a result of the higher level of exposure and dependence of the inhabitants on infective water sources.

A similar observation was made by Okun and Omeche (2003) who identified frequent contact with cercarie infected water to be a major risk factor predisposing people, particularly children to the infection in the area. In Utukwang, prevalence decreased from 91 per cent in 2003 to 78.0 per cent in 2013 probably due to improved water supply. This is not surprising because schistosmiasis has been reported to drastically reduce in areas where potable water is provided (Adie et al, 2013; WHO, 2002).

Moreover, prevalence of 74.5per cent and 71per cent urinary schistosomiasis reported in Adim and Abini endemic communities respectively was higher compared to earlier parasitological report by Ejezie *et al*. (1991) who confirmed prevalence of urinary schistosomiasis to be 43.5 per cent in Adim and 4.5 per cent prevalence in Abini (Inyang-Etoh *et al*., 2004). Ejezie *et al*'s (1991) work seems to be the first estimate of urinary schistosomiasis in Adim community and the high prevalence rate was found to be consistent with the rice farming occupation of the natives (Plate 3). Etim *et al* (2013) reported that rice farmers had a prevalence of 60.2 per cent, which was the highest for all the occupational groups in the area. Also, 76.5 and 67 per cent prevalence of urinary schistosomiasis in Assiga and Ijiman respectively corresponded to poor knowledge of the cause of the disease.

Risk perception affects health behavior, and decisions to guard against schistosomiasis infection depend on awareness of risk factors and knowledge of behaviours that predispose people to the disease (WHO, 1988). Human interaction with infected water source (streams, rivers, and swamps) is the major determinant of schistosomiasis infection, and behavioural activities, especially farming in vector environments, fishing, fetching of water, swimming, washing, sand minig and others, play a role in the prevalence of the disease (Gazzinelli, 2006; Wagatsuma *et al.,* 2003; Useh & Ejezie, 1999). Table 2 provides information on risk factors influencing prevalence of urinary schistosomiasis in endemic communities. The analysis revealed that out of the 798 persons interviewed, 624(78.2per cent) respondents had swum in the water source in the last one month, 607(76.1per cent) respondents claimed to have fetched water from the river source, and 637(79.8per cent) respondents affirmed bathing in the river source. Similarly, 553(69.3per cent) respondents have recently carried out laundry activities at the river source, 596(74.7per cent) of the respondents replied to have been farming in swampy areas, 310(38.8per cent) respondents have been involved in sand mining, 477(59.8per cent) respondents were engaged in fishing activities. Also, 65.0per cent and 81.2per cent of the respondents had engaged in the gathering and eating of snails respectively. Concerning the presence of dam/irrigation projects and rice farms in facilitating the prevalence of schistosomiasis in endemic areas, 219(27.4per cent) and 412(51.6per cent) respondents affirmed to have dam/irrigation projects and government owned rice farms sited in their communities respectively. These dam/irrigation projects as well as rice farms create suitable breeding grounds for the snail vectors of schistosomiasis and frequent human vector exposure. A similar observation was made by WHO (1988) that the building of dams and irrigation for rice farming by humans promote favourable conditions for snails and for increased water contact, consequently leading to the increase of schistosomiasis.

On the other hand, those who denied involvement in water contact activities include swimming 174 (21.8per cent), fetching water from the river source 191 (23.9per cent), bathing in the water source 161 (20.2per cent), doing laundry at the water source 245(30.7per cent), farming in swampy areas 202(25.3per cent), sand mining 488 (61.2per cent) fishing 321 (40.2per cent), and gathering and eating of snails 279(35.0per cent) and 150(18.8per cent) respectively. The analysis goes to show that most of the respondents have engaged in one activity or the other at the water source in recent times, thereby getting infected. The result further revealed that the residents depend on unsafe and unprotected water sources for farming, swimming, bathing, fishing, washing, defecation, drinking, and gathering of snails to mention but a few and these basic activities that are carried out at the water source may be responsible for the increasing number of persons reporting the disease in endemic communities.

To this end, it is apparent that prevalence of urinary schistosomiasis in endemic communities is closely linked with human water-contact behaviour. In a related study, WHO (1988) pointed out that those at high risk of schsistosomiasis infection are people involved in fishing activities, farming, bathing, paddling of canoes, swimming and possibly handling of infected snail host in the case of collecting edible ones. Since most of the activities of the inhabitants are linked with unsafe water sources, there is the likelihood that schistosomiasis would continue to devastate the health of the people if nothing is done to control or eradicate the disease.

Table 2: Risk factors influencing prevalence of urinary schistisomiasis

Variables/Responses	Swim in infective water No.(%)	Fetched infective water No.(%)	Bathed in infected water No.(%)	Laundry at the water source No.(%)	Farmed in swampy area No.(%)	Engaged in sand mining No.(%)	Engaged in fishing No.(%)	Engaged in snail gathering No.(%)	Eating of snails No.(%)	Defecated in the river source No.(%)	Presence of dam/irrigation projects No.(%)	Government owned rice farm No.(%)
Yes	624 (78.2)	607 (76.1)	637 (79.8)	553 (69.3)	596 (74.7)	310 (38.8)	477 (59.8)	519 (65.0)	648 (81.2)	375 (47.0)	219 (27.4)	412 (51.6)
No	174 (21.8)	191 (23.9)	161 (20.2)	245 (30.7)	202 (25.3)	488 (61.2)	321 (40.2)	279 (35.0)	150 (18.8)	423 (53.0)	579 (72.6)	386 (48.4)
Total	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)	798 (100)

Source: Researcher's Fieldwork, 2013

In order to determine the effects of risk factors on the prevalence of schistosomiasis, the logistic regression analysis was carried out. The data used for the analysis in the SPSS environment is shown in tables 1 and 2 above. The number of respondents reporting blood in urine in endemic communities is the dependent variable (Y) (Table 1), while swimming, fetching, bathing, washing, farming in vector environment, sand mining, fishing, snail gathering, eating of snails, defecation into river, number of dam and irrigation projects, and number of government owned rice farms constitute the independent variables (See Table 2).The logistic regression model is shown as the following form:

Logit {p(x)} = $\log [p(x)/1-p(x)] = a + b_1X_1 + b_2X_2 + b_2X_2 + b_3X_3 \ldots\ldots + b_{12}X_{12}$……eqn(4)

Where:

Logit (p) = log (to base e) of the odds ratio or likelihood ratio that the dependent variable is 1

p = probability of the dependent variable (prevalence of schistosomiasis);

$x_1 - x_{12}$ = independent variables, which are

x_1 = Swimming in infective water;
x_2 = Fetching infective water;
x_3 = Bathing in infected water;
x_4 = Done laundry at the water source;
x_5 = Farming in swampy areas;
x_6 = Engaged in sand mining;
x_7 = Engaged in fishing;
x_8 = Engaged in snail gathering;
x_9 = Engaged in eating of snails;
x_{10} = Defecated in the water source;
x_{11} = Number of dam and irrigation projects in endemic community;
x_{12} = Number of government owned rice farms in endemic community;

$b_1 - b_{12}$ = parameter estimate for independent variables

Details of the analysis are summarized in Table 4. The result of the analysis in Table 4 indicates that the logistic regression model is highly significant, showing that the independent variables; swum in infective water (x_1),fetched infective water (x_2),bathed in infected water (x_3),done laundry at the water source (x_4),farmed in swampy areas (x_5), sand mining (x_6), fishing (x_7), snail gathering (x_8), eating of snails (x_9), defecated in the water source (x_{10}), number of dam and irrigation projects (x_{11}), number of government owned rice farms (x_{12}) significantly predicted the dependent variable (prevalence of urinary schistosomiasis).

The strength of logistic regression relationship (model summary) is evident in Table 4.12. In this case, using the Nagelkerke R square value that provides an indication of the amount of variation in the dependent variable explained by the independent variables reveals that 37.6 per cent (0.376) of the variation in the dependent variable (number of respondents reporting blood in urine) was explained by the set of independent variables used in the model. In addition, the goodness of fit result (Table 4) shows that the model fits the data with p-value (sig) >0.05. The assumption is that if Hosmer and Lemeshow Test- *goodness-of-fit test statistic* is greater than .05, it shows that the model is well fit; thereby, rejecting the null hypothesis that there is no difference between observed and model-predicted values, implying that the model's estimates fit the data at an acceptable level. The usefulness of the logistic model is evaluated by further comparing the overall percentage accuracy (Table 4). The result reveals that the classification accuracy rate is 74.7per cent which is higher than the proportional by chance accuracy criteria of 56.6per cent (Bayaga, 2010), suggesting that the model is highly useful. In spite of the low contribution of the independent variables to the variation in the dependent variable, the regression model provided a significant explanation to the prevalence of urinary schistosomiasis in endemic communities ($R^2 = 0.376$; $p<0.05$). However, it is apparent from this result that other variables other than those considered in this study need to be investigated to account for the unexplained variance (62.4%).

Table 4: Behavioral risk factors influencing urinary schistosomiasis prevalence

Variables	β	SE	Wald	df	Sig.	Exp(β)	Odd ratio (e^{β})
Swam in infective water	-.134	.275	.236	1	.627	.875	0.875
Fetched infective water	.104	.246	.179	1	.672	1.110	1.110
Bathed in the river	-.035	.284	.015	1	.903	.966	0.966
Done laundry at the water source	.075	.224	.111	1	.739	1.077	1.078
Farmed in swampy area	.458	.214	4.584	1	.032*	1.581	1.581
Engaged in sand mining	-.076	.195	.153	1	.696	.927	0.927
Engaged in fishing	.256	.199	1.653	1	.199	1.292	1.292
Engaged in snail gathering	.190	.208	.835	1	.361	1.209	1.209
Eating of snails	-.108	.239	.203	1	.652	.898	0.898
Defecated in the river source	.184	.177	1.081	1	.298	1.202	1.202
Number of dam /irrigation projects	.303	.201	2.269	1	.132	1.354	1.354
Number of govt. owned rice farm	-.319	.175	3.331	1	.068	.727	0.727
Constant	.921	.368	6.278	1	.012	2.512	

Overall model estimation

	Chi-square	Df	Sig.
Step	22.136	12	.036*
Block	22.136	12	.036*
Model	22.136	12	.036*

Model chi square = 10.922*; -2 Log likelihood = 880.803; Cox& Snell R Square = 0.027; Nagelkerke R Square = 0.376; Overall model classification = 74.7

*Significant at 5% confidence level

The index of the significance of each predictor variable in the equation represented by the Wald statistic and associated probabilities is presented in Table 4. The Wald statistic has a chi-square distribution. The simplest way to assess Wald is to take the significance values and if less than .05 reject the null hypothesis as the variable does make a significant contribution. In this case, we note that among the predictor variables used in the model to predict the probability of the dependent variable, farming in swampy areas (Odd ratio: 1.58; $p<0.05$) contributes significantly to the prediction of the prevalence of urinary schistosomiasis, while other predictor variables do not contribute significantly to the prediction of the prevalence of urinary schistosomiasis ($p>0.05$), probably due to local variation in level of exposure to specific water contact points. The Exp (B) column in Table 4 presents the extent to which raising the corresponding measure by one unit influences the odds ratio. We can interpret EXP (B) in terms of the change in odds. If the value exceeds 1 then the odds of an outcome occurring increase; if the value is less than 1, any increase in the predictor leads to a drop in the odds of the outcome occurring (Agresti, 1996 and Pampel, 2000). For example, the EXP (B) value associated with farming in swampy area is 1.581. Therefore, if farming in swampy areas is raised by one unit (one person) the odds ratio is 2 times as large and therefore, farming in swampy areas is 2 times more likely to predict the prevalence of schistosomiasis. The 'B' values in Table 4 are the logistic coefficients that can be used to create a predictive equation (similar to the b values in linear regression). Hence, the logistic regression equation from the obtained result is given thus:

$$\text{Logit}(p) = 0.921 - 0.134(x_1) + 0.104(x_2) - 0.035(x_3) + 0.075(x_4) + 0.458(x_5) - 0.076(x_6) + 0.256(x_7) + 0.190(x_8) - 0.108(x_9) + 0.184(x_{10}) + 0.303(x_{11}) - 0.319(x_{12}) \quad \ldots\ldots\ldots\ldots \text{eqn}(5)$$

Farming in swampy areas in this study constitutes the only behavioural risk factor influencing schistosomiasis prevalence in endemic communities. One important reason for the significant influence of farming in swampy areas on the prevalence of schistosomiasis is the predominant rice farming occupation of the people that makes them vulnerable to schistosomiasis infection. A similar observation has been earlier made by Ejezie *et al*., (1991) who found the high prevalence rate of shistosomiasis to be consistent with the rice farming occupation of the people in the area. Hence, schistosomiasis can be seen as a rural, often occupational disease. In endemic communities, majority of the inhabitants engage in agriculture, particularly farming and this seems to highlight the fact that agricultural workers who have regular contact with vector environment are more likely to be infected with urinary schistosomiasis.

CONCLUSION AND RECOMMENDATION

The study has shown that swimming, fetching, bathing, washing, farming in swampy areas, sand mining, fishing, snail gathering, eating of snails, defecation into river, number of dams/irrigation projects and government owned rice farms significantly explained the prevalence of urinary schistosomiasis (chi square = 22.136, $p < .000$ with df = 12). However, only farming in swampy areas was identified to be the dominant behavioural risk factor influencing urinary schistosomiasis prevalence in endemic communities (Odd ratio: 1.58, $p<0.05$).

Based on the findings of the study, government and farmers alike should carry out swamp ecological services to reduce or eliminate the population of water dwelling snails which serve as intermediate host vectors of schistosomiasis. Also, awareness campaign should emphasize the need for farmers to apply themselves to knowledge gained on prevention in order to protect themselves from schistosomiasis. Government should provide farming kits to farmers in order to prevent contact with schistosomiasis vector. Farming kits in the form of foot wears and hand gloves should be distributed to farmers by relevant agencies, especially to those who work in swampy areas in order to protect against schistosomiasis infection.

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