SPATIAL PATTERN AND PERCEPTION OF URINARY SCHISTOSOMIASIS (*schistosoma haematobium*) IN CROSS RIVER STATE, NIGERIA

BY

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ABSTRACT

Schistosomiasis is one of the prevalent Neglected Tropical Diseases (NTDs) in Cross River State, Nigeria. Its transmission is associated with bathing, swimming and swamp farming especially in endemic communities. Previous studies on prevalence have focused on parasitological detection of infected persons and the effects of environmental and socioeconomic factors on exposure to schistosomiasis. However, spatial variations in the prevalence of the disease in endemic communities have received limited attention in the literature. This study, therefore, analysed variations in schistosomiasis prevalence and the perception of water related activities on its prevalence in Cross River State, Nigeria.

Disease ecology, health belief model and the triangle of human ecology of disease provided the framework, while survey design was adopted. Prevalence data were collected from National Bureau of Statistics for the period of 1981 to 2004 and Cross River State Ministry of Health 2012 schistosomiasis survey. A structured questionnaire was purposively administered on 800 selected household heads in seven endemic communities across the three senatorial districts. Data were collected on water related activities: swimming, fetching of water, bathing, laundry, sand mining, fishing, defecation in water, snail collection and farming in swampy areas; perception of blood in urine, infection, cause, modes of transmission, ailments, prevention and treatment. Endemic situations were classified into hyper >30% and meso>20% following the World Health Organisation standard. Descriptive statistics, Linear regression, Logistic regression, Correlation and Analysis of variance were used for data analyses at $p<0.05$.

A total of 499,143 cases were reported, but the number decreased by 56.4% from 1981 to 1990 and by 33.32% between 1991 and 2004. This implied a significant decline in schistosomiasis prevalence. The disease was hyper-endemic in the north (61.0%) and central (53.7%) districts, while meso-endemic in the south district (22.1%). About 39.0% of the infected individuals were age below 20 years, while prevalence was highest in males (61.2%). Bathing (79.8%), swimming (78.2%), fetching of water (76.1%), swamp farming activities (74.7%), laundry (69.3%), snail collection (65.0%), fishing (59.8%), defecation in water (47.0%), and sand mining (38.8%) influenced prevalence of schistosomiasis. Swamp farming activities significantly influenced schistosomiasis prevalence (Odd ratio: 1.581), while a positive relationship was observed between prevalence of schistosomiasis and population size (r=0.92). Awareness of schistosomiasis was high in central (84.0%), northern (75.0%) and southern Cross River (69.0%). However, a lower proportion of the vulnerable individuals (26.6%) across the endemic communities were aware of the causes of schistosomiasis. There were significant variations of causes $\left(F_{(7,793)} = 15.33\right)$, modes of transmission $\left(F_{(6,792)} = 16.75\right)$, ailments $\left(F_{(12,786)} = 18.78\right)$, preventions $\left(F_{(9,789)} = 27.44\right)$ and treatments $\left(F_{(10,788)} = 23.54\right)$ of perception of urinary schistosomiasis among endemic communities.

Schistosomiasis prevalence varies across different communities in the study area and closely associated with water related activities. This high prevalence is sustained by poor awareness of the causes of the disease in endemic communities. Therefore, mass mobilisation and health education is required in the area.

Keywords: Spatial pattern, Perception of urinary schistosomiasis, Human ecology, Neglected Tropical Diseases, Cross River State

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May God bless you all. Amen.

CERTIFICATION

I certify that this work was carried out by Mr. U. W. Ibor in the Department of Geography, University of Ibadan, Ibadan, Nigeria.

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DEDICATION

This thesis is dedicated to the Almighty God for His favour, Grace and provision and also to my elder brother Mr Maxwell Wisdom Ibor for his sacrifice.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Urinary schistosomiasis is one of the most prevalent parasitic diseases in the world and misconceptions about the disease are responsible for different levels of prevalence in different geographic locations. The World Health Organization (2002) reported that over 200 million people are infected with the disease globally and about 779 million people were at risk of being infected with schistosomiasis in 2003 (World Health Organization, 2008). Also, about 120 million people living with schistosomiasis were symptomatic and 20 million developed several related diseases (WHO, 2002). Documented evidence shows that schistosomiasis is endemic in 76 countries, and severe transmission takes place in 67 countries, of these, 46 are in Africa. Africa is known to account for 85 per cent of all schistosomiasis transmission globally (World Health Organization, 2000). Empirical evidence further suggests that sub-Saharan Africa bears a very high burden of the disease, accounting for 80 percent of all schistosomiasis cases in the region. The disease is prevalent in Nigeria and over 20 million people were infected in 1996 (National Schistosomiasis Control Programme, 1996).

Schistosomiasis is both an environmental disease and a disease of poverty (Tay *et. al*, 2011). Schistosomiasis is contracted in stagnant and fresh water snail vector habitats where there is close contact between the human population and infested water. The transmission of the disease takes place when an infected person urinates or defecates in the water body that serves as source of water supply to community members. Snails are the intermediate host vectors of schistosomiasis. Infected snails release pathogenic cercaria that upon human contact penetrates into the skin of the human host. Its geographic distribution reflects population access to potable water, sanitation, socio-economic status, and access to adequate treatment (Huang and Manderson, 2005). Demographic, economic and socio-behavioural characteristics of the local communities such as water-contact behaviour and sanitation shape the frequency of exposure (Kloss *et al.*, 2006; Li *et al*, 2007).

The perception of urinary schistosomiasis varies not only among socioeconomic groups but also among communities depending on their levels of vulnerability. Studies in

Nigeria and elsewhere in the world have shown misconceptions in the perception of Neglected Tropical Diseases like schistosomiasis. A misconception about schistosomiasis in areas where the disease occurs seems to contribute to maintain the disease at a high level of prevalence. Health care seeking behaviour is not only concern with knowledge of the cause and treatment of diseases, but also of perceived seriousness, cultural practices and socio-economic status. Although the mode of schistosomiasis transmission through water contact is fairly understood (Watts, 1987), few empirical studies have been carried out to analyze exposure to water and its relationship to infection (Kloos et al., 2006). In fact, recent studies have not established any association between exposure to water and infection (Watts, 2008). One reason for this may be that water contact alone does not entirely account for risk. Instead, it may be necessary to consider levels of exposure to different types of water bodies in areas where the disease is always present, and how these relate to human infection.

Since the assessment of parasitic disease burdens by the international health community in the late 1990s, the general problem of schistosomiasis seems to have lost priority in the global health agenda (Gambhir and Michael, 2008). This is unfortunate, because about 20 million people suffer from several schistosomiasis-related ailments on a daily basis and will experience recurrent episodes of the disease for as much as half of their lives (WHO, 2008). The burden of disease resulting from urinary schistosomiasis can be measured in terms of physical morbidities, such as liver damage, vaginal bleeding, bladder and kidney inflammation among others. Early treatment of schistosomiasis depends on perception of adverse condition and prompt recognition of symptoms in addition to knowledge of appropriate treatment. Thus, adequate information which addresses beliefs, understandings and attitudes about the disease are necessary to effectively tackle the disease. Human cognitive representation of urinary schistosomiasis is an important factor to consider within the ecology of diseases. Insight into epidemiological situation of urinary schistosomiasis may be gained through the human ecology of disease. This understanding offers important explanation on communities' vulnerability to disease and provides guide for any public health intervention. This study, therefore, seeks to examine the spatial pattern of urinary schistosomiasis and explore the perception of the disease in academic communities.

1.2 STATEMENT OF PROBLEM

Human behaviour affects the prevalence of Neglected Tropical Diseases (NTDs), including urinary schistosomiasis whose transmission is associated with bathing, swimming, farming and where access to potable water is limited, especially, in schistosomiasis endemic communities. After malaria, schistosomiasis is one of the leading causes of morbidity in endemic areas (WHO, 2002 and Ejezie *et al*., 1991). In rural Nigeria, schistosomiasis is one of the most prevalent waterborne diseases. About 22 million Nigerians, including 16 million children are at risk of infection of urinary schistosomiasis, making the country the most endemic in the world. In Cross River State, a prevalence of 91 per cent was reported in 2009 (Okon et al., 2009). As an occupational disease, schistosomiasis affects people as a result of their profession or because of lack of a reliable source of safe water for drinking, washing and bathing (Ofoezie, 2002). Farmers and their children may likely have the highest infection due to regular contact with contaminated water bodies when they go to their farms or during their recreational activities (Houmsou *et. al*., 2010).

The disease is highly endemic in coastal communities, where human exposure occurs primarily at swamp, river and stream snail habitats. In some areas, transmission takes place in water development projects like small irrigation schemes and rice farms where the snail intermediate host can find suitable breeding sites in large still water bodies. The high rate of prevalence of schistosomiasis in the endemic areas may be as a result of the higher level of exposure and dependence of the inhabitants on infective water. A previous study reported that the presence of snails in the region indicates that there is an increased possibility for disease transmission to humans (Etim *et al*., 1998). The fact that household sanitation facilities in endemic communities are inadequate makes the effect of schistosomiasis on the health of the people extremely serious. As a result, the link between household sanitation factors and exposure needs to be established (Lee, 2005; Watts, 2006).

Human water activities play a role in the prevalence of the disease. Houmsou *et. al*., (2010) reported that the inhabitants 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. In a study by Onyeneho *et al.* (2010) in Delta State, most of the inhabitants associated the disease with the drinking of dirty water and they believed that the average person with schistosomiasis does not experience advanced forms of the disease. Apart from kidney failure and liver damage associated with acute infections, the disease affects the physical fitness, cognitive performance, nutritional status and growth and school attendance (Nokes and Bundy, 1993; Gambhir and Michael, 2008) of school-aged children.

Studies of schistosomiasis prevalence have been carried out at both the macrogeographical (Ruyssenaars *et al*, 1973; Duerr et at, 2003 and Watts, 2008) and local levels (Ejezie *et al*., 1991; Anosike *et al*., 2001; Etim *et al*., 1998; Inyang-Etoh *et al*, 2009; CRSMoH, 2012; Adie *et al*, 2013). However, apart from the fact that most of these studies were concerned with screening the schistosomiasis infected and non-infected persons using parasitological methods of mine and stool samples (Agi and Awi-waadu, 2008; Anosike et aL, 2006; Etim, *et al*., 1998; Fry, 2004; Agi, and Awi-waadu, 2008; Adie *et al*., 2013), majority of them were carried out in the northern, south-east and western parts of Nigeria. These studies failed to offer important insights into the disease in the context of human ecology of disease and health belief theories. Findings based on empirical evidence could shed light on the appropriateness or otherwise of these theories in understanding the ecology of vectored diseases like urinary schistosomiasis.

Despite existing literature on urinary schistosomiasis, there is paucity of information on the spatial pattern of the disease, and temporal prevalence has not received sufficient attention. Recent studies show that large areas remain where prevalence levels are unknown especially, in schistosomiasis endemic communities. Information on variations in prevalence in endemic areas is scanty and regional-based estimates on epidemiologic patterns are limited. In spite of the growing number of cases in endemic communities, the spatial pattern of perception of the disease has received limited attention in the literature. Relatively few studies have examined the epidemiological situation of urinary schistosomiasis and more importantly the cognitive aspects of the disease in the south-southern part of Nigeria and elsewhere. Louirero *et al*. (1990) hypothesized that differences in perception of aspects of the environment would be associated with different levels of prevalence in a population. This study therefore seeksto analyze the spatial pattern and perception of urinary schistosomiasis, with a view to understanding the variations in the epidemiological situation of the disease in endemic communities.

1.3 AIM AND OBJECTIVES OF THE STUDY

The aim of the study is to examine the prevalence of urinary schistosomiasis as well as determine the spatial pattern of perception of the disease in order to understand its cognitive aspects and the epidemiological situation in endemic communities. The specific objectives are to:

I. Examine the spatial and temporal changes in the prevalence of schistosomiasis, with a view to determining the trend and pattern of occurrence of the disease.

2. Determine the influence of the following risk factors on the prevalence of schistosomiasis: swimming, fetching of water, bathing at the water source, laundry, fishing, and farming in vector environments, sand mining, gathering and eating of snails, defecation in the river, age and education of infected household members.

3. Establish the relationship between spatio-epidemiological factors and exposure to schistosomiasis.

4. Determine the spatial pattern of perception of schistosomiasis in endemic communities.

1.4 RESEARCH HYPOTHESES

The following research hypotheses were tested:

(i) Prevalence of urinary schistosomiasis is influenced by swimming, fetching of water, bathing at the water source, laundry, farming in vector environment, sand mining, fishing, snail gathering, snail eating, age and education of infected household members.

(ii) Exposure to schistosomiasis is a function of movement to infection source, household waste disposal, time spent on exposure activity, age of respondent distance from home to the nearest source of infection, household residential quality, household water source, household toilet type, distance from place of work to source of infection, education of respondent and estimated monthly income.

(iii) There is a positive relationship between the number of persons infected with urinary schistosomiasis and population size of endemic communities.

(iv) The perception of urinary schistosomiasis varies significantly among endemic communities.

1.5 SIGNIFICANCE OF THE STUDY

Nigeria is one of the highly endemic countries where schistosomiasis has been haphazardly reported and large areas remain where the prevalence levels is unknown. This is likely to be as a result of ignorance and lack of sufficient attention to adequate sanitation (Ofoezie, 2002; Anosike *et al*, 2001). Besides, local knowledge, attitudes, and practices (KAP) of schistosomiasis are poorly understood, although such information is required for prevention and sustainable control. Yet, previous parasitological studies especially in Nigeria have at best provided insufficient attention on the cognitive aspects of the disease. Therefore, this study is relevant in many ways. For instance, the spatial dimension of schistosomiasis disease is considered to be of great importance for understanding the variations in risk factors, prevalence and perception of the disease in a population.

The findings of the study would provide information on the specific risk factors associated with different groups of the affected population in order to understand variations in patterns of susceptibility. Understanding variations in peoples' perception of the disease would enhance the specification and implementation of the required action(s) to address the misconceptions and culturally sensitive issues relating to urinary schistsosomiasis.

The results from the study would be useful in understanding the relative significance and direction of different risk factors in endemic communities. This information is important in programming for the affected communities. The characterization of the disease into high and low prevalent areas will help in the priotization of interventions aimed at eradicating the disease. The mapping of disease prevalence and infection intensities would serve as tools for allocation of resources to effectively control the disease. The mapping of disease prevalence intensities would serve as tools for allocation of resources to effectively control the disease. This study would shed light on the appropriateness or otherwise of the disease ecology and health belief theories in understanding the ecology of human schistosomiasis. The study would build models that can be used to predict the geographic risk of urinary schistosomiasis and other related parasitic diseases whose transmission is dependent on human-water contact. The methods of analysis applied in this thesis will serve as a model for the geographic study of diseases of public health importance. This is because spatial statistics are considered to be appropriate methods for building models in order to explain the distribution of diseases and provide the means of monitoring and control. Due to the advarse effects of schistosomiasis on physical, social and economic conditions of infected populations, understanding people's perception of the disease can have a significant impact on the success of scientific interventions. Hence, relief from the burden of *Schistosoma haematobium* could be facilitated by a good understanding of the cultural practices that sustain exposure to the infection. The study would fill the knowledge gap in literature on the spatial epidemiology of macro-parasite diseases.

1.6 JUSTIFICATION

Urinary schistosomiasis is a serious public health problem in endemic areas. The disease is recognized by the presence of blood in urine. Infection can lead to bladder cancer or kidney problems if not properly treated. Victims of the disease are weakened and are often unable to work (Van de werf *et al*., 2003). In recognition of the numerous health and socio-economic problems associated with the disease, the prevalence of urinary schistosomiasis in Nigeria was explored in 1990-91, and the survey showed that disease was prevalent in the whole country.

In Cross River State, schistosomiasis is a public health problem but estimates of its prevalence and the perception of the disease vary widely. Hence, incidence and prevalence of urinary schistosomiasis were investigated in Biase, Cross River State using questionnaires, reagent sticks and parasitological technique (Ekanem, 2013). This study reported prevalence rates to be 33.4 percent. There was a high positive correlation between the results of questionnaires and reagent stick testing. The study suggested that the questionnaire-based approach may provide information on self-reported blood in urine and might prove a reliable technique for identifying populations with high prevalence. This will be of great benefit for any control programme in areas where the disease is endemic.

Due to limited prevalence data in hospitals with alarming prevalence cases in endemic areas, the Cross River State Ministry of Health conducted a survey of schistosomiasis and Soil Transmitted Helminths (STH) among school aged children in 2012. Apart from the fact that the survey did not take into account people's perception of schistosomiasis, at-risk children who are not in school were not captured. The potential problems associated with poor education in schistosomiasis endemic areas further heightened the need for awareness and enlightenment campaign before and during an intervention programme. But, health education interventions have not yielded, the expected results in the past. Some experts believe that promoting positive behaviours obscures underlying structural and political problems associated with the disease and is tantamount to victim blaming (Useh and Ejezie, 1999), while previous studies have shown that health promotion interventions failed because they were designed without knowledge of the health behaviour of the vulnerable population.

Arising from the above, there is therefore need for updated information on the extent of disease burden and the people's perception of the causes, modes of transmission, treatment and prevention at community level to facilitate effective privatization and monitoring while ensuring ownership and sustainability of prevention and control programs at the local level. It is pertinent to understand the physical and behavioural factors that enhance people's perception of the disease in endemic communities. A good understanding of the variations in cognitive aspects of the disease as become imperative now that despite the acclaimed high level of prevalence and endemism of the disease, there is still paucity of information on the actual number of persons who are infected with the disease in endemic communities due to cultural behavioural practices.

1.7 STUDY AREA

1.7.1 LOCATION AND PHYSICAL ENVIRONMENT

Cross River State is located at the south southern part 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 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.

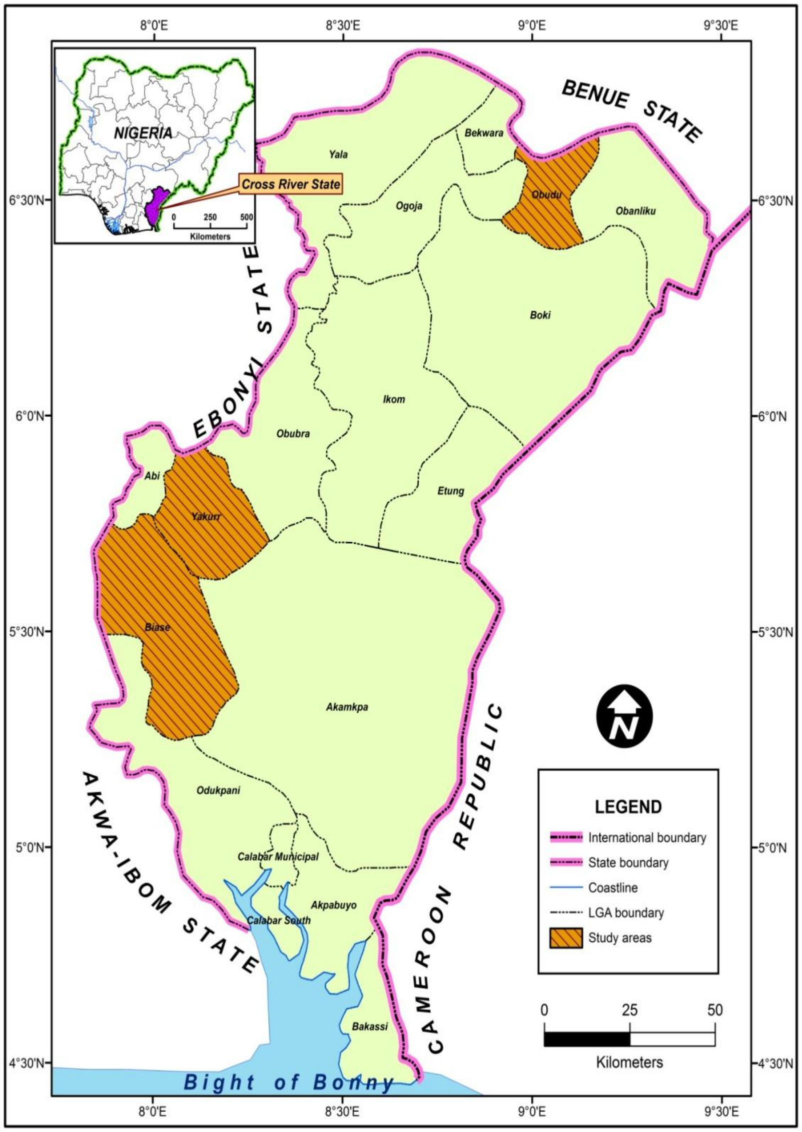

Fig. 1.1: Cross River State showing the study areas
Source: Cross River State Ministry of lands and Surveys, 2013

Apart from the two high land areas of Oban hill and Obudu plateau, which are a part of the ranges making up the eastern borderlands, separating Nigeria and Cameroon, the Cross River State region is a low-lying region which is called the Cross River Plains. It is made up of low lying coastal alluvial sedimentary formations in the south and undulating basement complex rocks in the interior central and northern parts. The terrain is made up of undulating depressions and low hills, as well as vast interfluves characterized by dry valleys (Bulktrade, (1989).

Arising from its location, the State enjoys a tropical humid climate with distinct wet and dry seasons. The State records annual rainfall between l300 — 3000mm (Uwem, 1997). Temperature is high throughout the year (not less than 27°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 (Ukpong, 1995). 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 has many water bodies from the tributaries of the Cross River, including streams, swamps, rivers and the Atlantic Ocean (Fig. 1.2). Cross River is the main river in the State. The Cross River drains into the Bight of Biafra in the extreme southeastern corner of Nigeria's coastline. The water falls in Ikom are considered important hydrological component of the area and consist of seven different streams, each cascading over steep cliffs, providing seven-faced falls. Cross River is also home to the largest naturally occurring lake in the South- South region of Nigeria: the Refome Lake. The lake is central to a fishing festival, which takes place between March and May every year.

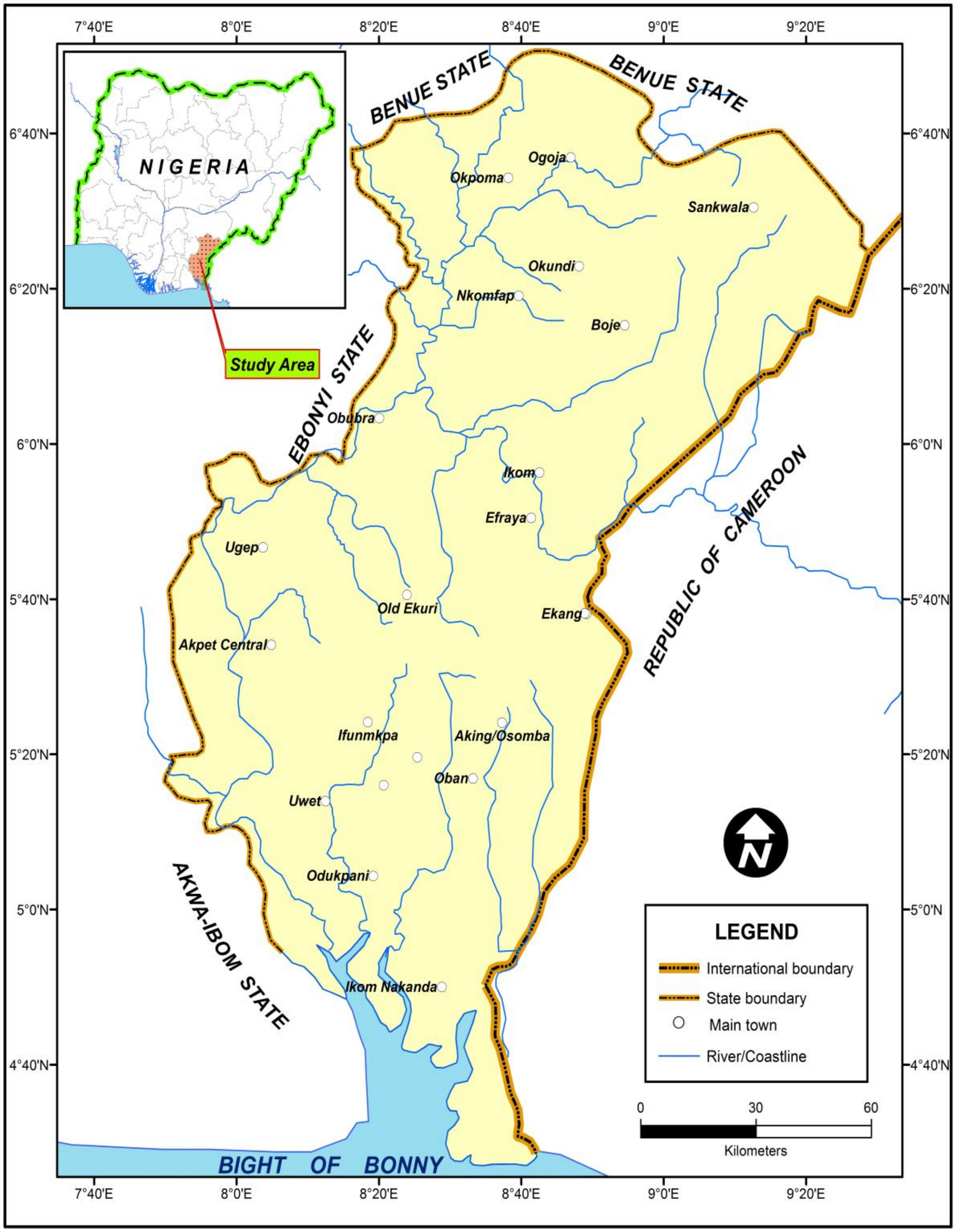

Fig. 1.2: Drainage system of Cross River State
Source: Cross River State Ministry of Lands and Surveys, 2013

Two-third of Cross River State is covered by mangrove and tropical rain forests, with incised streams, smaller rivers and swamps, suitable for snail survival. Schistosomiasis depends on the 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 vector, thereby influencing the endemism and distribution of the disease. The intermediate snail host of schistosomiasis generally inhabits 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.

The moist soil type creates conducive environment where the snail intermediate host vectors can survive. 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. Soil-transmitted helminths (STHs) infection is common in the area due to warm and moist climates. These STHs cause severe infections and suffering on the people in the area. Many people in endemic communities practice outdoor defecation, thereby contributing to environmental contamination.

1.7.2 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). In spite of the dialect groups that exist in the State, there are three dominant language groups. These are Efik, Bekwarra and Ejagham. 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 certain diseases like 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.

1.7.3 SCHISTOSOMIASIS CONTROL PROGRAMME

Urinary schistosomiasis is prevalent in Cross River State. Most of the people infected with schistosomiasis spend much of their time around water sources where they carry out farming and other activities which predispose them to the vector. Due to the increasing rate of the disease, the Cross River State Ministry of Health in collaboration with the Federal Ministry of Health, Abuja conducted epidemiological mapping/baseline survey of Schistosomiasis and Soil Transmitted Helminths among school aged children in twelve LGAs from the 14th October to 28th October, 2012. The survey was based on the World Health Organization standard diagnostic procedures on the examination of urine and faecal samples from school-aged children in the State for the presence of schistosome and intestinal helminths eggs. A total of 3012 school children were examined from the 58 primary schools in the three senatorial districts of the state. The survey was facilitated and supervised by the Technical Officers from the Federal Ministry of Health, Abuja.The prevalence data in these Twelve Local Government Areas include; Bekwarra 73 per cent, Ogoja 65 per cent, Yala 34 per cent, Obudu 68.3 per cent. Prevalence of schistosomiasis in Ikom 55 per cent, Yakurr 63 per cent and Abi 43 per cent, Akamkpa 0 per cent, Akpabuyo 0 per cent, Bakassi 0 per cent, Biase 73.2 per cent, and Odukpani 37 per cent.

Schistosomiasis control programme has been implemented in some of the Local Government Areas in Cross River state. These LGAs are: Abi, Akamkpa, Akpabuyo, Bakassi, Bekwarra, Biase, Ikom, Yala, Yakurr, Ogoja, Odukpani and Obudu. Most of these LGAs are surrounded by several rivers and streams including swamps where the vector lives. For now, there is yet no vaccine available for the prevention of urinary schistosomiasis. The current strategy of control is chemotherapy with praziquantel which is given as a single oral dose against all human schistosome parasite (WHO, 2002).

CHAPTER TWO

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.0 INTRODUCTION

The chapter presents the theoretical frameworks and review of relevant literature in order to gain insight into the existing depth of knowledge on the subject-matter.

2.1 THEORETICAL FRAMEWORK

Several theories have been developed to investigate the host-vector transmission dynamics of schistosomiasis; while some of these may provide important insights to the geographic risk factors of the disease, others do not consider the cognitive aspects of diseases (Dallapiazza, 2009; Dobson and Carper, 1992). Also, several studies have used spatial and temporal models to predict disease risk based on the links between habitat, population, and reported cases of diseases. Thus, each model has a unique application based on its relevance to the subject-matter.

The relevant theories for this study are the Disease Ecology Model, Triangle of Human Ecology of Disease and Health Belief Model. These frameworks are used to determine the significant elements and processes that influence the prevalence and perception of schistosomiasis in endemic communities. The Disease Ecology theory for instance, examines the relationships between habitat populations within a changing ecosystem. The Triangle of Human Ecology is a holistic framework that focuses on how habitat, population, and behavioral relationships affect the state of human health (Meade and Earickson, 2000) and the Health Belief Model explains how individual perception or personal belief characteristics affect health behavior. Together, these models were used to better understand the dynamic interaction between population, environmental risk and behaviour in order to improve our understanding on the usefulness of these theories in studying vectored diseases.

2.1.1 DISEASE ECOLOGY THEORY

Disease ecology theory is a useful theoretical model in medical geography, and has been extensively applied in the study and explanation of diseases. Although the study of how human-environment relations affect the state of human health may go as far back as Hippocrates' awareness of the effect of the environment on human health, scientific thinking in the field of medical geography started with Jacques May's Ecology of Human Disease. May (1958) observed that diseases are the outcome of interaction between two or more life forms such as humans, vectors, reservoirs, parasites and their hosts as well as microrganisms. May (1958) upheld the germ theory of disease, but at the same time called for a broader perspective of disease causation. He proposed the cultural ecology of diseases when he noted that humans are related "pathologically" to their culture. Cultural ecology of disease is concerned with the way in which human behavior interacts with environmental conditions to affect disease outcomes in a susceptible population.

May (1958) define diseases as the alteration of cells or tissues in humans such that their survival is jeopardized. He identified three types of stimuli that affect the state of human health to include: inorganic, organic, and socio-cultural stimuli. Inorganic stimuli are physical factors such as landforms, vegetation, weather, soil, water and so on, while organic stimuli are related to the interplay of organisms such as vectors and parasites, for instance, the cercaria in the case of urinary schistosomiasis. Socio-cultural stimuli are those adaptive strategies that humans have developed to tackle the inorganic and organic stimuli. These are different ways and means communities adopt to prevent and treat diseases.

Similarly, Dubos' (1950) publication entitled *Mirage of Health* explains that health is intricately related to one's ability to adapt to evolutionary stimuli coming from the external environment, rather than the mere absence of disease. Dubos' stressed that more of these stimuli often come from the modified environment. In an attempt to distinguish between the treatment of disease and promotion of health, he observed that antibacterial drugs were only one part in decreasing mortality from infections in a population, and that it was much more important to adapt human behavior against being infected in the first place. What Dubos mearnt here is that prevention is cheaper and better than cure. According to Dubos (1950), human pathologies and problems are generally in a complex interacting system, and any cure cannot be effective in the long run unless the effects of physical and social factors that are responsible for their occurrence and transmission are treated. In addition, he pointed out that infectious diseases replace one another. In other words, when a healthy human ecology does not exist, a new disease is likely to emerge even if one is eliminated. This belief was dominant around the same time, Audy (1954) conceived of a "medical ecology" in which human diseases are related to the environment and the populations of other organisms that affect human health.

The disease ecology theory describes how the temporal dynamics of human host, vector and reservoir interact spatially within a permissive environment to enable transmission. The theory provides a host-vector-environment framework for the assessment of risks of humans from vector-borne diseases like schistosomiasis. The scheme provides a guide to the evaluation of risks arising from human exposure to vector environment that result in disease at a given location. In the case of schistosomiasis, hosts include humans, vectors are the snail intermediate hosts and reservoir is the environment or habitat where the parasite lives and develops. The pathogen of schistosomiasis is the cercaria that affects humans. Relating the model to this study, the model show how exposure of humans to vectors or environmental risks, the presence of suitable breeding habitats (river, streams, lakes, swamps etc), and the ability of the pathogen affect humans. The model therefore demonstrates that the intrinsic relationship between pathogen, host, and environment that contribute to dynamics of schistosomiasis transmission are deined by the changing overlap in time and space as contained in Figure 2.1.

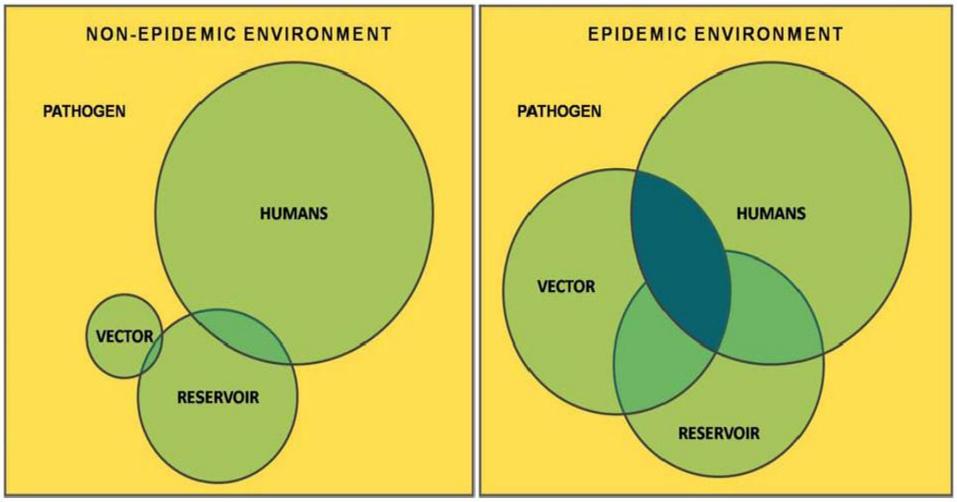

Fig. 2.1 The ecology of vector-borne diseases.

Adapted from: (Dallapiazza, 2009)

Figure 2.1 shows the ecology of a vector-borne disease like schistosomiasis in an epidemic and non-epidemic environment. The non-epidemic environment has no intersection between the vectors and humans, implying that humans have not come in contact with the vector environment or infectious agent. The overlap (dark blue) boundary in the endemic environment represents human infection.

The Disease Ecology theory captures the intricate relationship between humans and the dynamic environment, and demonstrates how processes of population interactions support or discourage disease (Meade and Earickson, 2000). In theory, the study of the prevalence and risk factors of schistosomiasis can identify the extent of spatial interactions between populations and vector habitat. However, one of the flaws of the disease ecology model is that it does not emphasize the role of human behavior in expanding the range of vector population densities and the place of vector habitat management in controlling disease vectors like snail population. A question of more growing concern in Human Ecology of Diseases, however, is not so much how vectors and other pathogens become established in human populations, but how changing ecological patterns and social activities can result in fundamental changes in the interaction between people, the biological environment, and the broader social and economic systems that may lead to disease outbreak (Jamie, 2003).

However, factors that can increase risk for human schistosomiasis infection are based on the population, behavior, and habitat (PBH) characteristics of both the disease vector and the human host (Meade and Earickson 2000). Considering vectors and humans as separate entities interacting in the environment, the ecological risk of infection is based on the varying boundaries of their habitats. The highest risk for transmission and infection is when and where these boundaries overlap (Meade and Earickson 2000). Schistosomiasis potential impacts such as prevalence, incidence, morbidity etc. can be measured by the variable amount of the overlap over time and space.

2.1.2 TRIANGLE OF HUMAN ECOLOGY OF DISEASE

Meade and Earickson (2000) advanced the disease ecology framework for the spatial understanding of human health, adopting Audy's (1974) definition of health as the individual's ability to rally from a wide range of "insults," be it physical, psychological, social, chemical and infectious. Their work synthesized that of May (1958), Dubos (1959), and Audy (1974), adding their view of diseases that integrated May's disease ecology framework more fully into geography. Meade and Earickson (2000) proposed the "triangle of human ecology of disease" which looks at how population, behavioral, and environmental factors affect human health, and broadened the perspective by applying the framework to the study of chronic and degenerative diseases as well as infectious ones. From their perspective of human ecology of diseases, geographers can build hypotheses relating to processes and modes of transmission of diseases, whether the disease vectored or non-vectored.

Meade and Earickson (2000) proposed that the complex system of interaction among habitat, population and cultural behavior forms a triangular model of human ecology and underlie disease aetiology, consequences and prevention. As described by Meade and Earickson (2000), the triangle of human ecology focuses on three main categories of factors that affect human health: population, behavior and habitat (fig. 2.2).

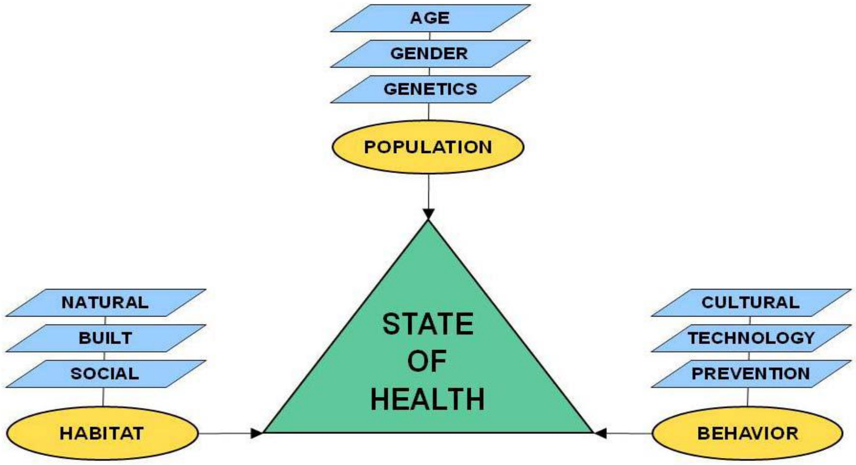

Fig. 2.2: Triangle of Human Ecology of Disease.

Adapted from: (Dallapiazza, 2009)

In this study, population refers to human beings that may be infected with schistosomiasis. It also covers their characteristics such as age, sex, education, income, occupation, including their susceptibility to the disease. The population component of the triangle of human ecology of disease is relevant in this study in many ways. Population characteristics such as sex, age, occupation, nutritional status and education affect exposure, infection and susceptibility to disease. Population exposure to schistosomiasis is determined by their characteristics, which intern affects their behaviour. Behavior refers to the observed activities of population in endemic communtites. Some of these activities are swimming, bathing, fetching of water, doing laundry and many more. It also includes cultural beliefs and local practices concerning schistosomiasis, as well as community's participation in schistosomiasis prevention and control. Through behavior, people create habitat conditions for vectors of schistosomiasis especially in dam hosting communities and rice cultivation areas; through behavior people expose themselves to schistosomiasis; through water contact behavior, sanitation and hygiene people protect themselves from schistosomiasis and through behavior (population movement), people move the disease agent from one place to another.

Habitat is made up of three subcategories: the natural, social', and built habitats. Natural habitat refers to topography, land cover, land use, climate, and weather patterns of a given area. Social habitat is concerned with social relations like family, friends, cultural, and spiritual influences. Built habitat is the environment where people live and work. It is the constructed part of the environment, including sanitation and waste disposal, water sources, building design, and health care facilities (Meade and Earickson, 2000). Two types of habitats as identified by Meade and Earickson (2000) featured prominently in this study; the built habitat and the natural habitat. In their analogy of habitat, Meade and Earickson (2000), considered the built habitat as the constructed part of the environment, wherein humans live and work. They assert that human beings spend most of their lives in houses or other buildings. Therefore, in this study, the type of houses people live in, sanitary facilities and source of water supply were used to understand household exposure risk factors. The natural habitat of schistosomiasis snail vector includes rivers, streams, ponds, lakes, swamps, creeks etc. These environmental factors, including distance from transmission site, were used to determine the vulnerability of communities to schistosomiasis.

The triangle of human ecology of disease provides a guide to identify population, habitat and behavior variables that contribute to schistosomiasis epidemics. This approach is the basis for many studies questioning the appearance and transmission of diseases among humans (Gesler, 2004). The patterns and associations between the important elements and processes that interact with habitat and human behavior give an insight into human risk to schistsomiasis (Fig. 2.2). The theory is also relevant in identifying the natural habitat of snail intermediate vectors of schistosomiasis. The presence of snail vectors in endemic areas could indicate the possibility of disease transmission. Also, proximity of human population to vector habitat, and the extent and form of human interaction with habitat can result in risk of schistosomiasis infection.

2.1.3 HEALTH BELIEF MODEL

The Health Belief Model (HBM) was developed in 1980 by Ross and Mico to explain the relation between health behavior and utilization of health services such as screening and immunization programs. HBM has four primary dimensions: first, health related behavior is predicated on the individual's belief that he is susceptible to a certain health problem. Each individual (water user) has his own perception of the likelihood of experiencing urinary schistosomiasis that would adversely affect his/her health. This is because individuals vary widely in their perception of susceptibility to a disease or condition. Second, individual's perceived seriousness of a given health problem. This refers to belief a person holds concerning the effects a given disease or condition would have on human health. In this study, these effects can be considered from the point of view of adverse effects of urinary schistosomiasis or the difficulties that the condition would create. Hence, the individual's readiness to comply with a recommended action is based on perception of "threat"

Third, the motivating and enabling forces that determine what the individual will do is predicated on the perceived benefit of taking action on the prevention of diseases after the individual is aware of his susceptibility and seriousness. The direction of action people choose towards prevention or treatment will be influenced by the beliefs regarding the ailments and cure. However, sometimes, effective actions may not be taken, even though an individual may be aware of the complications of schistosomiasis or the benefits of seeking appropriate treatment Forth, the compliance behavior actually exhibited. An individual's perception of the level of susceptibility and seriousness compels him/her to act, while the perceived benefits provide the path of action. It may require a cue to action for the desired behavior to occur. These cues may be internal or external. The fact that schistosomiasis does not readily lead to death may cause people not to take serious actions against it even in the face of high level of vulnerability. Another barrier to taking appropriate action against the disease could be people's understanding of the disease. Even when people have resolved to fight schistosomiasis, they may not be well informed about the right action to take.

People's perception of schistosomiasis is modified by their personal characteristics and social setting as well as by their perception of the nature and extent of the exchanges and cost that the recommended action towards ailment is likely to require. An additional stimulus to action is recognized in cues such as previous personal experience with the illness, current experience of symptoms, information input from others, the media and health professionals.

Concerning the available curative measure, the use of drug (praziquantel) is known to be capable of reducing the disease egg load in the human body to a level where it no longer constitutes a serious threat to health (WHO, 2002; CRMoH, 2012). However, for this to be effective, infected individuals must take a single dose of the drug. For people to take prompt action against the disease, they must understand the level of severity of the disease. However, a good health education about various aspects of the diseases is likely to mould people's perception of the disease in the right direction. At present, routine mass treatment of school-aged children is organized and this is expected to continue until the disease is effectively controlled.

The health belief theory is appropriate in the spatial understanding of schistosomiasis. For instance, the model was used to find out whether inhabitants of schistosomiasis endemic communities recognize that they are susceptible to the disease, and see schistosomiasis as a public health problem, as well as what strategies they adopt in preventing and treating the disease. The model was also used to highlight the perceived causes and mode of transmission of schistosomiasis in endemic communities. This understanding makes health education culturally sensitive. However, health belief competes with a person's other beliefs, and actual cognitive process may be difficult to quantify. Also, it may be difficult to find out accurate indicators of beliefs, feelings and perception.

2.2 LITERATURE REVIEW

This section reviews the literature on physical/environmental risk factors in relation to vectors and disease transmission. It also reviews relevant literature on risk factors with particular reference to socio-economic/household and behavioural environments and their associated effects on disease prevalence and intensity. The section also discusses studies on epidemiological characteristics and endemic scenarios and how people's perception and cultural practices affect disease prevalence. Literature on the role of distance on disease prevalence is also reviewed. The relationship between mobility and exposure is highlighted to provide clues on how population movements contribute to disease prevalence.

2.2.1 PHYSICAL/ENVIRONMENTAL RISK FACTORS OF DISEASES

The study of geographical description of diseases and the associated risk factors is of interest in the field of medical geography (Meade and Errickson, 2000). This understanding provides important explanation into why diseases occur where they do, and what causes them to occur in some locations or regions (Stodard, *et al*., 2009; Surtherst, 2004). A lot of studies have shown that environmental or physical factors often play a significant role in the occurrence and distribution of diseases. The role of environmental factors in the occurrence of Neglected Tropical Diseases like schistosomiasis cannot be over emphasized. The range of physical factors that influence the endemism and prevalence of schistosomiasis as reported by Tay *et al*., (2011) include: stagnant or slow-flowing water, freshwater snail vectors, vegetation type, rainfall and temperature, among many others. Both natural factors (e.g., water temperature and ream ecology) and anthropogenic processes (e.g., dams, agriculture, and reservoirs) create snail breeding site and affect the distribution of potential snail vectors. Although the intermediate snail host inhabits multiple geographic regions, many ecological factors are known to control its distribution and abundance. The intermediate snail host generally lives in shallow muddy sediments of lentic (still water) and lotic (slow flowing water), freshwater bodies like swamps, streams, rivers, ponds, lakes, irrigation canals, and heavily irrigated agricultural fields (Tay *et al*., 2011). Temperature, sunshine, river velocity, aquatic vegetation and dissolved oxygen are the primary ecological determinants of snail habitat suitability (Thomas and Tait, 1984). High temperatures over sustained time periods are known to limit snail productiveness and direct sunlight may also have lethal effects on snails as studies have shown that snails avoid strong sunlight and prefer shaded areas (Appleton, 1978).

Ruyssenaars *et al*., (2003) proposed that one approach to investigate the risk of disease transmission through vectors is to carry out cross-sectional surveys of a sample of water bodies in and around selected reservoirs, communities or schools. Water bodies can be classified (for example, reservoirs, canals, drains, seepage areas, pits, rain puddles), mapped, and vector incidence measured in a baseline inventory. A sample of these water bodies can be monitored (monthly or quarterly) for snails population. Babatimehin (2005) studied onchocerciasis prevalence and perception in Kwara State, Nigeria and reported water channels, which on the average were 388 metres from the villages as opposed to the vector's (black fly) flight capacity of over 12 kilometres from the infection source, serve as transmission sites.

Ricardo *et al*., (2012) studied the links between schistosomiasis prevalence and social-environmental factors in Brazil, and reported that: (i) summer minimum temperature had positive correlation with schistosomiasis prevalence, while Human Development Index had negative correlation; (ii) Similar summer minimum temperature impact was observed in all the vegetation types; (iii) the effect of 1991 Human Development Index was lower for savanna than forest The review of this study has shown that understanding the ecological distribution of vector organisms in relation to water bodies is important in identifying management options for environmental disease control. By controlling vector populations otherwise referred to as "source reduction", transmission risk is reduced. This can complement more conventional treatment-based disease control strategies. However, several other variables relating to the use of various water types, sanitation, and infection were not included in the study. These factors can be considered as explanatory variables to shed light on population-environment interaction.

In a similar study, Boelee and Laamrani (2004) conducted a cross-sectional snail survey involving the distribution of Bulinus truncates in relation to habitat factors in traditional irrigation system. The study identified the presence of aquatic vegetation as a major factor aiding schistosomiasis vector snail survival and abundance in canals, impoundments and isolated small puddles. Snail population densities significantly reduced after repeated forest clearance in the communities where their study was conducted. The study identified the habitats where schistosomiasis was found to include springs, impoundments and pools, lined and unlined canals, puddles, marshes created by seepage, and isolated small trickles. Open water surfaces were reported to vary significantly between habitats, but did not significantly affect snail occurrence and density. The study observed most human water contact occurred at the impoundments, which serve as source of water for swimming and suitable places for laundry and other activities. The study identified snail control as a means to reduce transmission of schistosomiasis.

Environmental change affects vector habitats and the transmission of vector-borne diseases, and the combined effects of these changes have the potential in some cases to multiply the risk of disease infection (Heller, 1998). Surtherst (2004) studied the vulnerability of societies to vector-borne diseases. The aim was to define the variables for the assessment of risks of potential changes in the status of vector-borne disease in a changing world and to consider approaches of effective adaptation. The study was based on the links between vulnerability, exposure, sensitivity and adaptive capacity of communities to disease. Surthearst (2004) opined that the concept of vulnerability is useful for assessing risk to human societies from vector-borne diseases. Vulnerability is a measure of the potential impacts of a given change, taking into account the adaptive capacity that is available in the affected community to respond to that change. In other words, it describes the sensitivity of a particular system to vector-borne diseases, taking its adaptive capacity into account.

The study stressed that a change in the geographical distribution of a vector-borne disease has a major effect on the exposure of vulnerable population to that disease. Such a change can be as a result of human movement to a new environment through trade, or human movement to natural areas. Alternatively, it can result from climate change allowing a vector or pathogen to shift its geographical range into environments that become more suitable (Dobson and Carper, 1992). The study argued that vulnerability of the local population to diseases depends on the abundance of the vector and pathogen in the habitat on the one hand and the immune status of the host population on the other, and then defines sensitivity as the degree to which a system responds to an external perturbation, such as change of temperature.

Surtherst (2004) succintly observed that to detect impacts of environmental change on disease, we need monitoring data for a number of environmental and disease related variables covering long time series. Evidence of records of disease incidence over time provide valuable basis for detecting a change in transmission patterns. There is also need to monitor current environment and social conditions. This provides benchmarks against which to measure the likely impact of environmental change on the transmission of vector-borne diseases. Moreover, Surtherst (2004) said that adaptative capacity consists of the adaptation technologies, cultural tools, the public health infrastructure and resources that are available to implement appropriate management responses, including society's capacity to implement appropriate adaptative measures among groups with disparate cultural, economic or environmental resources that are needed to implement those measures. According to Surtherst's (2004) description of risk assessment:

Vulnerability = impact x (1 -adaptative capacity)

Impact exposure x human density

Adaptative capacity (adaptative products and practices)

Surtherst (2004) has devised a means of risk assessment for vector-borne diseases. However, the study is an over simplification of the complex interactions that result in different health outcomes in a population under a changing climate. The theory was literal and descriptive in nature. In reality, the impact of a vector or pathogen on a population depends on the immunological status of the population and how early the population could detect the presence of the pathogen and not necessarily exposure and sensitivity of the population. Surtherst would have laid emphasis on how reproduction of vectors can be controlled and exposure to pathogens reduced, since most countries in the Third World lack the adaptive products, practices and resources to cope with insult.

2.2.2 RISK FACTORS AND DISEASE PREVALENCE

Though the physical environment provides the primary conditions for the breeding of disease vectors, the built environment also plays a significant role in modifying environments to enable permissive transmission of the disease. Matthys *et al.* (2007) conducted a survey to identify risk factors of *Schistosoma mansoni* and hookworm infections in urban farming communities, and to investigate infection prevalence in farming households and non-farming households in western Côte divoire. The variables considered were common agricultural activities, land and water use, education attainment, socioeconomic status and sanitation facilities. The study reported that prevalences of *Schistosoma. mansoni* and hookworm in fanning households were high. Risk factors for *Schistosoma mansoni* infection were identified as living in close proximity to the river, water contact with irrigation wells and ponds and low education attainment. Those who lived in zones of irrigated rice plots or large rice perimeters, using water from domestic wells, and low socioeconomic status were reported presented greater risk of hookworm infection. The study observed significant spatial heterogeneity between agricultural zones, with the highest infection prevalence of *Schistosoma mansoni* and hookworm in the zone where there was a large rice perimeter. Both schistosoma mansoni and hookworm infections were related to specific agricultural activities. The study suggested health education as a control measure.

In a related study, Sama *et al*., (2007) identified a population of mixed socioeconomic status as an intense focus of schistosomiasis and found that although fountains provided potable water, the population still uses the river and streams for most of its bathing, laundry and swimming activities. Age of the subjects, ethnic group and the intensity of contact with the river and/or stream were all significantly associated with schistosome infection. The potential risk of schistosome infection from water contact showed that the younger age groups were at relatively high risk and males were at more risk than females. In terms of knowledge about schistosomiasis, those aged 15-19 years had the highest mean score and those aged >44 years the lowest, with males having a significantly higher knowledge than females The study reported that at similar levels of exposure, children were more susceptible to schistosomiasis. Most surface-water contact by the children, the group most affected by schistosomiasis, occurred during playing and swimming and the study concluded that health education will have a significant impact on recreational high-risk behaviour.

2.2.3 HOUSEHOLD SANITARY FACILITIES AND DISEASE EXPOSURE

Boadi and Kuitunen (2005) studied environmental and health impacts of household solid waste handling and disposal practices in Accra Metropolitan Area, Ghana. The survey was initiated on the premise that inadequate provision of solid waste management facilities in Third World cities results in indiscriminate disposal and unsanitary environments, which threatens the health of urban residents. The study reported that residents generate large amounts of solid waste, beyond the management capabilities of the existing waste management system. Because the solid waste infrastructure was inadequate, over 80 percent of the population did not have home collection services. Only a few of households were served with door-to-door collection of solid waste, while the rest dispose of their waste at communal collection points, in open spaces, and in waterways. The majority of households store their waste in open containers and plastic bags in the home. Waste storage in the home was associated with the presence of houseflies in the kitchen, and the presence of houseflies in the kitchen during cooking was correlated with the incidence of childhood diarrhea. Inadequate solid waste facilities results in indiscriminate burning and burying of solid waste. There was an association between waste burning and the incidence of respiratory health symptoms among adults and children. Poor handling and disposal of waste are major causes of environmental pollution, which creates breeding grounds for pathogenic organisms, and the spread of infectious diseases. However, the study could not pay attention to the relationship between income and housing type which are important determinants of household facilities.

WHO (2008) lamented that providing adequate sanitation facilities for the poor remains one of the major challenges in developing countries. In Nigeria, an estimated eighty-three million households do not have access to adequate sanitation facilities. Many people use the bucket system, unimproved pit toilets or latrine for fecal disposal. In addition, there is a disturbing increase in poorly designed or operated water-borne sewerage systems, especially in rural areas. When sanitation systems are inadequate, the negative impact on the health of the community, populations and the general environment can be extremely serious. This contributes largely to about 1.5 million cases of diarrhea in children under the age of 5 annually and the recurrent episodes of cholera outbreak. Inadequate infrastructure combined with unhygienic practices represent Nigeria's sanitation problem. The unhygienic practices are clearly the outcome of: insufficient health and hygiene awareness, inadequate sanitation facilities, limited access to potable water supplies, poor waste disposal facilities; and inadequate toilet and hand washing facilities. The most common health problems associated with poor sanitation are: malaria, schistosomiasis, dysentery, diarrhea, typhoid, cholera, worms, eye infections and skin diseases, and increased risk from bacterial infections and disease for people with reduced immune systems due to HIV/AIDs (WHO, 2010).

In the past decades, sanitation was primarily a thing of toilet building, providing sewer systems and general environmental sanitation, whilst other aspects were given secondary consideration. It is now recognized that toilets constitutes just one component in a range of factors that make up good sanitation. Community involvement in hygiene, improved health of people, safer living environments, greater knowledge of sanitation-related health practices and general health issues are some of the factors that are critical to the maintenance of good hygiene (WHO, 2010). Huge investments are being made in the provision of safe water supplies for all. However, the health benefit of this investment can only be maximized where adequate attention is paid to sanitation, health and hygiene promotion. Recent evidence has shown that once people's basic needs are met (especially the provision of clean water), it results in the most significant impact on their health (WHO, 2000). Improving hygiene practices and providing sanitation facilities could have a direct influence on a number of important public health problems besetting developing countries. Thus, understanding how infections are transmitted and how to break the cycle of infection are important public health concerns.

2.2.4 PREVALENCE AND INTENSITY OF DISEASES

There are several ways in which disease can be estimated from populations as suggested by the World Health Organization (2002). One approach to measuring disease burden is through the death they cause-the mortality approach, which is determined by the number of death per thousand population. However, this approach has been criticized on grounds that it does not explain the causes of mortality and the age-sex pattern of death. Another way of determining disease is through disease incidence-the number of new cases of a disease per year; usually per thousand. However, disease incidence focuses on new cases only and does not account for the actual (total) number of people infected with the disease in a certain place at a particular time. Yet other ways of measuring disease are in terms of prevalence-the total number of people with a given condition at a particular point in time-or the burden of disability that a disease causes. Several studies have focused on the prevalence of different diseases. However, there is only very limited epidemiological information on which the space-time prevalence of human urinary schistosomiasis could be based.

Adamu and Galadima (1998) reported a prevalence of 50.9 percent in Bakolori irrigation project area while Ladan *et al.*, (2011) reported a prevalence of 47 percent in a village near a dam site in Gusau Local Government Area, Zamfara State. Ugbomoko *et al.*, (2010) conducted a cross-sectional study on the prevalence, intensities and risk factors of human Schistosomiasis in south-western Nigeria. The demographic, socio-economic and environmental variables were inventoried through a questionnaire survey.

The study reported that the subjects aged 10-14 years had both the highest prevalence and the highest mean intensity of infection. Ugbomoko *et. al*, (2010) further reported that prevalence was associated with low household income, the number of children aged 10-15 years in a household, not living with biological parents, and living close to the local river. The study reported that human urinary schistosomiasis appeared to be highly prevalent in peri-urban/rural areas and closely associated with poverty, and protection against infection was common among educated heads of households in the area.

Another survey was carried out by Countinho *et al*., (1997) in two villages' prevalent for schistosomiasis in Northeast Brazil and no statistical difference was found regarding prevalence in the two endemic communities. High prevalence was reported in one of the endemic communities due the type of occupation practiced in the area. In spite of the high infection rates, no association was found between parasite burden and severity of disease. The study reported that schistosomiasis prevalence was high in children and low in adults. Concerning the nutritional status of subjects, the study reported a prevalence of moderate under-nutrition in patients under 18 years old and reported a positive association between prevalence of schistosomiasis and chronic under-nutrition. Similarly, for patients over 18 years old, the prevalence of under nutrition was equally reported to be higher. However, no association was reported between nutritional status and either prevalence of schistosomiasis or parasite burden.

In the same vein, Kapito-Tembo *et al*. (2009) conducted a survey in Malawi to determine prevalence and factors associated with Schistosoma haematobium infection among primary school pupils using questionnaire information. The study reported that schistosomiasis showed a focal distribution of infection and identified male gender, child's knowledge of water source like river, dam, springs, lake, etc., history of blood in urine in the past month, distance from school to nearest water source and age 8-10 years compared to those 14 years to be associated with infection. The study concluded that those children attending schools in close proximity to water sources were at increased risk of infection.

In Bala *et. al*'s (2012) survey, a high prevalence of urinary schistosomiasis infection was reported, equal among both sexes but different with age, occupation and water contact activity in Northern Nigeria. Intensity of urinary schistosomiasis was reported to be associated with sex, age, occupation and water contact activity. The age group 10-19 years had the highest prevalence, followed by 40-49 years, then 0-9 years old. The least prevalence occurred within the 5 0-59 years age group. Evaluation of occupation related prevalence showed that students were the highest infected, followed by farmers, traders, housewives and civil servants. A significant difference was reported between civil servants and the other occupational groups. With respect to water contact activities, the study reported high prevalence in people engaged in fishing, then those that went to the river for washing, bathing, swimming, and drinking, and then finally those that went to the river to fetch water. Highest mean egg intensity was reported among those that went to the river for fishing and the lowest intensity occurred among those that went to fetch water, while mean egg intensity correlated with water contact activity.

In another study, Deribe *et al*., (2011) identified reasons for ‘high prevalence of urinary schistosomiasis in two communities in South Darfur. The study reported a prevalence rate of 56.0 percent of urinary schistosomiasis among the respondents and identified the snail intermediate host *Bulinus truncatus* that was well adapted to pools and slow-flowing waters as breeding ground of the disease vector. Deribe *et al*., (2011) noted that before the commencement of their study in Sudan, the risk for schistosomiasis had been reported as widespread, especially in the major irrigation systems in the Gezira area between the Blue and White Nile Rivers - high prevalence of *Schistosoma. mansoni* infection in some areas in the West Equatorial region and both *Schistosoma. mansoni* and *Schistosoma. haematobium* which are also highly endemic in the Upper Nile region.

The study noted some disparity in the pattern of the schistosomiasis infection among the individuals of different age groups with school-age children having the highest infection rate and the lowest inflections occurring among children in pre-school age due to low exposure. Also, female children were reported to have relatively lower infection than their male counterparts. It was reported that subjects in Abuselala, one of the endemic areas, had higher infection rates than those found in Alsafia and this was attributed to types of water bodies and water contact practices which need further investigation.

2.2.5 SOCIO-ECONOMIC FACTORS AND DISEASE PREVALENCE

The physical environment provides a suitable breeding habitat for the disease vector, but transmission and severity of the disease is largely determined by socioeconomic factors. A number of studies have shown the association between socioeconomic environment and diseases. Barretto (2010) carried out a study to determine the association between biological, socioeconomic, behavioural, and geographical factors and the prevalence and intensity of *Schistosoma mansoni* infection in Bahia State. It was a cohort-based study of all children born in 1970-71. A well structured questionnaire was used to collect information on each child, family and household conditions; including samples of stools. The study found that prevalence of *Schistosoma. mansoni* infection was 31.0 percent. The population' cultural practices were strongly associated with the prevalence and the intensity of the disease. A large proportion of the children who were infected reported having played or swum in bodies of water at some time. Those who were not involved in these water contact activities had a very low prevalence of *Schistosoma. mansoni* infection. Those children who reported playing or swimming in water source last month exhibited two times the prevalence and a considerably higher intensity of *Schistosoma. mansoni* infection than other children. Fishing was identified to be associated with an increased risk of infection. The prevalence and intensity of *Schistosoma mansoni* infection decreased as water contact reduced.

The study further reported that most of the children lived in houses and households equipped with a flush or pit latrine, and piped water. Children From households with piped water and sewage disposal systems had the same prevalence of *Schistosoma. mansoni* infection but a lower mean egg than those from households that relied on ponds. However, the number of children infected with *S. mansoni* from households with piped water but no wastewater disposal facility was greater than both groups. High prevalence was associated with households that depended on open water sources. Children from such households had a prevalence infection of 52.5 percent and mean egg excretion of 107 eggs per gram of stool. This study is valuable in understanding the mechanisms involved in the transmission of schistosomiasis and its distribution in urban locations as well as for defining high-risk groups.

In a related study to explore the socioeconomic determinants of chronic schistosomiasis japonica at a community (village) level, Jia et al. (2012) used socioeconomic and epidemiological data on Years Lived with Disability, (YLDs) in two counties in China to model health inequalities. The community risk factors relating to chronic schistosomiasis were also explored by the multiple regression models. From the study, the concentration index for Dangtu County was -0.12 and 0.03 for Hanshou County, suggesting that there were no variation in schistosomiasis prevalence between communities with different socioeconomic conditions. The study concluded that although distance from community centre to water source and wet land area per capita were significantly related to YLDs of chronic schistosomiasis, there was a non-linear relationship between socioeconomic levels and YLDs of chronic schistosomiasis. Also, Babatimehin (2005) observed that the socio-economic characteristics of the people such as occupation (farming and fishing) isolated and dispersed settlement pattern and dressing pattern exposed them to disease vector bite in Kwara Sate, Nigeria.

Also, Kitimbo et al. (2009) conducted a cross-sectional study on the role of socioeconomic situation in influencing the risk and intensity of infection of *Schistosomia mansoni* in southeast Uganda. The socioeconomic conditions of households were assessed and used to develop wealth index (based on type of housing and ownership of assets), and the multivariate logistic regression analysis was applied to classify households in four classes. The intensity of infection was reported to decrease with wealth index linearity, while the geometric egg count for those in the lowest wealth index was high compared to the highest wealth index, The study reported that the risk of schistosomiasis infection among individuals aged 10-20 at the family level was significantly higher if the head of the household was a farmer or involved in fishing and living in a rural area. Religion and sex of the individual were not associated with risk of schistosomiasis infection. The study disclosed that the groups without formal education and those whose head of household had only completed lower primary (up to primary four), had an extremely high risk of being infected. However, the risk of infection was found to decrease with higher levels of educational attainment.

Enk et al. (2010) carried out a transversal study on the factors related to infection and transmission of *Schistosoma mansoni* and identified the following four sets of variables to be relevant in the study of schistosomiasis: (i) a demographic set of data such as age, gender and family's origin, (ii) a set of socio-economic variables, consisting of information about water supply, presence of electrical energy, household possessions (car, bicycle, television set, radio, refrigerator), regime of ownership, total household income (less or more than 2 minimum wages), education (none, 1st grade, 2nd grade and more than 2nd grade) and occupation (children and school children, manual and rural worker, employed in service sector, housewife, housekeeper, retired person and pensioner and unemployed), (iii) a set of information about sanitation facilities, including sewage disposal "canalization, septic pit, rudimentary pit and direct disposal into the river) and sanitary toilet (presence of toilet and type of floor) and (iv) a set of data on water contact patterns categorized into leisure activities (swimming and fishing), horticultural activities, activities, fetching water, occupational exposure to untreated water and crossing natural water collection, which means water contact with the bare feet when crossing rivers or swamps.

Evaluation of the outcome of the study shows that males were at a higher risk of infection than females. The age groups between 10-19 years and 20-30 years showed risks of infection 7.1 and 7.5 times higher, respectively, than the control age group between 0-10 years. Individuals engaged in leisure activities at the water source had a higher risk than those who are not. This study has shown that the factors related to the transmission of schistosoniiasis cannot be understood only as an outcome of a variety of demographical, socio-economical and biological variables, which differ among study areas, but must also be seen in a framework in which multiple and complex biological and social systems interact to influence each other. Nevertheless, this evidence shows that the real situation of infection with schistosomiasis in areas considered as having low and medium prevalence requires more attention and a more sophisticated approach in order to obtain reliable information.

2.2.6 ENDEMICITY AND DISEASE PREVALENCE

Few studies have been conducted to model the focality of parasitic diseases (Yilma and Malone, 1998; Ejezi eta l., 1989)). Ejezi et al. (1989) studied the problem of schistosomiasis in Nigeria and reported that the development of several irrigation projects in the country has stabilized the infection in northern Nigeria while, rapid urbanization, safe water supply and mass treatment have combined to reduce the prevalence rates in the south west. In a study on the distribution of *Schistosoma mansoni* infection in Brazil, Ricardo et al. (2012) found that schistosomiasis prevalence was low after mass treatment in most households in a rural area in northern Minas Gerais, but prevalence were observed in relation to exposure risk and type of water supply in several districts. Low exposure risk was reported to be associated with the low pre-treatment infection in the Municipal area but did not contribute to the decline of infection rates. There was significant increase in water contact during the post treatment period. However, distance between households and the streams and socioeconomic factors were not significant in explaining the prevalence of the disease.

In another study, Mas-Coma (2004) explored patterns of human fascioliasis in endemic areas of South America and Africa. The study reported weak positive association between vectors and human fascioliasis. High transmission was not found in localities where the disease was a great public health concern. Epidemics in vector and non-heavily infected areas were observed. The study reported that prevalence was more intense in children than in adults, and significantly higher in males than females. However, several low to highly infected areas showed epidemiological characteristics relating to the diversity of environments.

Similarly, Esteban et al. (2003) carried out a survey to characterize human fascioliasis in the Nile Delta region of Egypt. The study reported high prevalence of fascioliasis. The disease was spreading from an original situation of sporadic human infection in heavily infected area to a population moderately infected, but with several severely infected smaller areas. The study reported prevalence to have close relationship with sex. It was also reported that most of the infected persons suffered liver fluke at a later-stage of their lives due to prolong infection. The study noted that Prevalence was lower before and after school age, although the peak in the 9-11-years old appeared less evident. However, prevalence was relatively low for highly infected areas.

2.2.7 PERCEPTION AND DISEASE PREVALENCE

Populations vary in their perception of the environment. Individuals, groups and society view and interpret diseases in different ways and geographic settings. Meade and Erickson (2000) pointed out that when several medical systems are available, people we choose among them according to their perceptions of efficacy for particular health problems. This is reflected in certain components of the socio-economic environment that affect the general standard of living, attitudes, beliefs and behaviour (Malta, 1982). specifically, Kloos (1995) stated that the prevalence and intensity of schistosomiasis and : the potential for its control are largely a function of the interaction of socio-economic as factors in any given area with local and regional ecological and environmental factors. Local beliefs are formed by an interaction between individual's social environment and internal cognition. However, relatively few studies of human-water contact behavior have focused on the cognitive aspects of schistosomiasis transmission. For instance, Louirero *et al*., (1990) hypothesized that differences in perception of aspects the environment that is known to be important in schistosomiasis transmission will be associated with different levels of prevalence of schistosomiasis in a population.

Onyeneho *et al*., (2010) studied people's perceptions, attitudes and local practices predisposing residents to schistosomiasis in Delta State, Nigeria and reported that one-third of the people were aware of schistosomiasis, and a majority of them perceived the causes of the disease to be related to witchcraft and sexual or body contact with infected persons. According to their study, for some of the respondents, the disease was not known to be a serious health problem since it does not harm or prevent the victim from eating. The study reported that, in many cases, the disease was not treated because of the belief that there was no effective cure for it and that it reoccurs after treatment due to re-exposure. The study however identified perception of the causes and means of transmission, and management practices as knowledge gaps in future schistosomiasis studies.

A similar study was carried out by Gazzinelli (1998) to determine the sociocultural factors influencing *Schistosoma mansoni* infection in the State of Minas Gerais, Brazil. The study used qualitative approaches to collect data from school-aged children and their teachers. The study reported that the individuals were aware of the disease but held inaccurate popular beliefs about transmission. The disease was not seen as a major health problem and was perceived not to affect their activities since it did not cause severe symptoms in most of the individuals. The study proposed health education as being important for behavioral change.

In a related study, Sangho et al. (2002) investigated the prevalence of urinary and intestinal schistosomiasis, the knowledge, attitude and practice (KAP) regarding the disease among both the children and their parents in a Suburban area of Bamako and reported that 88 percent of children and 91 percent of adults considered micro-haematuria pathology, but did not know anything about intestinal schistosomiasis. The study concluded that misconception of schistosomiasis contributes to maintain the disease at a high level of prevalence in a population and advocated for mass health education.

Babatimehin (2005) undertook a spatial analysis of onchocerciasis prevalence and perception in Kwara State, Nigeria and reported significant variation in people's perception of the disease. Though the inhabitants were aware that onchocerciasis constituted a public health problem, the people lacked the knowledge of the causal relationship between onchocerciasis and its vector. The study also disclosed that respondents attributed the disease to the type of water consumed, witchcraft, breeze, and trigger foods among others and found people's perception of the disease to be patterned along their perception of cause. Whereas the people could ascertain that the disease could be prevented by avoiding blaclfly bites, most of the people believe in the efficacy of the drug to treat onchocerciasis. However, Babatimehin's (2005) study did take into account household factors that account for exposure and its relationship to infection.

2.2.8 DISTANCE AND DISEASE PREVALENCE

Ekwunife (2005) worked on the effects of season, and distance to water source on the prevalence and intensity rates of Schistosoma haematobium infection in Anambra State and reported prevalence to be similar in both dry and rainy season. Prevalence and geometric mean egg count were highest in the 10-14 years age group in all the schools and in both dry and rainy seasons. Prevalence rates and intensity were reported to show significant decrease with increase in the distance from the village to the river source. The infection pattern increased as one moved from South to North and from East to West, whereas the number of cases decreased as one moved away from the lake. The intensity of infection also followed the same pattern. This study is relevant in demonstrating the important role of distance from focus of infection in the prevalence of disease, which is portrayed by the fact that children who lived at a considerable distance from the lake had no infection. It is also an indication of the relationship between distance of water bodies from communities and the extent of usage of each water body by the communities, pointing to the fact that communities rely on water sources which are close to their location. The study concluded that since frequency of contact with focus of infection diminishes with increase in distance, prevalence of schistosomiasis would be expected to decline with increase in distance from the source of infection.

In a related study in Niamey, Ernould *et al*., (2000) perfomied a distance decay analysis of the effects of distance on schistosomiasis prevalence and found that the prevalence of schistosomiasis was very low in schools far from the river and higher inthose closer to the river bank, particularly in villages on the periphery of the urban area. Geographical factors were more important than socio-economic ones in explaining the distribution of the disease. The infection risk was low in pools, high in the river and very high in the canal. The study confirmed that exposure to the infection source did not increase their infection levels. Also, Adebayo' s (2003) study of the effects of prevalence of urinary schistosomiasis among irrigation farmers in Northern Nigeria found prevalence to decrease with distance from the source of infection. Farooq *et al*., (2008) studied the influence of the size and location of communities in relation to the different types of watercourse, the availability of safe water supply, types of housing and the presence of other sanitary facilities on the prevalence of bilharziasis in Egypt, and reported that there was no direct relationship between the size of village and the prevalence of bilharziasis. Rivers and their distributaries were identified as potent sources of infection and the river channels facilitated the transmission of the disease. The study pointed out that although the presence of latrines do not influence the extent of schistosome infection, their installation assisted in the cultivation of healthy habits, thereby lessening the prevalence not only of bilharziasis but also of certain other infections.

2.2.9 GEOGRAPHIC INFORMATION SYSTEM (GIS) AND DISEASE MODELLING

The importance of geographic information system (GTS) in disease modelling cannot be over-emphasized. GIS provides the fundamental geographic context to exploring spatial patterns of diseases (Chaikaew *et al*, 2009). A geographic information system (GIS) consists of an integrated set of tools for the analytical manipulation and the visual representation of spatial data. In the context of geographical epidemiology, this provides a powerful aid to the analysis and understanding of the connections between population, the environment, and human health (Micheal, et al., 2010). Yizhou *et al*., (2009) used GIS-based methodology to investigate spatial networks of schistosomiasis infection. The study hypothesized that spatial network approach in conjunction with analytical and modeling capability of GIS can be used in exploring the epidemiology and spatial risk factors associated with schistosomiasis. The study employed different forms of visualization of disease maps to explore basic spatial elements such as polygon (e.g. residence, fields), lines (e.g. streams and roads) and points (e.g. snails sites, water contact sites).

Evaluation of the outcome of the study confirmed that residential polygons that are most connected were responsible for the spatial structure in infection-related attributes. Measures of infection, such as disease prevalence among humans and infection rates among snails had positive correlations, whereas snail density, human water contact, age and occupation did not. The study has shown that knowledge on the relationship between human prevalence and snail infection measured as the number of locations where infected snails are found can aid the understanding of schistosomiasis transmission from snails to humans. Despite developments in GIS and the increasing recognition of spatially explicit processes in determining disease risk, the use of spatial information for the analysis of spatial locations and mapping disease risk remains rare (Carter, 2007; World Health Organization, 1988; Besag, 1991; Best, 2005).

However, these techniques can be used for mapping prevalence and predicting the risk of infection, thereby enabling greater understanding of the large-scale ecology of disease, and also highlighting the influence of the determining factors within the microenvironment (parasite and snail) relating to transmission of this disease. However, prevalence intensities can be viewed and measured using this technique and endemicity can be characterized, thus, indicating areas of high and low prevalence, and disease surveillance in endemic areas can be complemented by understanding water contact behaviors and perception of the disease.

2.2.10 POPULATION MOVEMENTS AND DISEASE PREVALENCE

Human mobility approach has been used to study disease transmission. Population movement often increases exposure to parasitic diseases and can affect disease prevention and control efforts. Movement may be seasonal, over long or short distances, or it may be caused by disaster and conflict, which again entails different social dynamics (Mehanna *et. al*., 1994). There can be high rates of mobility patterns over short distance, which may influence the distribution of disease and reinfection rates. The main mechanism is that movement leads to new exposure to the infectious agents – either because the daparting population moves into new areas and gets in touch with infected populations or environments, or because the migrating population carries the infection and brings it to hitherto uninfected populations at their point of destination. Aspects of population movements and disease transmission have been considered by previous scholars (Gushulak and MacPherson, 2004; Mac- Pherson *et al*., 2007). Different patterns of mobility may lead to exposure to diseases (Bruun and Aagaard-Hansen, 2008). A case in point was the introduction of *Schistosoma mansoni* to Latin America by African slaves. Their poor living and working conditions created environment favourable for transmission (Loureiro, 1989). Population movements have significant implications for disease transmission. Aagaard-Hansen and Nombela (2010) reported how population movements led to exposure in Ethiopia as seasonal labourers moved from the highlands to the malaria-endemic lowlands. These people are often engaged as daily labourers in the farm fields during the planting and harvesting seasons, when malaria transmission is at its peak. The poor living conditions and insufficient health care services in such agricultural plantation projects often worsen the problem of disease transmission.

Aagaard-Hansen and Nombela (2010) observed that population movements and migration also worsen the disease problem in the areas from which the migrants came or returned. Seasonal migrant workers often bring the parasites back to their communities and local transmission can be readily established as many of these settlements could support vector breeding. A study of the infection trends between 1950 and 1990 in Bahia, Brazil, showed that migration in combination with increased access to piped borne water supply and sanitation, changes in the ecosystem that influenced smaller animal life, and changes in water contact behaviour explained the reduction of prevalence of schistosomiasis (Carmo and Barreto, 1994). Mott *et. al*.'s (1990) work on the various ways by which parasitic diseases may spread to urban areas contains a number of case studies of schistosomiasis. Intense leisure travels of tourists to rural areas in the vicinity of Belo Horizonte in Brazil led to infection of new sections of the population (Enk *et. al*., 2004).

Although multistage migrations have received limited attention in the literature by spatial epidemiologists, they may result in additional exposure risk and influence the reliability of migrant exposure histories (Enk etal, 2004). Well structure questionnaires have been used at the community level to collect information, at relatively low cost, on spatial, temporal and motivational aspects of the migration process and disease exposure. Although these questionnaires can contain both quantitative and qualitative information, they are, however, subject to human errors (Friedman *et al*., 2001). On the other hand, Prothero's (1977) classification of population movement is often used in most spatial epidemiological studies to relate population movements and disease occurrence. According to Prothero (1977) "migration" (the permanent change of residence) and "circulation" (daily, periodic, seasonal and long-term movements) have implications for disease. Movement from rural to urban areas was found to be aiding schistosomiasis transmission as reported by Carmo and Barreto (1994). Watts (2006) pointed out forced population movement has a major effect in schistosomiasis transmisssion. Recent studies on human movement and schistosomiasis have shown that many types of mobility are relevant for infection to occur. These include: resettlement, labour migration, urbanisation and to a certain extent tourism (Huang and Manderson 2005; Li *et al*., 2007). However, Prethero's population movement categorization has been criticized on grounds that some movements can be placed in more than one category because they may be multi-purpose and may overlap in space and time. Also, it is well documented that population movements are closely associated with other factors such as biosocial and environmental forces, socioeconomic and political processes as well as water resources development schemes.

From the literature reviewed so far, it is apparent that previous studies have not used time series data on prevalence to examine the spatial and temporal changes in the prevalence of urinary schistosomiasis. This understanding offers important insights into where and when risk of the disease is highest, and provide guide for measuring previous interventions. It also points out where future intervention measures should be targeted, and possibly how many cases can be eliminated if a certain level of intervention is implemented. It appears that the problem of urinary schistosomiasis in endemic communities has received little or no attention in the literature. As human population in endemic communities continue to grow, with increasing exposure to different water sources, there is likely to be a considerable variation in exposure characteristics of population. Consequently, there is need to determine factors of vulnerability of communities as a result of exposure to various types of water bodies which constitute infection sources. There is need for rigorous and context-specific studies that would assess the relative significance and direction of different risk factors within an endemic area or locality due to regional differences.

Also, recent studies have at best provided insufficient attention on human cognition of urinary schistosomiasis. The perception of people about the causes of urinary schistosomiasis will result in different preventive and curative behaviour. However, information on the perception of prevention and treatment of schistosomiasis in endemic communities is scanty. Various local knowledges are used in many endemic communities to explain schistosomiasis according to the level of severity and perceived causes. Similarly, empirical evidence on the extent to which the epidemiology of urinary schistosomiasis conforms to human ecology of disease is lacking. Insights into variations in endemic situation of urinary schistosomiasis may be gained through human ecology of diseases, and risk factors can be modeled to show how individual's belief affects health outcomes. By focusing on the dynamic interaction of population-habitat and behaviour provided by the Triangle of Human Ecology of Disease, relevant insights into prevalence levels and cognitive aspects of urinary schistosomiasis in endemic communities can be highlighted.

CHAPTER THREE

METHODOLOGY

3.1 STUDY POPULATION

The study population consists of primarily household heads that live in schistosomiasis endemic communities and depend on the vector source for most of their domestic, recreational and agricultural water needs. Most of them had perculiar indigenous knowledge and local practices concerning urinary schistosomiasis.

3.2 RESEARCH DESIGN

The survey research design was adopted for this study. The survey design is used in both quantitative and qualitative research. This design allowed an in-depth study of several variables at a time and the case study gave an insight into the various factors that govern prevalence and perception of schistosomiasis disease in certain locations. In the survey design, a location or certain locations are selected for the study and their characteristics generalized for the entire population. In this study, communities that have been adjudged to be endemic of schistosomiasis through the Cross River Ministry of Health Epidemiological Survey were selected for the actual field and questionnaire surveys and the results were used to make inferences about the physical and behavioural vulnerability of the communities to the disease. Survey research design based on representative samples, permits generalization to populations that would otherwise be difficult to study as a whole.

3.3 DATA TYPES

Two types of data were used, primary and secondary data. Primary data include data on: (i) economic activities that expose residents to vector environments (farming in vector environment, sand mining, fishing and snail gathering); ii) social activities that take people to water source (swimming, fetching, bathing, washing in vector environment); iii) cultural practices that predispose residents to intermediate host vectors of schistosomiasis (eating of snails and method of excreta disposal). Items (i) to (iii) were used to determine risk factors of urinary schistosomiasis in endemic communities.

Spatio-epidemiological and exposure data on: (i) demographic/individual-level data such as age, sex, education, occupation and income group of respondents were used to determine other risk factors of schistosomiasis; ii) household factors such as household toilet type, household water source, household residential quality and household waste collection method were used to evaluate household sanitary condition and exposure to schistosomiasis; iii) data on levels of exposure to infection source (high exposure, medium exposure and low exposure) gave an insight into the extent to which residents are exposed to different vector environments depending on levels of surface-water use; domestic, recreational and agricultural uses. Level of exposure to schistosomiasis was calculated based on number of days respondent visited each water source in a month; 0-10 days (low level exposure), 11-20 days (medium exposure) and 21 days and above (high exposure). This information was also used to explore water contact patterns; iv) seasonal movements to infection source and time spent on exposure activity was used to understand the link between mobility and levels of exposure to different water types and how the disease is contracted over time and space; v) distances from respondents' homes and places of work to the nearest vector environment as well as distance from centre of the community to the nearest infection source revealed the role of distance on the prevalence of urinary schistosomiasis; vi) geographical references of study communities were used to determine the geographic location of the communities. Information on people's awareness, knowledge and local practices was useful in demonstrating general perception of the cause, symptoms, modes of transmission, schistosomiasis ailment, and prevention and treatment of the disease in order to understand cultural practices promoting the prevalence of the disease.

On the other hand, secondary data consisted of information on prevalence of schistosomiasis, population sizes of LGAs and endemic communities. Secondary data include reported cases of urinary schistosomiasis from the National Bureau of Statistics, published epidemiological reports and baseline data from the Cross River State Ministry of Health. Reported cases of urinary schistosomiasis from the National Bureau of Statistics (NBS) were used to determine the trend in the national prevalence of the disease. Thirty years data from 1981 to 2010 was sourced from NBS but only twenty-four years temporal and sixteen years spatial prevalence data were available at the time of this survey. As regards epidemiological reports, schistosomiasis prevalence survey was conducted in all the eighteen Local Government Areas of the state by Adie *et al* (2013). The data from this prevalence survey were used in determining prevalence in all the eighteen Local Government Areas of the State. Due to the increasing rate of urinary schistosomiasis, the Cross River State Ministry of Health conducted a parasitological /baseline Survey in 2012. The survey involved baseline parasitological detection of schistosomiasis and Soil-Transmitted Hilmenths in twelve highly endemic areas. The data from the survey enabled the characterization of endemic situations into hyper-endemic and meso-endemic areas. Also, data on the population sizes of endemic communities and LGAs were used to determine the study sample and the role of population size in relation to prevalence.

3.4 SOURCES OF DATA

Two sources of data were used in this research. These are primary and secondary sources. The primary sources were actual field surveys of the endemic communities. Secondary data (Prevalence of schistosomiasis) were gathered from Natioanl Bureau of Statistics, the Cross River State Ministry of Health as well as recently published epidemiological studies. Information on the population sizes of endemic communities and LGAs were derived from the reports of the 1991 (for local communities) and 2006 (State and LGAs) National Population censuses respectively. The political and hydrological maps of endemic LGAs and Cross River State were collected from the Cross River State Ministry of Lands and Survey.

3.5 METHODS OF DATA COLLECTION

Primary data collection included reconnaissance survey of the study communities, direct field observation, field measurement, use of GPS, oral interview and use of questionnaire. The reconnaissance survey involved visits (see plate 3.1) to all the LGAs in the state and the identification of vector contact points, routes to vector environments as well as Primary Health Centers/selected hospitals in the study area. The political and hydrological maps of Cross River State and the sampled LGAs were used in the identification and selection of endemic communities. Oral interviews were carried out to elicit information on the epidemiological situation, health-seeking behavior of people in endemic communities towards the disease, and government intervention programmes from patent medicine dealers/health officers because they have routine contacts with at-risk populations and patients currently undergoing treatment, counseling and drugs administration.

Plate 3.1: Researcher briefing the community leaders about the fieldwork

The questionnaire was used to gather information on self-reported blood in urine (urinary schistsosomiasis) and people's perception of the disease. The usefulness of asking people in endemic areas about their history of blood in urine (an indirect prevalence diagnostic method for schistosomiasis infection) has been recently supported (WHO, 2002; Adie *et. al*., 2013). In this study, questionnaires were distributed to the respondents in the endemic communities to obtain information on:

i. number of persons who have had blood in urine in endemic communities (self-reported blood in urine)
ii. different water sources used by the communities;
iii. social activities that took people to infection sources (swimming, fetching, bathing, washing in vector environment);
iv. economic activities that exposed residents to vector environments (farming in vector environment, sand minig, fishing, and snail gathering);
v. cultural practices that predisposed residents to intermediate host vectors of schistosomiasis (eating of snails and method of excreta disposal);
vi. seasonal movements, time spent on exposure activity, age, sex education, occupation and income group of respondents;
vii. Household factors (household residential quality, household water source, household toilet type and household waste collection method);
viii awareness, knowledge and beliefs of the causes and how schistosomiasis is contracted, symptoms, modes of transmission, ailments, and prevention and treatment of urinary schistosomiasis.

The questionnaire was divided into four sections. The first section was concerned with the socio-economic and demographic characteristics of respondents such as age, sex, occupation, educational attainment, estimated monthly income. The second section contains information on distance from home to source of infection, distance from place of work to vector environment, movement to infection source, levels/intensity of exposure and duration of exposure. The third section focused on household facilities such as toilet system, residential type, waste collection and disposal method, water supply system as well as their effects in increasing exposure levels. The fourth section pertains to the factors influencing prevalence of schistosomiasis and symptoms of the disease, while section five focuses on people's perception of the cause and how one could get infected with the disease, modes of transmission, schistosomiasis ailments and the prevention, and treatment of schistosomiasis.

3.6 SAMPLING PROCEDURE AND SAMPLE SIZE

This study employed the multi-stage sampling technique involving three steps. In the first step, twelve local government areas hosting some of the primary schools that were sampled during the Cross River State Ministry of Health parasitological survey on schistosomiasis prevalence were selected 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 chosen for the study. Apart from the fact that these LGAs are endemic LGAs where schistosomiasis has been confirmed higher through a parasitological 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 (Figs. 3.1-3.3).

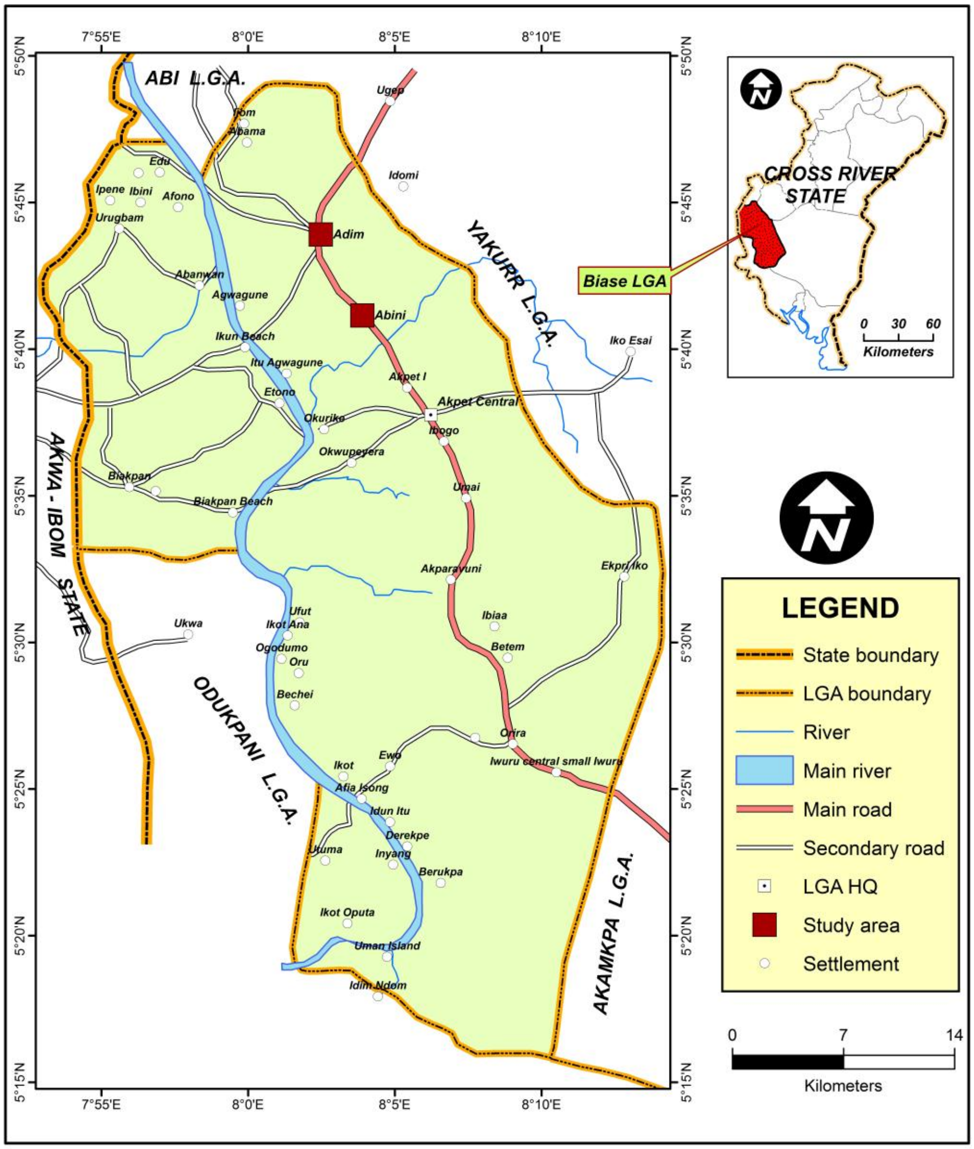

Fig. 3.1 Biase Local Government Area showing sampled communities

Source: Adapted and Modified from Biase LGA Administrative Map, 2013

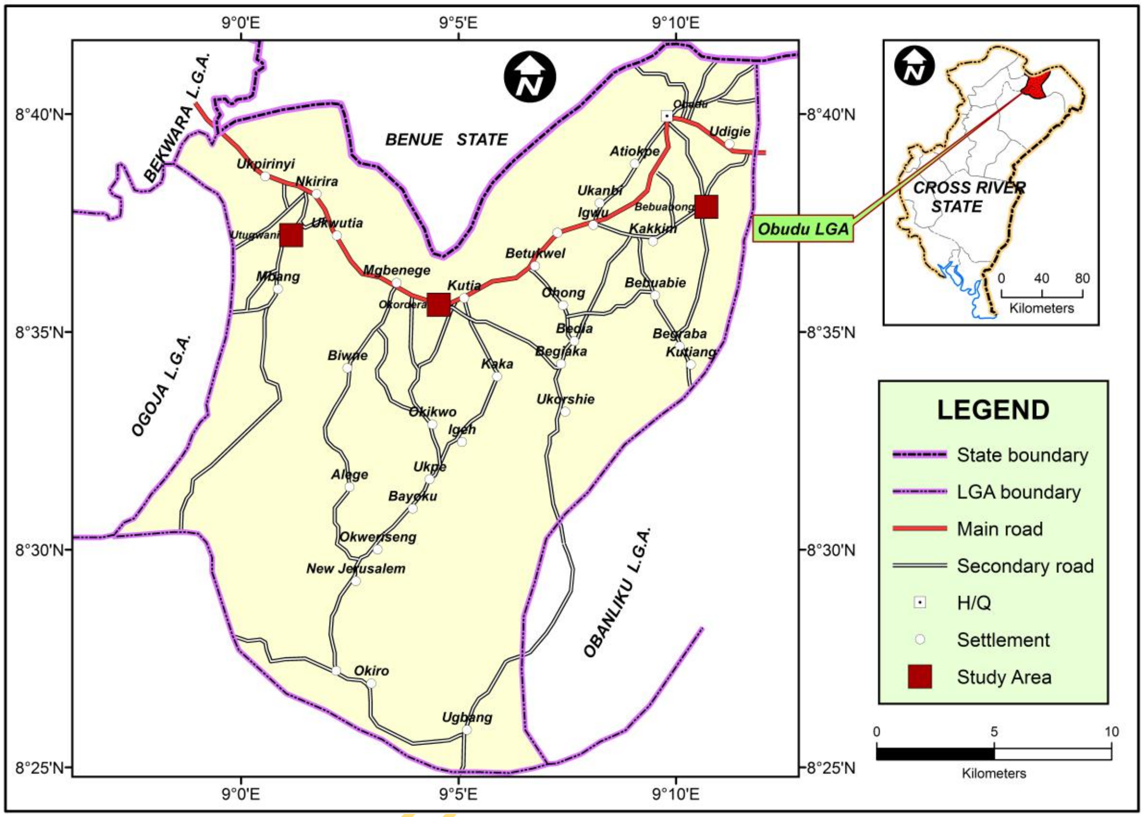

Fig. 3.2 Obudu Local Government Area showing study areas

Source: Cross River State Ministry of Lands and Surveys, 2013

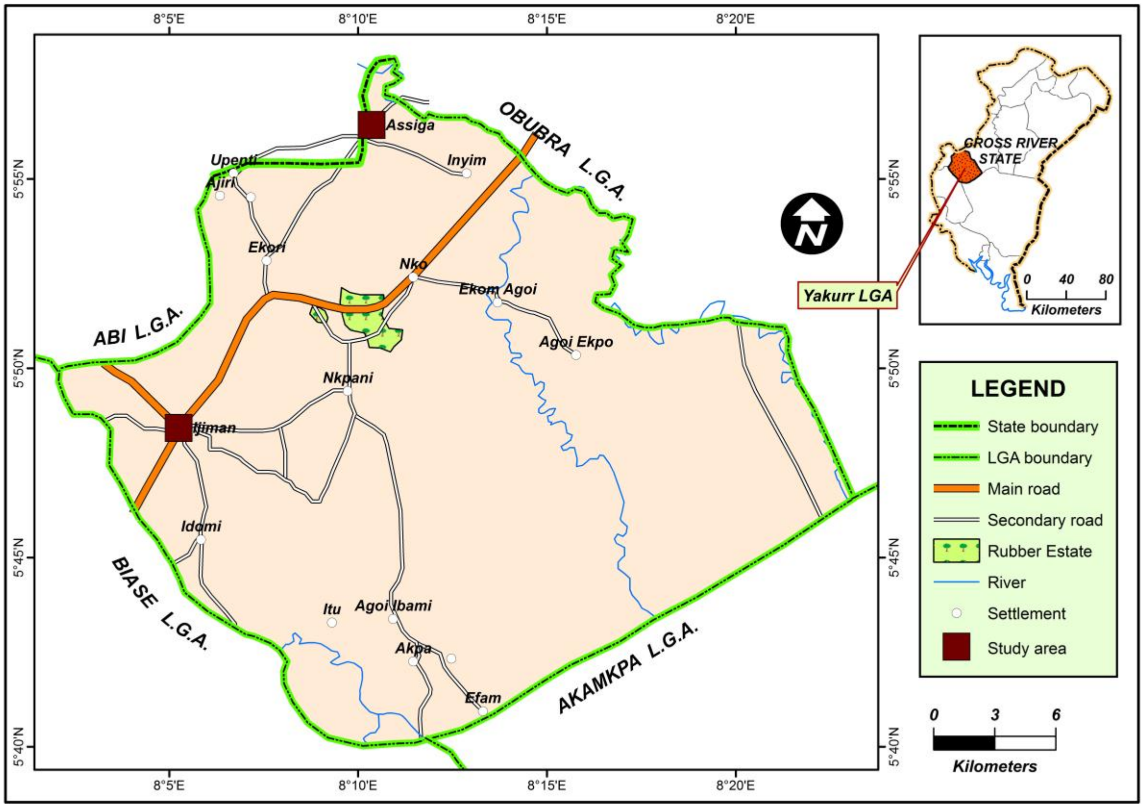

Fig. 3.3 Yakurr Local Government Area showing study areas
Source: Cross River State Ministry of lands and Surveys, 2013

In the third step, in each of these three LGAs, seven endemic communities were selected for questionnaire survey. These endemic communities were Abini and Adim for Biase Local Government Area; Ijiman and Assiga representing Yakurr Local Government Area and Okwel- Obudu, Utukwang I and Utukwang II representing Obudu Local Governemnt Area. It is important to note that Utukwang is a double settlement consisting of Utukwang I and Utukwang II respectively. However, a two- stage sampling method was used for i) estimation of study population and determining the sample size; and ii) administration of questionnaire in endemic communities. In the first stage, the study sample was determined using the Taro Yamen's formula. The essence is to have an overall sample size for the study. The Taro Yamen's formula is as follows:

$$n = \frac{N}{1+N(e)^2} \qquad \text{eqn(1)}$$

Where:

n = sample size

N = population

e = level of precision or confidence level (0.05)2

Furthermore, 5% error estimate was used, as this value gives sample size sufficiently large to guarantee an accurate prediction at 95% confidence level. Hence,

$$n = \frac{58915}{1+58915(0.05)^2}$$

$$n = 400$$

The sample was further increased by the product of 2 to account for contingencies such as non-response or sampling error, then,

$$nx2 = 400x2$$

$$n = 800$$

In the second stage, purposive (quota) sampling technique was applied since infected population and those having contact with the vector environment in endemic communities was unknown. However, one striking feature of most of the endemic communities is that their population sizes do not vary widely (see Table 3.1). Also, most of the endemic communities have similar patterns of susceptibility. Wrenn *et al* (2002) noted that quota sampling involves dividing the population and assigning appropriate quotas (questionnaires) based on prior knowledge and understanding of the characteristics of the population. To satisfactorily carry out this sampling, the settlements were grouped. The grouping was such that 100 copies of questionnaire were administered in communties with population less than 10,000, whereas a set of 200 copies of questionnaire were administered in settlements with more than 10,000 population. In all, 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 administered in one community (Adim). A total of eight hundred questionnaires were administered to respondents. Meanwhile, the population sizes of the communities and the sample size of the study are shown in Table 3.1.

Table 3.1: Population sizes of endemic communities and sample size of the study

Name of community	Total Population 1991	Projected population 2013	Sample Size	% of total Sample
Abini	2800	5706	100	12.5
Adim	9612	19584	200	25.0
Ijiman	3114	6481	100	12.5
Utukwang I	3319	8171	100	12.5
Utukwang II	2341	5763	100	12.5
Okwel-Obudu	3261	8028	100	12.5
Asiga Old Town	3060	5184	100	12.5
Total	27507	58917	800	100.00

Source : Researcher's fieldwork, 2013.

The systematic sampling technique was adopted in the administration of questionnaire. In order to determine the sampling interval, the systematic sampling formula was applied. Thus, the sampling interval was calculated by dividing the sample size (800) by the number of questionnaires to be administered in each community (100 and 200 respectively) as shown in the formula, thus;

$$k = \frac{N}{n} \qquad \text{...........eqn (2)}$$

Where: K = sampling interval

N = Sample size (800)

n = Sample size per community (100 and 200)

then; $K = \frac{800}{100} = 8$

K = 8

For the community with 200 sample size (Adim);

$K = \frac{800}{200} = 4$

K = 4

In this case, the sampling intervals were 8 and 4 respectively. Starting from the first household along each road transect, one in every 8th household was sampled. In essence, for the communities with 100 sample size, sampling using the interval of 8 was such that the administration of questionnaire to the respondents involved sampling the 1st, 8th, 16th, 24th, 32nd, 40th, 48th households and so on. In Adim community, one in every 4th household was sampled. In this case, the sampling was such that the first household was interviewed after which the fourth, and in that order. That is to say, sampling using the interval of 4 was such that the administration of questionnaire to the respondents involved counting down the list starting with the 1st, 4th, 8th, 12th, 16th, 20th, 24th households and so on. 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 February, March and April 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.

3.7 METHODS OF DATA 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, bar graphs and pie charts were used for data analyses and presentation, whereas, inferential tools were employed to test the hypotheses. Specifically, Logistic Regression Analysis, Pearson's Product Moment Correlation Analysis, Canonical Correlation Analysis (CCA) and One-Way Analysis of Variance were employed to test the hypotheses. All analyses were done using SPSS Version 19.0.

To test the first hypothesis which states that: "prevalence of schistosomiasis is influenced by swimming, fetching, bathing, washing, farming in vector environment, sand mining, fishing, snail gathering, snail eating, defecation into river, age and education of infected household member", the logistic regression analysis was applied. In this hypothesis, responses on self-reported blood in urine in the endemic communities constitute 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} = Age of infected household member;

x_{12} = Education of infected household member;

In order to effectively carryout this test, respondents were asked if they have had blood in urine, if yes=1, no=0. They were also asked if they have ever engaged in predisposing activities (items 1 to 12) 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; eating snails, if yes= 1, no=0; defecated in the water source, if yes= 1, no=0.

Canonical Correlation Analysis (CCA) was used to test the second hypothesis which states that: "Exposure to schistosomiasis infection is a function of movement to source of infection, household waste disposal, time spent on exposure activity, age, distance from home to nearest source of infection, household residential quality, household water supply, household toilet quality, distance of place of work to nearest source of infection, education and income. Exposure to schistosomiasis is the dependent variable (Y) and spatio-epidemiological variables constitute the independent variables. These independent variables include: movements to source of infection (x_1), household waste disposal (x_2), time spent on exposure activity (x_3), age of the respondent (x_4), distance from home to the nearest source of infection (x_5), household residential quality (x_6), household water supply (x_7), household toilet quality (x_8), distance from place of work to nearest source of infection (x_9), education of the respondent (x_{10}) and income (x_{11}). Canonical Correlation Analysis (CCA) was used because there are three dependent variables and several independent variables. Exposure to schistosomiasis (independent variable) was measured based on level of exposure to stream, level of exposure to river and level of exposure to swamp). So, instead of predicting level of exposure to stream alone as an exposure variable, we had three levels of exposure, namely: level of exposure to stream, level of exposure to swamp and level of exposure to river as dependent variables.

In order to effectively carryout these tests, some of the variables were transformed and cetegorized. Exposure, for instance, was categorized into low for <10 days of water contact in a month =1, medium for 11-20 days of water contact in a month =2 and high for > 20 days of water contact in a month=3. Furthermore, exposure to river was categorized as low risk =1, exposure to swamp was caliberated as high risk =2 and exposure to stream was recoded a very high risk =3. For the independent variables, questions like movements to infection source were recoded into three categories of movement as daily =1, periodic =2 and seasonal =3, educational attainment of respondents was transformed and recoded, with respondents with no formal education as (none) =0, respondents with primary education (very low) as 1, secondary education as low = 2 and Tertiary education as high = 3; while estimated monthly income of respondents was measured using actual monthly income and then categorized into < ₦40,000 as low-income group = 1 and >₦ 40,000.00 as high-income group =2. Household toilet quality was caliberated as none = 0, open latrine (very poor) as 1, pit toilet (poor) as 2, pour flush (good) as 3 and hand cistern (very good) as 4. Household water supply was further categorized into natural sources (poor) = 1 and alternative sources (good) = 2; household waste disposal was categorized into indiscriminate disposal as 0; bush/river as inadequate =1, and dumpsite/dumpsters as adequate = 2. Household residential quality was operationalized based on mud-thatch as very poor = 1, zinc –mud (poor) = 2, bungalow (good) = 3 and duplex as very good = 4.

Similarly, the third hypothesis which states that: “There is a positive relationship between the number of persons infected with urinary schistosomiasis and the population size of endemic communities” was tested using pearson’s correlation analysis, where: the number of respondents reporting blood in urine in endemic communitiesis is the dependent variable (Y) and the independent variable is population size of endemic communities (x_1). The fourth hypothesis which states that “perception of schistosomiasis varies significantly among endemic communities” was tested using the One-Way

Analysis of Variance (ANOVA) in order to determine if the variation in the perception of the disease across endemic communities is statistically significant.

CHAPTER FOUR

SPATIAL PATTERN OF URINARY SCHISTOSOMIASIS

4.0 INTRODUCTION

This chapter presents the trends and spatial pattern of urinary schistosomiasis prevalence in Nigeria. It examines the prevalence and endemic situation of urinary schistosomiasis in Cross River State, as well as the age-sex pattern of infection. Furthermore, the chapter presents the prevalence of urinary schistosomiasis in endemic communities and discusses the results of the logistic regression analysis of human risk factors influencing prevalence.

4.1 Trends in schistosomiasis prevalence in Nigeria

Table 4.1 shows the trends in prevalence from 1981 to 2004. In 1981, 41, 662 cases of schistosomiasis were reported. The number of reported cases of schistosomiasis decreased markedly by 56.4 per cent from 41, 662 in 1981 to 18, 146 in 1990 and then dropped drastically by 33.32 percent between 1991 and 2004 to 4, 282 cases in 2004, which perhaps represents the lowest reported number of cases of urinary schistosomiasis in Nigeria.

Table 4.1: Reported cases of urinary schistosomiasis in Nigeria (1981-2004)

S/n	Years	Numbers of years	No. of reported cases
1.	1981		41,662
2.	1982	1	40,028
3.	1983	2	41,889
4.	1984	3	36,710
5.	1985	4	31,788
6.	1986	5	26975
7.	1987	6	31,146
8.	1988	7	32,977
9.	1989	8	13,146
10.	1990	9	18,146
11.	1991	10	13,204
12.	1992	11	17,066
13.	1993	12	11,957
14.	1994	13	17,100
15.	1995	14	17,381
16.	1996	15	9,685
17.	1997	16	10,494
18.	1998	17	19,497
19.	1999	18	15,134
20.	2000	19	14,251
21.	2001	20	11,311
22.	2002	21	13,657
23.	2003	22	7,657
24.	2004	23	4,282
Total			499143

Source: National Bureau of Statistics, 2013.

Fig. 4.1 also revealed that the highest reported case of schistosomiasis was in 1983 (41,889 cases), while the lowest was recorded in 2004 (4, 282 cases), which is 89.8 per cent decrease in the reported cases of schistosomiasis from 1983 – 2004. The phenomenal increase in the number of reported cases of urinary schistosomiasis in the early 80’s (1981 - 1983) could be a consequence of the proliferation of irrigation projects of the 1970’s especially in the northern part of the country. In recent years, early warnings have followed many irrigation and dam projects on the likely impact of disease outbreak. In some instances, these pedictions came true, including the Kainji Lake project in Nigeria around 1970. However, after 1983, the number of reported cases of urinary schistosomiasis declined steadily with the lowest prevalence recorded in 2004 (4, 282 cases). As could be seen, the figure however shows a downward trend for the period under review. This sharp decline in active infection may be attributed to the provision of basic infrastructure such as pipe-borne water etc., which reduce peoples’ contact with the vector environment (see Plate 4.3).

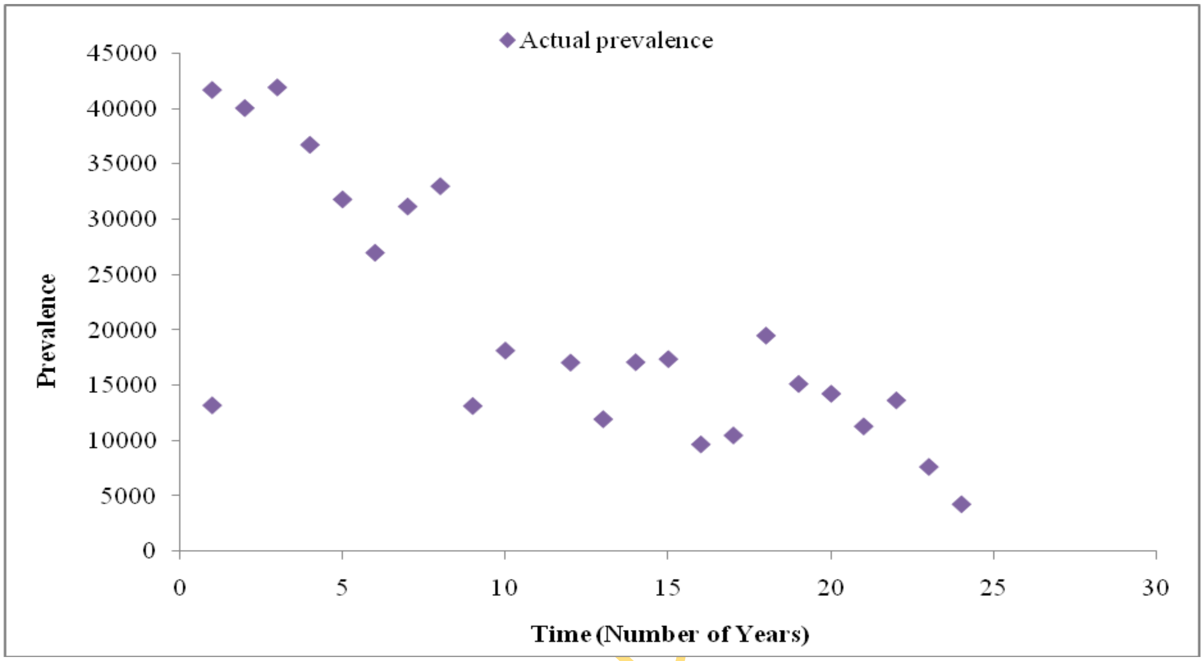

Fig 4.1: Trend in reported cases of urinary schistosomiasis (1981 – 2004)

An attempt was made to find out whether or not the time factor (over 23 years) is important and significant in the explanation of schistosomiasis prevalence in Nigeria. The test statistic for linear regression was used for the analysis. Linear regression is one of the most common tests for time series data and, in its basic form, assumes that data are normally distributed. Data on urinary schistosomiasis prevalence was taken as the number of all reported cases of urinary schistosomiasis from 1981 to 2004 (Table 4.1). Time was caliberated based on the number of years the disease was reported. The linear regression equation is defined thus:

$$Y = a + b_1X_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{egn (3)}$$

Where:

Y = dependent variable (Reported cases of urinary schistosomiasis)

a = intercept of the linear trend line

b_1 = regression coefficient and

X = time (Number of years)(1981 to 2004)

The regression result in Table 4.2 shows that the time factor significantly explains the number of reported cases of urinary schistosomiasis. This is so given the fact that the R^2 = 0.628 is significant at 5 percent level (R^2= 0. 628, p<0.05). The regression coefficient also shows that there was a marked decline in the prevalence of urinary schistosomiasis (Fig. 4.1). This is confirmed by the regression coefficient in Table 4.2 which has a negative sign (-0.792). This result implies that urinary schistosomiasis is fast declining. This sharp drop in schistosomiasis prevalence could be attributed to concerted efforts from government and other sponsoring agencies in the provision of safe water, mass treatment of affected populations as well as increased health education. This corroborates the assertion by the WHO (2000) that once people's basic needs are met, especially the provision of potable water, sanitation improvements together with health and hygiene promotion, it results in improvements in their health.

Table 4.2: Summary of linear regression result

Variables	Coefficients		
	B	**B**	**t-value**
Year	-0.027	-0.792	6.090*
Test results			
F- value	37.092*		
R	0.792		
R^2	0.628		
Constant	4.577		72.793*
DF	1/22		

*Significant at 5% significance level
Source: SPSS Window Output Version 20.0

The reported cases of urinary schistosomiasis across the six (6) geopolitical zones are shown in Appendix I and Fig 4. 2. It shows that the northeastern region had the highest prevaence of urinary schistosomiasis, followed by the northwestern and north-central regions. The geopolitical zones with the lowest reported cases of schistosomiasis were southeast and south-south. Fig. 4.2 indicates that the geopolitical zones in the northern part of the country (northeastern, northwestern and north-central) are the worst hit. A plausible explanation for the high prevalence of urinary schistosomiasis among geopolitical zones in northern Nigeria is the dependence on irrigation and dam water for agriculture and other purposes. Irrigation and dam projects favour the breeding of schistosomiasis snail vectors and increased man-vector contact. This confirms the findings of Adebayo (2003) who explored the effects of prevalence of urinary schistosomiasis among irrigation farmers in northern Nigeria and noted that within the irrigation system, the adverse public health effect is the outbreak of diseases. The study reported the widespread human infection with urinary schistosomiasis and river blindness along Kainji and Jebba Basins following the construction of dams.

The picture portrayed in Fig 4. 2 invariably implied that the northern region was the most affected, while the southern part of the country had the lowest prevalence of urinary schistosomiasis. Low prevalence of urinary schistosomiasis in southern Nigeria could be attributed to rapid urbanization and access to safe water supply. Across the geopolitical zones, years with the highest reported cases of schistosomiasis revealed that in 1983, 25854 cases of urinary schistosomiasis were reported in the northeast. In 1982, there were 11496 reported cases in the north-central; 10301 cases in the northwest in 1988; in 1990, 773 and 764 cases were reported in south-south and southwest respectively, while only 230 cases of schistosomiasis were reported in the southeast in 1994 (Appendix I). For the 16 years spatial prevalence (1982 – 1997), the northeastern zone recorded a mean value of 24, 596, northwestern zone recorded 8, 225, north-central had 5, 290 cases, south-southern zone had 372 cases, southwestern zone recorded 849 cases, while southeastern part reported 274 cases. The national epidemiological situation of urinary schistosomiasis indicates that the disease is a public health problem. Ejezi *et al*. (1989) studied the problem of schistosomiasis in Nigeria and reported that the establishment of several irrigation projects all over the country has stabilized the infection in northern Nigeria while in the south intensed urbanisation, access to potable water and mass treatment have combined to lessen the prevalence rates.

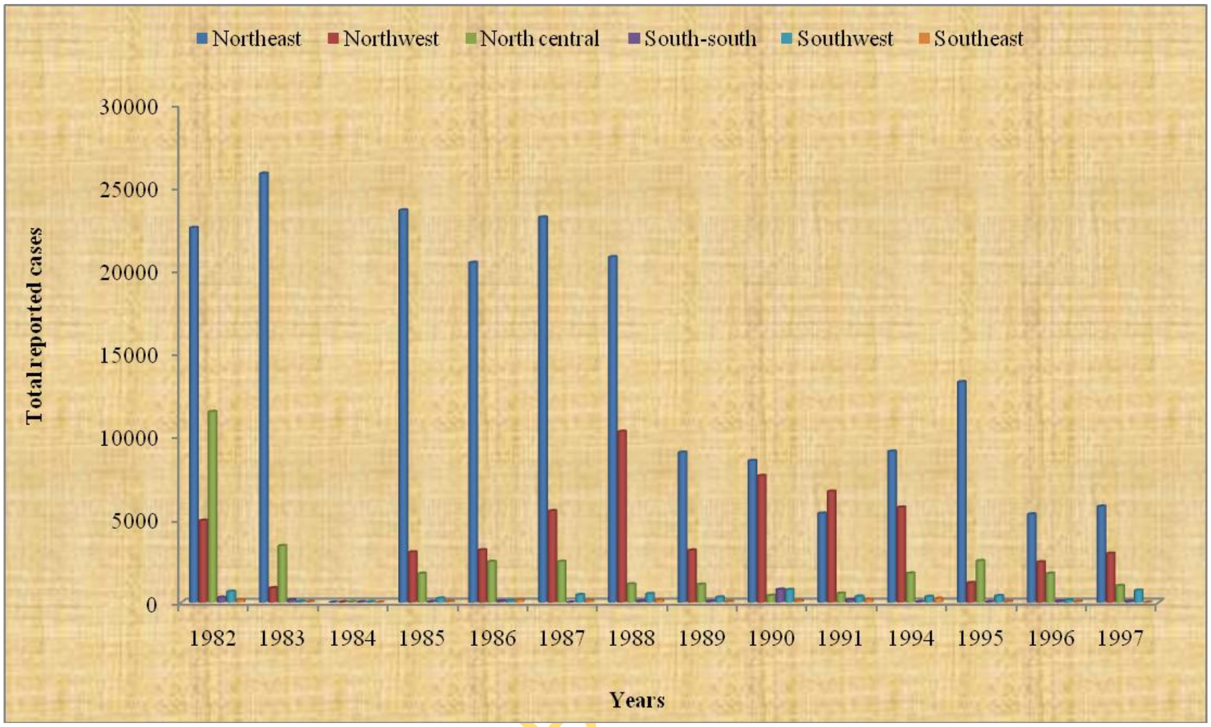

Fig 4. 2: Trend in reported cases of schistosomiasis across Geopolitical zones

The reported cases of schistosomiasis across states in Nigeria are contained in Appendix I and presented in Fig 4.3. It shows that the highest prevalence of schistosomiasis was reported in the then Gongola state (now Taraba and Adamawa states), followed closely by Borno, Taraba and Plateau states. Low schistosomiasis cases were reported in states found in the southern part of the country. However, among the states, Ondo, Ogun and Oyo states, all in the southwestern part, had higher prevalence of schistosomiasis. States in the northeast and northwest had the highest prevalence of schistosomiasis, followed by states in the north-central and then those in the southwestern and south-southern zones. States in the southeast had the lowest prevalence of schistosomiasis. This indicates that urinary schistosomiasis is highly prevalent among states in the northern part of Nigeria. Arinola (2005) explored the immunological status of urinary schistosomiasis in Nigeria and reported that urinary schistosomiasis is known to have existed from time immemorial and might have been brought to the country by the migrating Fulani people when they travelled westwards from the Nile Basin. In the southern part of Nigeria, particularly, the Niger Delta Region, apart from the fact that the numerous ponds, creeks and swamps may have favoured the breeding of the vector, Anosike *et al*., (2006) opined that the spread of the disease may have occurred during the Civil war when infected Nigerian soldiers migrated southwards and had contact with the freshwaters.

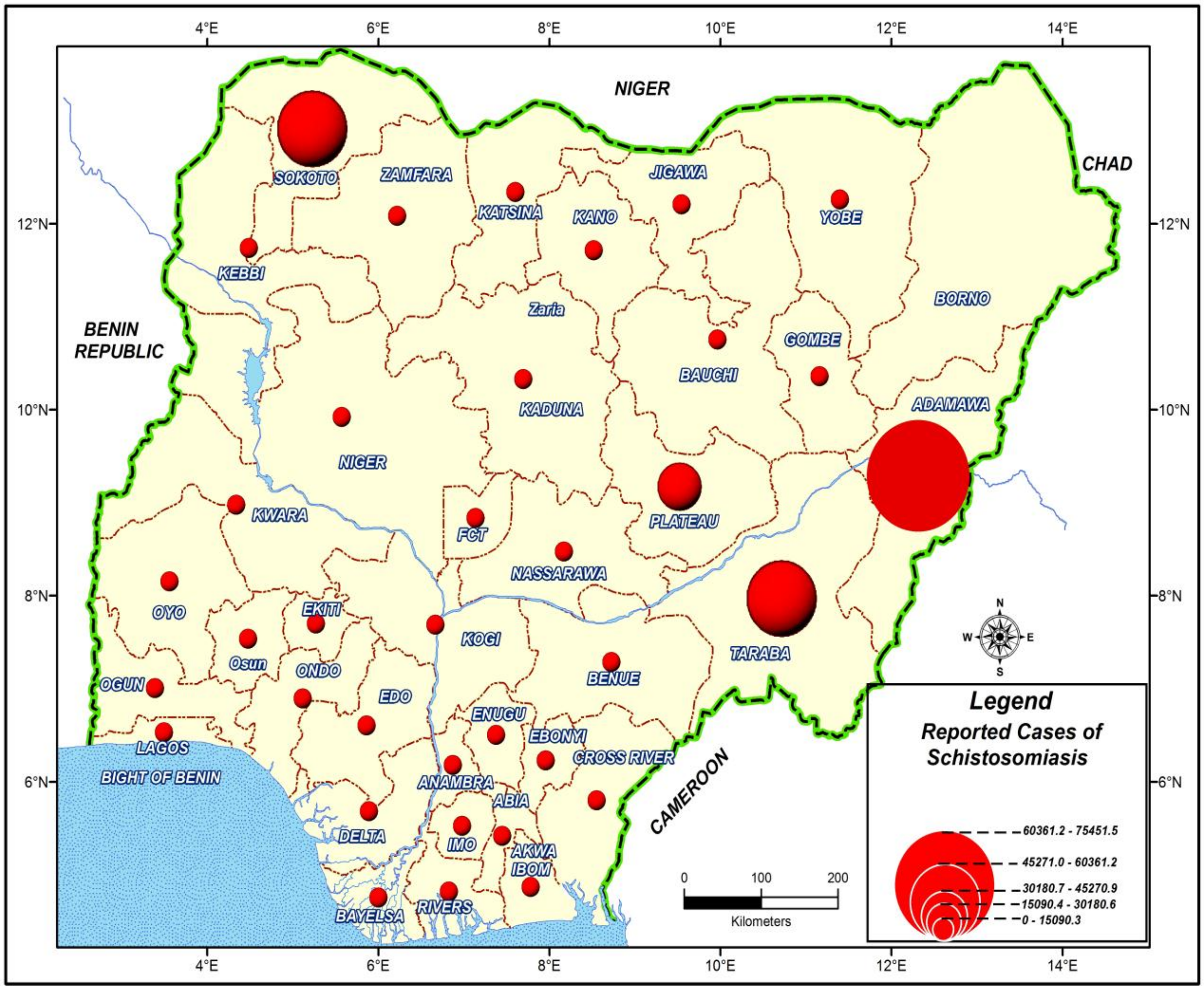

Fig. 4.3 Spatial distribution of urinary schistosomiasis in Nigeria

4.2 SPATIAL PATTERN OF SCHISTOSOMIASIS PREVALENCE IN CROSS RIVER STATE

Existing studies of urinary schistosomiasis show that the disease is prevalent in Cross River State, and it has been reported in almost all the Local Government Areas of the state. A recent study by Adie *et al,* (2013) in the eighteen Local Government Areas has shown that urinary schistosomiasis is highly prevalent in Ogoja Local Government Area with a prevalence of 36 per cent, indicating the highest prevalence among the endemic LGAs (Table 4.3). In the same vein, Abi with a prevalence of 26 per cent was the second worst hit, and Obudu Local Government Area which was third in the sequence recorded 23 per cent prevalence. In Obubra and Etung Local Government Areas respectively, 20 per cent and 19 per cent cases of urinary schistosomiasis were confirmed, while Biase Local Government Area recorded 17 per cent cases of urinary schistosomiasis. The proportion of persons infected with schistosomiasis in Yakurr within the period under review was 14 per cent and 13 per cent infection was reported in Yala Local Government Area.

Table 4.3: Spatial prevalence of urinary schistosomiasis in Cross River State

Name of LGA	No. of persons reporting urinary schistosomiasis	% reporting urinary schistosomiasis
Abi	1523	26
Akamkpa	0	0
Akpabuyo	0	0
Bakassi	0	0
Bekwarra	319	9
Biase	2686	17
Boki	416	2.8
Calabar Municipality	0	0
Calabar South	0	0
Etung	1613	19
Ikom	1625	5
Obanliku	1256	9
Obubra	1774	20
Obudu	2610	23
Odukpani	38	0.8
Ogoja	2570	36
Yakurr	1979	14
Yala	1912	13

Source: Adie *et al* (2013)

Prevalence of 9 per cent was recorded in each of Bekwarra and Boki Local Government Areas, and only 0.8 per cent prevalence of urinary schistosomiasis was reported in Odukpani Local Government Area. However, there were no cases of infections in Akampkpa, Akpabuyo, Bakassi, Calabar South and Calabar Municipality, all located in the southern part of Cross River State. This indicates that urinary schistosomiasis was highly prevalent in LGAs located in the northern and central parts of Cross River State and only two Local Government Areas (Biase and Odukpani) reported the disease in the southern part of the state. The northern and central parts of Cross River State have a high level of prevalence of urinary schistosomiasis due to regular contact with snail infested water, whereas the reason for the prevalence of urinary schistosomiasis in Biase and Odukpani Local Government Areas is as a result of proximity to the central part of the State (see fig. 1.1) and close interaction with people from the area.

A very striking feature of schistosomiasis is its focal distribution, and this explains why the disease is highly prevalent in areas where it is endemic. Therefore, in order to gain a better understanding of the prevalence of urinary schistosomiasis, parasitological data (Table 4.4) were obtained from the Cross River State Ministry of Health to characterize endemic situations. The epidemiological situation of urinary schistosomiasis can be classified into; hyper endemic > 30%: Meso endemic > 20%; and hypo endemic < 10% (WHO, 2002). This task was done using the recent 2012 Cross River State Ministry of Health schistosomiasis baseline data and soil transmitted helminths and was based on the World Health Organization (WHO) standard procedures for community diagnosis of schistosomiasis and soil-transmitted helminths (Appendix II).

Table 4.4: Prevalence of schistosomiasis and soil transmitted helminths (STH) infections in Cross River State, 2012

S/n	LGA	no. examined	% +ve for schistosomiasis	%+ve for STH
1	Abi	268	43	27
2	Akamkpa	262	0	30
3	Akpabuyo	266	0	12.4
4	Bakassi	253	0	21
5	Bekwarra	274	73	16
6	Biase	263	73.2	21
7	Ikom	281	55	8.2
8	Yala	107	34	11.2
9	Yakurr	257	63	8.2
10	Ogoja	250	65	18
11	Odukpani	257	37	15
12	Obudu	274	68.3	8
	TOTAL	3012	31	16

Source: Cross River State Ministry of Health, 2013.

The pattern of prevalence of urinary schistosomiasis shows that there is spatial variation in the prevalence of schistosomiasis across the state (Table 4.4 and Fig. 4.4). In fact, most of the endemic Local Government Areas show over 30 per cent prevalence. It was the realization of the high prevalence rate of the disease that made the Cross River Ministry of Health in collaboration with the Federal Ministry of Health to select twelve LGAs where the disease is highly prevalent as part of preparation for the National Schistosomiasis Prevalence Survey that is yet to be carried out. Soil transmitted helminths was included in the 2012 Cross River State Ministry of Health Epidemiological Mapping/Baseline survey because soil transmitted helminths (STH) is intimately related to the presence of schistsosomiasis (WHO, 2002) and its occurrence in a region indicates that there is an increased possibility for schistosomiasis transmission. The survey was based on the examination of urine and fecal samples from the most vulnerable group (school-aged children) for the presence of schistosome and intestinal helminths eggs.

The geographical analysis of the data in the Twelve Local Government Areas (Table 4.4) shows that the prevalence of shistosomiasis varies widely among the LGAs. An average prevalence of 61 per cent was confirmed in the northern part of Cross River State, consisting of Bekwarra 73 per cent, Ogoja 65 per cent, Yala 34 per cent, Obudu 68.3 per cent. Prevalence of schistosomiasis in Ikom 55 per cent, Yakurr 63 per cent and Abi 43 per cent of the central part of Cross River State accounted for an average of 54 per cent. Also, an average prevalence of 22 per cent was recorded in the southern part of Cross River State that comprises Akamkpa 0 per cent, Akpabuyo 0 per cent, Bakassi 0 per cent, Biase 73.2 per cent, and Odukpani 37 per cent. For Soil Transmitted Helminths, the prevalence is as follows: Abi 27 per cent, Akamkpa 30 per cent, Akpabuyo 12.4 per cent, Bakassi 21 per cent, Bekwarra 16 per cent, Biase 21 per cent, Ikom 8.2 per cent, Yala 11.2 per cent, Yakurr 8.2 per cent, Ogoja 18 per cent, Odukpani 15 per cent and Obudu 8 per cent. The overall percentage prevalence of urinary schistosomiaisi was 31 per cent and 16 per cent for Soil-Transmitted Helminths, an indication that the disease is hyper endemic in the study area (Tables 4.4 and Appendix I).

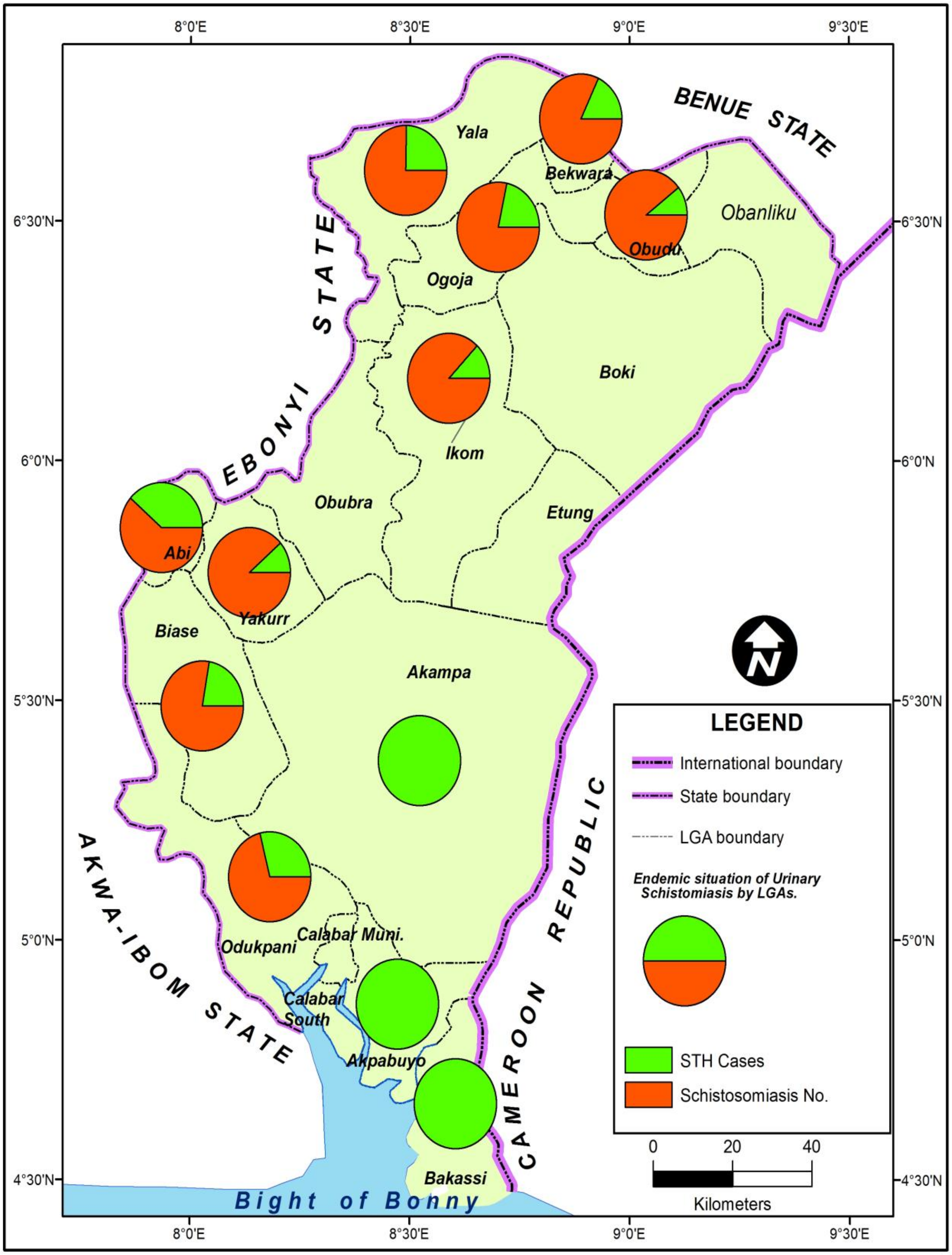

Fig. 4.4 Spatial distribution of urinary schistosomiasis in Cross River State

Source: Cross River State Ministry of Lands and Survey, 2013

The study revealed that urinary schistosomiasis is a disease of great public health concern in Cross River State. The state-wide prevalence is 31 per cent. The disease is highly endemic in some LGAs, an indication that the problem needs immediate attention. The high prevalence of the disease in the area could be due to lack of adequate knowledge about the cause of the disease and dependence on infective water sources. However, the current 31per cent prevalence recorded in the state is well below 62.3per cent prevalence, which was earlier reported by Ejezie *et al*. (1991). The finding serves to highlight the fact that schistosomiasis is fast declining and that current interventions seem to be yielding results in lessening the prevalence rates of the disease. The prevalence is far below previous levels reported in other parts of Nigeria like Bakolori irrigation project area by Adamu and Galadima (1998) who confirmed a prevalence of 50.9per cent and Ladan *et al*., (2011) who reported 47per cent prevalence in selected villages near a dam site in Gusau Local Government Area, Zamfara State.

From the result, it can be deduced that focal areas of schistosomiasis exist. Nine LGAs (Bekwarra, Biase, Ikom, Yala, Yakurr, Ogoja, Odukpani, Abi and Obudu) out of the twelve LGAs surveyed had prevalence rate of 30 per cent and above, thus, placing those LGAs in hyper endemic category (Fig. 4.5), while three LGAs have zero prevalence of urinary schistosomiasis. Further analysis revealed that out of the nine LGAs that are hyper endemic for the disease, four of them (Bekwarra, Yala, Ogoja, and Obudu) are located in the northern part of Cross River State, three (Ikom, Yakurr and Abi) are situated in central Cross River and only two (Biase and Odukpani) LGAs are located in the southern part of Cross River State (Fig. 4.5). Similarly, 8 of the 12 LGAs had prevalence of STH below 20 per cent, placing them in the category of hypo-endemic regions while 4 LGAs had prevalence levels above 20 per cent, representing moderately high prevalence meso-endemic areas (Appendix ii). This shows that prevalence of schistosomiasis in endemic areas is not uniform, probably due to differences in local environmental, sanitation and behavioural factors. The prevalence situation of the disease in the state revealed a moderately high prevalence of Schistosoma haematobium infection. Thus, due to the advarse effects of urinary schistosomiasis on physical and pysiological conditions of infected persons, relief from the burden of the disease could be come from a better knowledge of the epidemiology of the disease and good public health practice.

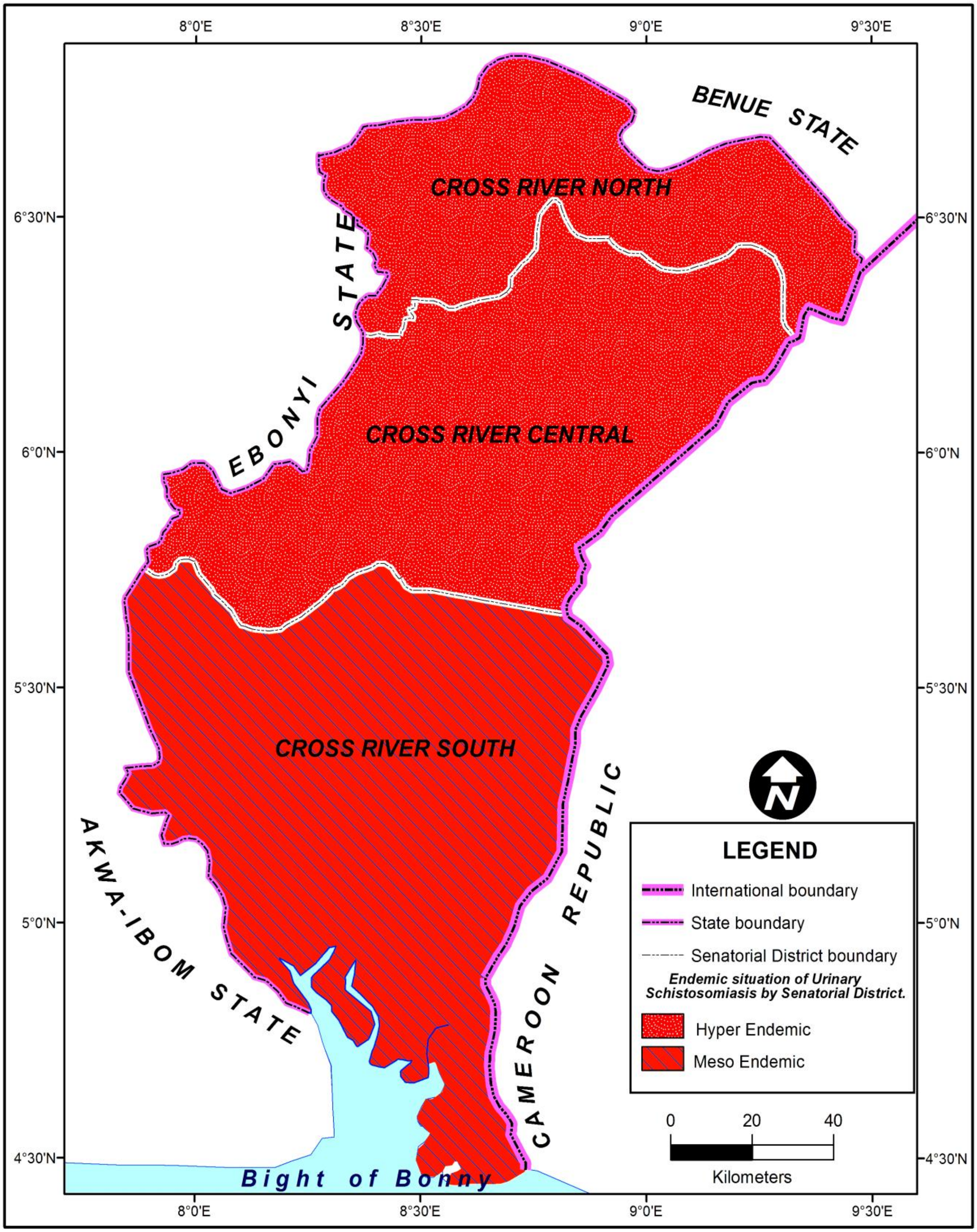

Fig. 4.5 Endemic situations of urinary schistosomiasis in Cross River State

The findings of the study show that endemicity of schistosomiasis varies spatially in many LGAs, with Bekwarra, Biase, Yakurr, Ogoja, and Obudu presenting the highest prevalence rates of 60per cent and above. There were no cases of schistosomiasis in Akpabuyo, Bakassi and Akamkpa, implying that the disease is not prevalent in these LGAs. The reason could be due to improved water supply in recent years which discourages populations from engaging in water-related activities in open fresh water bodies. Furthermore, this result indicates that the prevalence of the disease in the entire state ranged from low in the southern to very heavy infections in the central and northern parts of the state where the disease is hyper endemic (Fig. 4.4). A recent study by Adie *et al.*, (2013) in the area disclosed that prevalence intensities varied widely among communities and that heavily infected children were found along coastal communities. A plausible explanation for the high prevalence of schistosomiasis in the northern part of Cross River State may be proximity to northern Nigeria. Infected Fulani migrants from the northern part of the country into the area may have arrived with the disease. Cowper (1973) reported that although schistosomiasis has been known in northern Nigeria from time immemorial, the disease may have been brought into the southern part of the country by the migrating Fulani people. A similar situation was reported in Brazil, where movement from rural to urban areas was found to significantly influence schistosomiasis infection as demonstrated by the work of Carmo and Barreto (1994).

Similarly, the hyper endemic situation of schistosomiasis in central Cross River State corresponded with extensive agricultural practices especially rice paddies found in the swampy areas of this part of the state. Whereas the mesoendemic situation in the southern part of Cross River State seems to be determined by the differences in the quality of houses between the population in the municipal area and its environs; settlements in the southern part of Cross River State are more urbanized and have access to better houses equipped with piped water supply, good toilet facilities and majority of them are involved in non-agricultural occupation. Also, the low prevalence of schistosomiasis in the southern part of Cross River State may be due to the high salinity content of water bodies in the area. A recent study by Adie *et al.*, (2013) attributed low schistosomiasis prevalence in the area to high salinity of water bodies, which is a result of closeness to the Atlantic Ocean. It is notable that high salinity is unfavourable for the survival of the snail intermediate host vectors of schistosomiasis.

4.3 PREVALENCE OF SCHISTOSOMIASIS BY AGE AND SEX

Attempts have been made by scholars to show the age-sex pattern of schistosomiasis, and there is a general agreement that the disease is more common among children and young people. Table 4.5 shows that the age group 11-20 years (39.3 per cent) have the highest prevalence, followed by 21-30 years (21.6 per cent), less than 10 years (14.4 per cent), 36-40 years (8.6 per cent), 31-36 years (8.2 per cent), 41- 45 years (3.4 per cent), and 46 years and above (4.5 per cent). The lowest prevalence occurred within the 41-45 years age group. The result shows that people below the age of 20 years are more infected with schistosomiasis. The fact that children and younger populations are less likely to use preventative strategies may be an important reason as well as reasons related to immune status. The young (below 20 years) appears to be more vulnerable to schistosomiasis probably because of their frequent water contact activities like swimming and fetching of water.

Table 4. 5: Prevalence of urinary schistosomiasis by age in endemic communities

Age	**Prevalence of urinary Schistosomiasis**		
	Had blood in urine	No blood in urine	Total
<10 years	86(14.4%)	23(11.4%)	109(13.7%)
11 – 20 years	234(39.3%)	73(36.1%)	307(38.5%)
21 - 30 years	129(21.6%)	44(21.8%)	173(21.7%)
31 - 36 years	49(8.2%)	18(8.9%)	67(8.4%)
36 - 40 years	51(8.6%)	16(7.9%)	67(8.4%)
41 - 45 years	20(3.4%)	13(6.4%)	33(4.1%)
>46 years	27(4.5%)	15(7.4%)	42(5.3%)
Total	596**(74.7%)**	202 **(25.3%)**	**798(100.0%)**

Source: Researcher's fieldwork, 2013

Data from an epidemiological study by Adie *et al* (2013) on age prevalence of schistosomiasis is contained in Table 4.6. The data indicates peak infection in the 11-15 years old age in all the Eighteen Local Government Areas of the State (Table 4.6). In the 5 – 10 age group, 5 per cent, 1.8 per cent, 3 per cent, 6 per cent, 1 percent, 1.6 per cent, 4 per cent, 6 per cent, 4 per cent, 12 per cent, 3 per cent, and 6 per cent prevalence rates were recorded in Abi, Bekwerra, Biase, Boki, Etung, Ikom, Obanliku, Obubra, Obudu, Ogoja, Yakurr and Yala respectively. In the 16-20 age group, 8 per cent, 2.3 per cent, 4 per cent, 4 per cent, 2 per cent, 1.2 per cent, 4 per cent, 3 per cent, 5.4 percent, 2 per cent, and 1 per cent prevalence of infections were observed in Abi, Bekwarra, Biase, Etung, Ikom, Obanliku, Obubra, Obudu, Ogoja, Yakurr and Yala. Among 21 and above age group, 1 per cent, 0.9 per cent, 1 per cent, 2.8 per cent, 1 per cent, 1.4 per cent, 3 per cent, 1.7 per cent, 4 per cent, and 2 per cent urinary schistosomiasis was reported in Abi, Bekwarra, Biase, Boki, Etung, Obanliku, Obubra, Obudu, Ogoja and Yakurr respectively.

Table 4.6: Prevalence of urinary schistosomiasis by age in Cross River State, Nigeria

Name of LGA	Children infected	5-10 yrs. (%)	11-15 years (%)	16-20 years (%)	21 years and above (%)
Abi	1523 (26.0)	292 (5.0)	702 (12.0)	469 (8.0)	59 (1.0)
Akamkpa	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Akpabuyo	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Bakassi	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Bekwara	319 (9.0)	64 (1.8)	142 (4.0)	81 (2.3)	32 (0.9)
Biase	2686 (17.0)	474 (3.0)	1422 (9.0)	632 (4.0)	158 (1.0)
Boki	416 (28.0)	0 (0.00)	416 (2.8)	0 (0.00)	416 (2.8)
Calabar Mun.	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Calabar South	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Etung	1613 (19.0)	509 (6.0)	679 (8.0)	340 (4.0)	85 (1.0)
Ikom	1625 (5.0)	325 (1.00)	650 (2.0)	650 (2.0)	0 (0.00)
Obanliku	1256 (9.0)	224 (1.6)	670 (4.8)	167 (1.2)	195 (1.4)
Obubra	1774 (20.0)	355 (4.0)	798 (9.0)	355 (4.0)	266 (3.0)
Obudu	2610 (23.0)	681 (6.0)	1362 (12.3)	341 (3.0)	193 (1.7)
Odukpani	38 (0.8)	0 (0.00)	38 (0.8)	0 (0.00)	0 (0.00)
Ogoja	2570 (36.0)	857 (12.0)	1042 (14.6)	386 (5.4)	286 (4.0)
Yakurr	1979 (14.0)	424 (3.0)	990 (7.0)	283 (2.0)	283 (2.0)
Yala	1912 (13.0)	882 (6.0)	882 (6.0)	147 (1.0)	0 (0.00)
Total	199,794 (20.32)	5087 (2.5)	9793 (4.6)	1851 (1.9)	1973 (0.9)

Source: Adie *et al*, 2013.

Evaluation of parasitological report (Appendix iii) further revealed that the highest ova load was among subjects aged 11-15 years recording 43 ova per 10 mL of urine and 37 ova per 10 mL of urine in male and female respondents respectively.This result may be partly explained by the fact that children and young people are more involved in swimming and playing in stream and swamp water sources that expose them to schistosomiasis vector (Plate 4.1). In particular, the age group of 11-15 years that is found to be highly infected represents such a group of population, which seems to be the case in other studies in Africa and Brazil (Gazzinelli et al., 2006; Enk et al., 2010).

Plate 4.1: Male children swimming in a stream

Information on the sex distribution of schistosomiasis prevalence is contained in Table 4.7. The sex specific prevalence as contained in the table shows that out of 596(74.7%) of the respondents that are infected with schistosomiasis, 365(61.2%) are males, while 231(38.8%) are females. Males are more infected than their female counterparts.

Table 4.7 Prevalence of urinary schistosomiasis by sex in endemic communities

Variable	Prevalence of urinary	schistosomiasis	
Sex	Had blood in urine	No blood in urine	Total
Male	365(61.2%)	99(49.0%)	464(58.1%)
Female	231(38.8%)	103(51.0%)	334(41.9%)
Total	596(74.7%)	202(25.3%)	798(100.0%)

Source: Researcher's fieldwork, 2013

Data from an epidemiological study by Adie *et al* (2013) indicates that 783 (25 per cent) males and 740 (27.8 per cent) females were infected in Abi Local Government Area. In Bekwara Local Government Area, 211 (15.4 per cent) males and 108 (7.8 per cent) females reported urinary schistosomiasis (Table 4.8). Also, prevalence of infection was highest in Biase Local Government Area with 1527 (16.1per cent) cases of peak infection in males and 1157 (18.3per cent) prevalence in females. In Boki and Etung Local Government Areas, prevalence of urinary schistosomiasis infection in males was 187 (2.6 per cent) and 953 (20.0 per cent) respectively, whereas 229 (2.9 per cent) prevalence and 660 (17.6 per cent) infections were recorded in females respectively. In Ikom Local Government Area, males (4.5per cent) were more infected than females (4.6 per cent) and a proportion of (8.1per cent) males and (9.3 per cent) females reported infection in Obanliku Local Government Area. Prevalence of urinary schistosomiasis was highest in females (27.0 per cent) than males (13.2 per cent) in Obubra Local Government Area, while males (33.4 per cent) were more infected than females (13.4 per cent) in Obudu Local Government Area.

Table 4.8: Sex prevalence of urinary schistosomiasis in Cross River State

Name of LGA	No. reporting urinary schistosomiasis	Males Frequency	%	Females Frequency	%
Abi	1523	783	25	740	27.8
Akamkpa	0	0	0	0	0
Akpabuyo	0	0	0	0	0
Bakassi	0	0	0	0	0
Bekwarra	319	211	15.4	108	7.9
Biase	2686	1529	16.1	1157	18.3
Boki	416	187	2.6	229	2.9
Calabar Mun.	0	0	0	0	0
Calabar S.	0	0	0	0	0
Etung	1613	953	20.0	660	17.6
Ikom	1625	817	5.4	808	4.6
Obanliku	1256	661	8.1	595	9.3
Obubra	1774	594	13.2	1180	27.0
Obudu	2610	1821	33.4	789	13.4
Odukpani	38	14	0.5	24	0.1
Ogoja	2570	1029	26.5	1541	47.3
Yakurr	1979	1016	13.5	963	14.6
Yala	1912	713	0.9	1199	17.9
Total	20,321	10,328	10.0	9993	10.2

Source: Adie *et al*, 2013.

In Ogoja Local Government Area, the proportion of males reporting urinary schistosomiasis was 1029 (26.5 per cent) and 1541 (47.3 per cent) females were also infected. Similarly, prevalence of infection in Yakurr Local Government Area was high in males 1016 (13.5 per cent) and low in females 963 (14.6 per cent) and on the contrary, peak infection was found in females 1199 (17.9 per cent) than males 713(0.9 percent) in Yala Local Government Area. However, evaluation of parasitological report from Cross River State Ministry of Health revealed that the mean ova load for male and female primary school pupils was 36 ova per 10 mL of urine in males and 29 ova per 10 mL of urine for females, an indication that males are more infected than females (Appendix III). These data revealed that peak infection occurs in males than females in almost all the Local Government Areas with the exception of Obubra and Yala. Males had the highest prevalence compared to their female counterparts probably due to differences in exposure status. They are more involved in out-door activities that bring them in contact with the vector.

4.4 PREVALENCE AND RISK FACTORS OF URINARY SCHISTOSOMIASIS

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 4.9 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. 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 4.9 : 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: Researcher'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. 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 situation of the disease, given that it was based on the results of the examination of 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 (plate 4.2).

Plate 4.2: A woman and young ladies fetching water, some gathering sand and others playing at the water source

A similar observation was made by Okon *et al* (2009) 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 I, prevalence decreased from 91 per cent in 2003 to 78.0 per cent in 2013 probably due to improved water supply (plate 4.3). This is not surprising because schistosmiasis has been reported to drastically reduce in areas where potable water is provided (Adie *et al.*, 2013 and WHO, 2002).

Plate 4.3: Two young teens fetching water from a borehole in Utukwang I

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. 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 (see Table 6.4).

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. Human interaction with infected water source (streams, rivers, and swamps) is the major determinant of schistosomiasis infection. Table 4.10 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.

Table 4.10: Risk factors influencing prevalence of urinary schistisomiasis

Variables/ Responses	Swim in the river No.(%)	Fetched water at the water source No.(%)	Bathed at the water source No.(%)	Done Laundry at the water source No.(%)	Farmed in swampy areas 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.(%)
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)
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)
Total	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

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 result further revealed that the residents depend on unsafe and unprotected water sources (Plate 4.4) 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.

Plate 4.4: A large swamp which constitutes a breeding ground for the snail vector of schistosomiasis.

Table 4.11: Blood Urine and Risk Factors of Urinary schistosomiasis

Blood in Urine	Ever Swam in the River	Ever fetched water	Ever bathed in the river	Doing laundry in the River	Ever farmed in swamped area	Ever engaged in sand mining	Ever engaged in fishing	Ever engaged in snail gathering	Snail eating	Ever depeated in the river source	Age of infected household member	Educational of rinfected house hold members
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)
Yes	471 (75.5)	460 (76.8)	481 (75.5	423 (76.5)	463 (77.7)	239 (77.1)	371 (77.8)	901 (77.3)	489 (75.5)	290 (77.3)	< 10yrs 73 (74.5)	No formal education 77 (77.5)
No	125 (71.8)	136 (71.2)	115 (71.4)	173 (70.6)	133 (65.8)	357 (73.2)	224 (79.1)	195 (69.6)	107 (71.3)	306 (72.3)	11-20yrs 135(81.3)	Primary Education 205 (72.7)
											21-30yrs 76 (81.7)	Secondary Education 233 (73.7)
											31-40yrs 145(64.2)	Tertiary 81 (82.7)
											>40yrs 167 (77.7)	
Total	596 (74.7)	596 (74.7)	596 (74.7)	596 (74.7)	596 (74.7)	596 74.7	596 (74.7)	596 (74.7)	596 (4.7)	596 (74.7)	596 (74.7)	596 (74.7)

Source: Researcher's fieldwork, 2013

Table 4.11 provides information on blood in urine and risk factors of urinary schistosomiasis. The table shows that out of the 596 persons who reported blood in urine in endemic communities, 75.5% swum in the river and 76.8% went to fetch water from the river source. Others who were infected as a result of involvement in water contact activities include: bathing in the river (75.7%), laundry (76.5%), farming in swampy areas (77.7%), sand mining (77.3%), fishing (77.8%), snail gathering (77.3%), snail eating (75.5%) and defecation into river (77.3%). With respect to the age of infected household members, 74.5% were <10 years, 11-20 years (81.3%), 21-30 years (81.7%), 31-40 years (64.2%), >40 years (77.7%). Concerning the educational attainment of infected household members, Table 4.12 shows that 77.5% had no formal education, 72.7% had primary education, 73.7 had secondary education and only 82.7% had tertiary education. The analysis goes to show that most of the respondents have engaged in one activity or the other at the water source, thereby getting infected.

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 4.10 and 4.11 above. The responses on self-reported blood in urine, calibrated as ‘’ever urinated blood in urine, if yes=1 and no=0’’ constitute the dependent variable (Y) (Table 4.11), while swimming, fetching, bathing, washing, farming in vector environment, sand mining, fishing, snail gathering, eating of snails, defecation into river, age and education of infected household members are the independent variables (See Table 4.10).The logistic regression model is shown as the following form:

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

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} = Age of infected household member;

x_{12} = Education of infected household member;

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

Details of the analysis are contained in Appendix IV and summarized in Table 4.12. The result of the analysis in Table 4.12 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}), Age of infected household member (x_{11}), education of infected household member (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 4.12) 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 4.12). 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. However, the R^2 of 37.6 per cent (0.376) means that the contribution of the independent variables to the variation in the dependent variable is relative low even though the result is significant (R^2 = 0.376; p<0.05). 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 4.12: 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
Age of infected household member	.303	.201	2.269	1	.132	1.354	1.354
Education of infected household member	-.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

Source: Researcher's fieldwork, 2013

The index of the significance of each predictor variable in the equation represented by the Wald statistic and associated probabilities is presented in Table 4.12. 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 4.12 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, 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 4.12 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:

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

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 (Plate 4.5). 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.

Plate 4.5: Rice cultivated area

CHAPTER FIVE

SPATIO-EPIDEMIOLOGICAL FACTORS AND SCHISTOSOMIASIS PREVALENCE

5.0 INTRODUCTION

This chapter is concerned with factors of vulnerability to schistosomiasis. It looks at individual-level risk factors as well as household factors of vulnerability to urinary schistosomiasis. The chapter presents the results of the canonical correlation analysis of distance, demographic/household factors and level of exposure to infection. It also contains analyses of the relationship between prevalence of urinary schistisomiasis and distance from centre of community to infection source as well as population size of endemic communities.

5.1 FACTORS OF VULNERABILITY TO SCHISTOSOMIASIS

In 1988, the World Health Organization (WHO) reported that various spatio-epidemiological factors are responsible for exposure and level of infection of urinary schistosomiasis. Among such factors are: distance from community to transmission site, movement/migration, socio-economic factors, sanitation and hygiene, water supply patterns and level of fecal contamination of water sources.

5.1.1 DEMOGRAPHIC/HOUSEHOLD RISK FACTORS OF SCHISTOSOMIASIS

Although, physical factors (streams, rivers, swamps and distance from transmission site) provide suitable breeding conditions for schistosomiasis vector, socio-demographic characteristics determine level of contact with the disease vector and by extension cases of re-infections (Huang and Manderson, 2005). The socio- demographic data of respondents in endemic communities are important in shistosomiasis surveys because they are regarded as primary risk factors. These are variables that relate to individual-level characteristics. These include age, sex, occupation, educational attainment and income. Table 5.1 sets out the socio-economic and demographic characteristics of the respondents in endemic communities.

Table 5.1: Socio-demographic risk factors of exposure

Variable	Categories	Frequency	%
Age	18- 24 years	109	13.7
	25 - 30 years	307	38.5
	31 - 35 years	173	21.7
	36 - 40 years	67	8.4
	45 - 50 years	67	8.4
	51 - 55 years	33	4.1
	56- 60 years	42	5.3
	Total	**798**	**100.0**
Sex	Male	464	58.1
	Female	334	41.9
	Total	798	100.0
Occupation	Agriculture	438	54.9
	Non-agriculture	360	45.1
	Total	**798**	**100.0**
Educational attainment	No formal education	97	12.2
	Primary education	126	15.8
	Secondary education	430	53.9
	Tertiary education	134	16.8
	Others	11	1.4
	Total	**798**	**100.0**
Estimated monthly income	0 - ₦10,000	327	41.0
	₦11,000 - ₦20,000	169	21.2
	₦21,000 - ₦30,000	142	17.8
	₦31,000 - ₦40,000	60	7.5
	>N41,000	100	12.5
	Total	**798**	**100.0**

Source : Researcher's fieldwork, 2013

Age is one of the primary risk factors of schistosomiasis. The risk of being infected with schistosomiasis decreases with increasing age, and children and young people are more likely to be infected than their adults' counterparts (Kitimbo et al, 2009). The information on the age distribution of respondents in Table 5.1 shows that 109(13.7per cent) are 18-24 years old and 307 (38.5 percent) of the respondents are between age 25 - 30 years. Also, 173(21.7per cent) respondents are between ages 31 - 35 years. The respondents aged between 36- 40 are 67(8.4per cent) and 67(8.4per cent) of the respondents are between 41-45 years old. Only 33(4.1per cent) of the respondents are 50-55 year s old, while 42(5.3per cent) of them are 56-60 years. This result shows that over 50per cent of the respondents are in the age bracket of 18-30 years. This group is believed to be the most vulnerable to urinary schistosomiasis. Also, the sampled population cuts across different age categories, since the disease affect people of any age; but more typically young people in endemic areas are especially at risk. Furthermore, concerning the sex characteristics of respondents, 464(58.1per cent) of the respondents were males, while 334 (41.9 per cent) are females. The analysis shows that both sexes are well represented in the study. The occupational characteristics of people could predispose or protect them from urinary schistosomiasis.

The occupational distribution of respondents in Table 5.1 shows that 438(54.9per cent) respondents are engaged in agriculture, mostly farming and 360(45.1per cent) are involved in non-agricultural occupations which include the civil service (majority of whom are primary and secondary school teachers as well as Local Governement workers). It should be noted however, that like in many other rural communities in the study area, majority of the people are into farming regardless of their primary occupation. It is important to note that primary occupations such as farming in vector environment, swimming, fishing, collection of edible snails increase man-vector contact and thus have the potential to increase the transmission of schistosomiasis, whereas occupations such as Civil Service and other non-agricultural occupations reduce man's contact with the disease vector and thus prevent infection.

Another important risk factor in the transmission of schistosomiasis is educational attainment. The risk of being infected with schistomiasis is a function of individual's educational attainment and indirectly level of education. Educational attainment of people can influence their perception of the cause and treatment of schistosomiasis ailments in endemic areas. The educational attainment of respondents shows that 97(12.2per cent) of the respondents have no formal education, 126(15.8 per cent) of the respondents have primary education, 430(53.9per cent) respondents have secondary education and 134 (16.8per cent) of the respondents have tertiary education. Only 11(1.4per cent) respondents could not give information about their educational attainment (Table 5.1). From the data, the majority of the respondents have low formal education; but the proportion of respondents with secondary education is slightly higher. However, given this level of education, one would have expected that residents would protect themselves from urinary schistosomiasis. This is because educated population is likely to be well informed and is able to adopt preventive strategies at the personal level, even if it requires reducing their contact with contaminated water sources, or making water safe for use.

The estimated monthly income of respondents as contained in Table 5.1 shows that 327(41.0per cent) of the respondents earn less than ₦10,000 and 169 respondents representing 21.2 per cent of the respondents earn an estimated monthly income of ₦11,000 - ₦20,000. Also, 142(17.8per cent) respondents are within the category of ₦21, 000 - ₦30,000 and 60 respondents representing 7.5 per cent of the respondents earn estimated monthly income of ₦31,000 - ₦40,000. The result shows that 80per cent of the respondents earn less than ₦30, 000 monthly and only 100(12.5per cent) respondents earn more than ₦40, 000. 00. This result implies that majority of the residents in endemic communities are low-income earners and are therefore more susceptible to schistosomiasis infection than those with higher income. Low-income earners or poor people are at increased risk both of becoming infected with urinary schistosomiasis and of becoming infected more frequently. This is because the higher the income of an individual, the more access he or she has to basic needs and sanitary services and the less likely he/she is to be infected with preventable diseases like schistosomisis. Respodent's vulnerability to urinary schistosomiasis is to some extent linked with their income, which is partly a function of educational attainment and type of occupation. Level of education and individual monthly income affect exposure and frequency of infection.

As earlier said, schistosomiasis vectors thrive under conditions of poor housing, dirty water, and poor waste management. Therefore, the presence or absence of sanitary toilets is an important factor in the transmission of the disease at household and community levels. Details of the analysis of household sanitary facilities of respondents in endemic communities are shown in Table 5.2.

Table 5.2 Household sanitary facilities of respondents

Variable	**Categories**	**Frequency**	**%**
Household toilet type	None	80	10.0
	Open latrine	290	36.3
	Pit toilet/latrine	210	26.3
	Pour flush	183	22.9
	Hand cistern	31	3.9
	Others	4	.5
	Total	**798**	**100.0**
Household water source	Tap	219	27.4
	Borehole	249	31.2
	Well	257	32.2
	Others	73	9.1
	Total	**798**	**100.0**
Household residential quality	Zinc-mud	406	50.9
	Bungalow	188	23.6
	Thatch	100	12.5
	Duplex	102	12.8
	Others	2	.3
	Total	**798**	**100.0**
Household waste disposal	None	73	9.1
	Open dumpsite	252	31.6
	Dumpsters	90	11.3
	River disposal	230	28.8
	Nearby bush	133	16.7
	Others	20	2.5
	Total	**798**	**100.0**

Source : Researcher's fieldwork, 2013

Table 5.2 shows that out of the 798 persons interviewed, 290(36.3 per cent) live in households that depend on open latrine for fecal waste disposal, 210(26.3per cent) of the respondents live in households having pit toilet, 183(22.9per cent) live in households that use pour flush toilet system and only 31(3.9per cent) of the respondents live in houses equipped with water closet or hand cistern. From the data, it can be deduced that a great proportion of respondents lived in houses with very poor toilet facilities. As a result, they are more likely to be infected, and or involved in the transmission of schistosomiasis than those that have good fecal disposal facilities like the pour flush and hand cistern. Similar studies conducted in Africa and elsewhere in the world such as those by Gazzinneli *et al*., 2006; Ximenes *et al*., 2001; Boadi and Kuitunen, 2005; Barretto *et al*., 2010 found exposure to decrease with improved household sanitary toilet system. Whereas Magalheas *et al.* (2011) explored the role of water supply and sanitation in the risk of helminth infections and pointed out that schistosomiasis infection was partly explained by inadequate disposal of human excreta, even in the presence of adequate toilet facilities, resulting in constant environmental contamination.

The source of household water supply affects schistosomiasis transmission. Fig. 5.6 shows that 219(27.4per cent) of the respondents lived in households that depend on tap water for their water needs, 249 (31.2per cent) respondents indicated borehole, 257(32.2per cent) live in households that make use of well water, and 73 (9.0per cent) indicated the use of other natural water sources to meet their daily water needs (Table 5.2). More than half of the respondents rely on alternative sources (tap and borehole) for their water supply. However, respondents complained of the charges and opening hours and because some of the local residents were unable to afford the cost of water, they resort to natural sources of supply. Fetching of water from tap and borehole (alternative sources) located within the community may reduce man-vector contact and thus the rate of prevalence. The study found that the inhabitants in endemic communities had limited access to potable water supply, a factor that pushes them to unprotected natural water sources, mainly wells, streams and swamps. Fetching water from streams, rivers and other unsafe sources could bring people in contact with the schistosomiasis vector, thereby getting infected. However, Olusegun *et al.*, (2011) in their study of the prevalence of urinary schistosomiasis among HIV-infected persons in Edo State reported low prevalence of urinary schistosomiasis in areas that have access to potable water. In some communities, borehole and well water were not suitable for bathing; and so local residents used them only for limited domestic activities, while continuing to rely on river and stream water sources that resulted in long and extensive exposure. Onyeneho *et al*, (2010) further reported that a very high proportion of people in the endemic community where their study was based depend on infected natural sources for all the domestic water needs even where there were alternative sources. This is because river and stream water was perceived to be purer than water from hand dug wells.

Apart from source of water supply that makes respondents vulnerable to schistosomiasis, the dwelling characteristics of people in endemic communities also put them at even greater risk. Table 5.2 shows that 406(50.9per cent) and 100(12.5per cent) of the respondents live in poor houses made of zinc-mud and thatch respectively, 188(23.6 percent) respondents live in bungalow, and only 102(12.8per cent) of the respondents were resident in duplexes (Table 5.2). From the data, it can be deduced that a large proportion of the inhabitants in endemic communities live in houses constructed with poor quality materials, which in turn affects adequate sanitation. These substandard houses are characterized by lack of good toilet; unsafe water supply and inadequate waste disposal system (see Plate 5. 1 and 5. 3). Those that occupy these dwellings stand a greater risk of being exposed to urinary schistosomiasis. In Utukang II and Okwel-Obudu, for example, 71.0per cent and 63.0per cent of the respondents live in zinc-mud houses respectively. Also, in Ijiman, a high percentage of its inhabitants live in thatch houses, an attribute that is common to almost all other endemic communities. Respondents in households with inadequate housing conditions are more likely to be infected with schistosomiasis due to poor hygiene and sanitation. This result agrees with Ayele *et al's* (2012) work on malaria prevalence and risk factors in Ethiopia who noted that type of house has an influence on the risk of malaria transmission with those houses constructed with poor quality materials having an increased risk. It is notable that out of the 596(100.0per cent) repondents who reported urinary schistosomiasis, over 70per cent of them live in substandard houses and practiced out-door defecation.

In addition, the household waste disposal practices of respondents show that respondents in endemic communities live in homes with poor waste disposal facilities, and improper waste disposal has potential effect on transmission and prevalence of urinary schistosomiasis. Concerning the waste disposal practices of residents in endemic communities, 252(31.6per cent) of the respondents said they dispose their waste in open dumpsite, 90(11.3per cent) of the respondents make use of dumpsters, 230(28.8 percent) of the respondents dispose of their household waste in the river and 133(16.7per cent) of the respondents discard their waste in nearby bush and 9.10 percent do not have any means of disposal and so engage in indiscriminate waste disposal (Table 5.2).

The data indicates that respondents do not have adequate waste disposal systems and this presents a great risk of schistosomiasis transmission. This goes along with the report of WHO (2008) that those who have inadequate sanitation may be using the bucket system, poorly designed local sewerage systems, and poor latrines or unimproved pit toilets. The importance of adequate waste disposal system lies in the reduction of vector contact and spreading of pathogen. Inadequate solid waste collection and limited access to effective waste diposal system create filthy and unsafe habitats that provide favorable conditions for the survival of vectors. The presence of toilet facilities in a house, access to potable water and living in a standard house offer a greater opportunity of not being infected with schistosomiasis, even where the disease is endemic.

5.1.2 DISTANCE AND EXPOSURE TO SCHISTOSOMIASIS

Distance from home to water source affect the use of water and the associated risk. Table 5.3 shows that 602(75.4per cent) respondents live close to the swamp vector environment and 52 (6.5per cent) respondents reside near the river vector source, 106(13.3 per cent) of the respondents reside close to the stream and 28(3.5per cent) near ponds, whereas 10(1.3per cent) do not live near any vector source. Further enquiries to know the approximate distance from home of respondents to the nearest infection source (Table 5.3) revealed that 232(29.1per cent) and 143(17.9per cent) of the respondents live roughly 100 - 400m to the nearest vector source. Also, 265(33.2per cent) and 143 (17.9per cent) of the respondents reside approximately 500 - 800m away from the disease breeding ground. The table further shows that 6(.8per cent) and 7(.9 per cent) of the respondents indicated the distance from their homes to the nearest vector environment to be approximately 900 - 1km and 11/2km - 2km respectively, and only 0.3per cent of the respondents live 2 km to the most proximate water source. The result further demonstrates that a large percentage of the respondents live <1km to the nearest vector environment and this implies increased vulnerability to schistosomiasis infection.

Inhabitants travel a considerable distance for their daily occupation, mostly farming activities. Table 5.3 shows that only 232(29.1per cent) of the respondent’s work

<1km to the nearest source of infection, 258 (32.3per cent) respondents reported that the distance from their place of work to the nearest vector source is 1km - 2km. Also, 159 (19.9 per cent) of the respondents have their work place 3 - 4km to the nearest breeding site and 41 (5.1per cent) of the respondents work approximately 5 - 6km to the most proximate water source. Only 28 (3.5 per cent) and 49(6.1per cent) respondents reported the distance from their places of work to the closest infection source to be 7km - 10km, and 26(3.3per cent) respondents work more than 10km to the disease source. This table indicates that more than half of the respondents had their places of work less than 2 kilometers from the disease breeding ground. This implies that the distance of most respondents from their places of work to the nearest infection source is relatively short, and this is likely the reason for occupational exposure since majority of the inhabitants in endemic communities are farmers. This goes along with the findings of Adebayo (2003) who found that the prevalence of urinary schistosomiasis among farmers who work at irrigation sites in Northern Nigeria decreased with increase in distance from the source of infection. The overall analyses on distance from home and place of work to nearest source of infection have shown that the risk of schistosomiasis infection is highest not only amongst those who live and work close to the vector environments (WHO, 2002) but also amongst the population of those exposed to the vector environment.

Table 5.3: Distance of home and work place and exposure to schistosomiasis

Variable	Categories	Frequency	%
Location of residence in relation to vector environment	Live near vector source	574	71.9
	Do not live near vector source	224	28.1
	Total	**798**	**100.0**
Type of vector environment nearest to respondents' residence	Swamp	602	75.4
	River	52	6.5
	Stream	106	13.3
	Pond	28	3.5
	Others	10	1.3
	Total	**798**	**100.0**
Distance from home to nearest vector source	100m - 200m	232	29.1
	300m - 400m	143	17.9
	500m - 600m	265	33.2
	700m - 800m	143	17.9
	900 m- 1km	6	.8
	11/2km - 2km	7	.9
	>2km	2	.3
	Total	**798**	**100.0**
Distance from place of work to nearest source of infection	<1km	237	29.7
	1km - 2km	258	32.3
	3km - 4km	159	19.9
	5km - 6km	41	5.1
	7km - 8km	28	3.5
	9 km- 10km	49	6.1
	>10km	26	3.3
	Total	**798**	**100.0**

Source: Resaercher's fieldwork, 2013

Distance from community centre to transmission site also plays a major role in the prevalence of the disease. The streams, swamps and river in the study area (See Fig. 1.2: P. 11) which the inhabitants depend on for sustenance provide favourable breeding sites for the snail vectors of urinary schistosomiasis (Etim, 1995). The extent of usage of each water body demonstrates the relationship between distance from community to the water source, owing to the fact that communities rely on water sources which are close to their locations for their daily water needs.

Table 5.4 shows that some of the endemic communities are relatively proximate to swamps, streams and rivers that serve as vector environment and one of them (Adim) was situated right at the bank of the water source (swamp) (plate 4.3). Table 5.4 further provides information on the proportion of persons reporting blood in urine and distance from community centre to nearest infection source. Adim which is located at a distance of 56m from the swamp had a prevalence of 74.5 per cent. Abini community is located 126m from the swamp vector source and had a prevalence of 71.0 per cent. Okwel-Obudu is located at a distance of 400m from the dam vector source and had a prevalence of 81.0 per cent. Ijiman community is located about 207m from the stream, and had a prevalence of 67.0 per cent. Assiga is located at a distance of 241m from the river source and had a prevalence of 76.5 per cent. Utukwang I is located 280m from the swamp vector source. It recorded a prevalence of 78.0 per cent and Utukwang II is located 81m from the stream vector habitat and had a prevalence of 75.0 per cent. These data indicate that some communities are relatively close to rivers, swamps, streams, dams and rice farms that serve as breeding sites for the snail vectors of schistosomiasis.

Table 5.4: Route distance and prevalence of urinary shistosomiasis

Endemic communities	Nearest vector environment	Route distance from community centre to nearest source of infection (m)	proportion of persons reporting blood in urine
Adim	Swamp	56m	74.5
Abini	Swamp	126m	71.0
Ijiman	stream	207m	67.0
Assiga	Rice farm/river	241m	76.5
Okwel-obudu	dam	400m	81.0
Utukwang 1	Swamp/rice farm	80m	78.0
Utukwang 11	stream	280m	75.0

Source: Researcher's Fieldwork, 2013.

Given the relatively close proximity of communities to transmission sites, and the high dependence of communities on these infective water sources for sustenance, the prevalence of urinary schistosomiasis in the area is therefore expected. The data on Table 5.4 was used to determine if distance from community centres to vector environment has any association with the prevalence of schistosomiasis. The Pearson's correlation result in Table 5.5 however shows that distance from community centre to vector environment does not have any significant association with the prevalence of schistosomiasis ($r = -0.361$, $p>0.05$). The strength of the correlation coefficient further implies that there is a weak association between distance and prevalence of schistosomiasis. The negative sign of the correlation coefficient indicates a reduction in the prevalence of schistosomiasis with the increase in distance from community centre to vector environment and vice versa. A possible explanation for this result is that some of the communities have alternative sources of water and therefore use infected sources less frequently (see plate 4.3). This study therefore does not identify distance as a significant determinant of the prevalence of schistosomiasis in endemic communities. This result negate the findings of earlier studies like those of Ernold *et al* (2000) that reported distance from community centre to infection source to be more important in explaining the prevalence of schistosomiasis than socioeconomic factors in Niamey.

Table 5.5: Pearson's correlation between distance from community centre to nearest infection source and proportion of persons reporting blood in urine

Test statistics	Distance	Prevalence of schistosomiasis
Pearson Correlation	1	-0.361*
Sig. (2-tailed)		0.427
N	7	7

***Correlation is insignificant at 5% alpha level** (. (2-tailed)
Source: Researcher's field work, 2013.

5.1.3 MOBILITY AND LEVELS OF EXPOSURE TO VECTOR ENVIRONMENT

Different patterns of mobility lead to disease exposure and population movements have significant implications for schistosomiasis transmission. Information on mobility pattern of respondents and their level of exposure to vector environment is presented in Table 5.6. The table shows that 239 (29.9per cent) of the respondents reported they go to the water source on daily basis, 269 (33.7per cent) of the respondents reported periodic exposure and 290 (36.3per cent) respondents go to the vector environment at the onset of the rainy season. From the table, movement to the infection source during certain seasons seems to be the most dominant mobility pattern responsible for exposure to schistosomiasis in the area. The likely reason may be the predominant rice farming occupation of the people which is usually practiced during the rainy season. Concerning the vector environment frequently contacted by respondents, 108 (13.5per cent) indicated rivers, 577 (72.3per cent) claimed to have frequent contact with swamp, 55 (6.9per cent) regularly go to the stream and 58 (7.3per cent) did not identify any vector environment most frequently contacted. The result shows that majority of the respondents had frequent contact with swamp vector habitat. This is due to the fact that the inhabitants depend on large still water bodies for their essential activities such as sand minig, rice farming and other domestic water activities. In a related study, Ernould *et al* (2000) found the risk of infection to be low in streams, high in rivers and very high in swamps.

Exposure to infective water bodies is a major determinant of schistosomiasis infection. Brief or prolonged exposure as well as sporadic or regular contact with infective water could result in schistosomiasis infection (Leshem, *et al*., 2007). Information on the level of exposure to water sources in Table 5.6 shows that 224(28.1per cent) and 230(28.8per cent) of the respondents reported low and medium exposure to stream respectively and 344(43.1per cent) indicated high exposure to stream. Also, 187 (23.4per cent) of the respondents had low exposure to swamp vector source, whereas 503(63.0per cent) and 108(13.5per cent) reported medium and high swamp water contact respectively. Concerning exposure to river vector source, 340(42.6per cent) reported low level of exposure, 185(23.2per cent) reported medium level and 273(34.2per cent) high level of exposure. From the analysis, it is obvious that too much exposure and close interaction with infective water sources is the likely reason for the prevalence of schistosomiasis in endemic communities. This seems to be true because previous studies such as those by Boadi and Kuitunen (2005), Barbosa, *et al*. (2011), and Barreto (1991) have observed low prevalence of urinary schistosomiasis in areas where there is a decreasing exposure to infective water.

Concerning time spent on exposure activity, 362(45.4per cent) of the respondents spend < 1 hour at the water source, 176(22.1per cent) reported 11/2 hours - 2hours water contact, and only 71(8.9per cent) and 32(4.0per cent) reported prolong exposure of 3hours and above. This indicates that more than half of the respondents had direct contact with infective water for more than an hour and exposure to infective water has a potential effect on level of infection and transmission of urinary schistosomiasis (Leshem, *et al*., 2007). In most endemic communities, prolong exposure to infested water is particularly common among farmers and children in the area. These children often spend more of their time playing and swimming in the river, streams or swamp. For farmars, prolong occupational exposure is the reason for contact with infective water bodies. Some of the community members claimed that it is impossible to avoid contact with potential sources of schistosomiasis because the water source was linked to their livelihood. In a similar study, Bala *et al* (2012) noted that prolong exposure to infective water was a factor aiding schistosomiasis prevalence as the people engaged in farming had the highest infection rate while those that went to the river to fetch water had the lowest infection rate in Northern Nigeria.

Table 5.6: Mobility and levels of exposure risk to vector environment

Variable	Categories	Frequency	%
Movement to Vector environment	Daily	239	29.9
	Periodic	269	33.7
	Seasonal	290	36.3
	Total	798	100.0
Frequently contacted vector environment	None	58	7.3
	River	108	13.5
	Swamp	577	72.3
	stream	55	6.9
	Total	798	100.0
Level of exposure to stream	Low	224	28.1
	Medium	230	28.8
	High	344	43.1
	Total	798	100.0
Level of exposure to swamp	Low	187	23.4
	Medium	503	63.0
	High	108	13.5
	Total	798	100.0
Level of exposure to river	Low	340	42.6
	Medium	185	23.2
	High	273	34.2
	Total	798	100.0
Duration of exposure	<1hr	362	45.4
	1hr	157	19.7
	1 - 2hrs	176	22.1
	3 - 4hrs	71	8.9
	>5hrs	32	4.0
	Total	798	100.0

Source: Reaercher's Fieldwork, 2013

In order to ascertain the relationship between spatio-epidemiological factors and level of exposure to stream, swamp and river vector sources, the canonical Correlation Analysis (CCA) was carried out. Some of the data used for the analysis in the SPSS environment are shown in tables 5.1, 5.2, 5.3 and 5.6 above. Instead of using one level of exposure to stream as the dependent variable (Y), we had three levels of exposure, namely: level of exposure to stream, level of exposure to swamp and level of exposure to river vector souce. These dependent variables were used to generate the three canonical variates used to develop a single model for the study (see Table 5.9). In doing so, the three dependent variables (Ys) were disaggregated. The essence is to see how each variate relates with the independent variables. The independent variables are: age (x_1), distance from home to the nearest source of infection (x_2), distance from place of work to nearest source of infection (x_3), educational attainment (x_4), estimated monthly income (x_5), movement to vector environment (x_6), household waste disposal (x_7), duration of exposure (x_8), household toilet quality (x_9), household water supply (x_{10}) and household residential quality (x_{11}).

These independent variables were used to define the evidence linking demographic and household sanitation factors in relation to exposure. This is important because some of these variables (age, income, education and distance) are self-evident and some (household sanitary facilities) are not, but interact to reinforce behaviours that expose people to the vector environment. The World Health Organization (2002) noted that household sanitation services such as potable water, toilet system, and safe waste disposal among others are all hygiene services that contribute to decreased schistosomiasis morbidity and mortality in endemic areas.

We express the general form of canonical model as

$$Y_1 + Y_2 + Y_3 = X_1 + X_2 + X_3 + \ldots + X_{11} \quad \text{.........eqn(6)}$$

(Metric, nonmetric) (Metric, nonmetric)

The variables chosen to represent these factors are:

Dependent variables (exposure to schistosomiasis vector environment) measures:

Y_1 = Level of exposure to stream

Y_2 = Level of exposure to swamp

Y_3 = Level of exposure to river

While *the independent variables are*:

x_1 = age,

x_2 = distance of home from the nearest source of infection

x_3 = distance from place of work to nearest infection source

x_4 = educational attainment

x_5 = estimated monthly income

x_6 = movement to vector environment

x_7 = household waste disposal

x_8 = duration of exposure

x_9 = household toilet quality

x_{10} = household water supply

x_{11} = household residential quality

Details of the analyses are contained in Tables 5.7 – 5.9 and Appendix v. The results show that three canonical variates are extracted, and each was identified by independent and dependent variables with loadings ≥0.50. The information on Table 5.7 provides alternative tests of significance. The result shows that the tests are significant ($p<0.05$). In addition, Table 5.7 provides information on the ratio of the eigenvalues, which provide relative measure or variance on the importance of the three canonical correlations (otherwise known as canonical roots). The first canonical variate/correlation is more important than others because it explains the highest variance in the data set, followed by the second canonical variate and so on. The result shows that the first canonical variate explains 7.7 per cent (0.278 x 0.278) of the variance in the dependent canonical variable. In the same way, the second canonical variate explains 4.4 per cent (0.210 x 0.210) of the variance on the second dependent canonical variables, while the third canonical variate explains 3.5 per cent of the variance on the third dependent canonical variables.

Table 5.7: Eigenvalues and canonical correlations

Root no.	Eigenvalue	Pct.	Cum. Pct	Canon. Corr	Sq. Cor
1	0.0839	0.5044	0.5044	0.278	0.077
2	0.0462	0.2778	0.7823	0.210	0.044
3	0.0362	0.2177	1.0000	0.187	0.035

Source: Researcher'fieldwork, 2013.

Furthermore, the significance of the F-test in Table 5.8 indicates that the three canonical correlations are significant ($p<0.05$), which implies that the three pairs of canonical variates need to be retained for further discussion. The redundancy index result in Table 5.8 shows that for the first canonical correlation, the independent canonical variable is able to predict 2.4 per cent of the variance in the individual original dependent variables, while the dependent canonical variable is able to predict 30.9 per cent of the variance in the individual original dependent variables. In addition, for the second canonical correlation, the independent canonical variable is able to predict 1.5 per cent of the variance in the individual original dependent variables, while the dependent canonical variable is able to predict 33.3 per cent of the variance in the individual original dependent variables. Lastly, on the third canonical correlation, the independent canonical variable is able to predict 1.3 per cent of the variance in the individual original dependent variables, while the dependent canonical variable was able to predict 35.8 per cent of the variance in the individual original dependent variables (Table 5.8).

In addition, for the dependent canonical variable, the redundancy result for the first dependent canonical correlation shows that the dependent canonical variable is able to predict 0.71 per cent of the variance in the individual original independent variables, while the independent canonical variable is able to predict 9.1 per cent of the variance in the individual original independent variables. For the second dependent canonical correlation, the dependent canonical variable is able to predict 0.40 per cent of the variance in the individual original independent variables, while the independent canonical variable is also able to predict 9.1 per cent of the variance in the individual original independent variables. Lastly, on third dependent canonical correlation, the dependent canonical variable is able to predict 0.29 per cent of the variance in the individual original independent variables, while the independent canonical variable is able to predict 8.3 per cent of the variance in the individual original independent variables. Therefore, the canonical redundancy analysis provides evidence that the first three canonical variables give good and overall prediction of the opposite set of variables, with cumulative proportions being 1.4 and 5.1 per cent respectively (Table 5.8). This perhaps indicates that the first-three second canonical variables constitute the main variables that are related to each other. Thus, the dependent and independent variables are interrelated.

Table 5.8: Canonical redundancy analysis

Canonical Variate	Their own canonical variables		The opposite canonical variables	
	Proportion (%)	**Cum. Proportion (%)**	**Proportion (%)**	**Cum. Proportion (%)**
Dependent				
1	0.3093	0.3093	0.0240	0.0240
2	0.3325	0.6417	0.0147	0.0387
3	0.3583	1.0000	0.0125	0.0512
Independent				
1	0.0914	0.0914	0.0071	0.0071
2	0.0905	0.1819	0.0040	0.0111
3	0.0825	0.2647	0.0029	0.0140

Source: Researcher fieldwork, 2013.

Moreover, canonical loading reflects the variance that an observed variable in one set of variables shares with the canonical score for that set. Thus, canonical loading measures the simple linear correlation between the canonical function (dependent and independent variables) and their respective canonical variates (Hair et al., 1998). The results of canonical loading or canonical structure correlation in Table 5.9 shows that the first linear combination of independent variables loads positively and heavily on household residential quality (0.54), while the first linear combination of dependent variable load negatively and heavily on level to exposure on river (-0.96); this therefore implies that negative correlation exists between household residential quality and level of exposure to river. In essence, the result of the first canonical function/axis shows that household residential quality and level of exposure to river are negatively related; implying that those who live in good houses are less exposed. A plausible explanation for this result is the fact that residential houses in endemic communities are of poor quality and lack sanitary facilities (Plate 5.1), as a result inhabitants depend on the river source proximate to them for recreational and domestic purposes.

Plate 5.1: Thatched houses, note the houses have no sanitary facilities

The inhabitants live in zinc-mud, thatch, bungalow houses not equipped with appropriate sanitary facilities (Plate 5.1 and 5.2), and living in this kind of houses could increase the risk of schistosomiasis infection and transmission. This assertion is similar but differs slightly from earlier work by Gazinelli *et al* (2006) who found place of residence of respondents to be significantly associated with prevalence of schistosomiais; but that the quality of houses was not a significant predictor of the disease in Brazil. The implication of this result is that increased exposure to river would make inhabitants susceptible to schistosomiasis infection and help to maintain the disease at a high prevalence level. But the provision of better houses equipped with sanitary facilities would reduce exposure to the river and thus lessen prevalence rates.

For the second canonical variate, the linear combination of independent variables loaded negatively and heavily on household toilet quality (-0.68), while the second linear combination of dependent variable loaded negatively on level of exposure to stream (-0.53) and positively on level of exposure to swamp (0.84). This means that household toilet quality and level of exposure to stream exhibit a negative correlation, while household toilet quality and level of exposure to swamp also shows an inverse association (Table 5.9). One important factor responsible for this result is the fact that some households have locally improvised toilets (Plate 5.2) where fecal waste is flushed into a sock away, and do not dispose their fecal waste in nearby streams.

Plate 5.2: A locally improvised pour flush toilet in Okwel-Obudu

In some of the endemic communities, the stream water was perceived to be purer than other sources and more suitable for drinking, hence, the level of fecal contamination is relatively minimal. Also, it is taboo to defecate in a stream that serves as a source of water for the community. Similarly, previous studies in West Africa and elsewhere in the world have shown many cases where no schistosomiasis infection or increase in schistosomiasis transmission seems to occur in areas where toilet facilities were either poorly designed or completely absent. On the contrary, Gazinelli *et. al*., (2006) reported risk of schistosomiasis infection to be associated with household latrine in Brazil.

However, an inverse association was detected between household toilet quality and level of exposure to swamp; implying that poor household toilets would increase the risk of exposure to the swamp vector source and vice versa. This result is consistent with the known epidemiology of schistosomiasis, in that transmission of schistosomiasis occurs when there is contact with contaminated water in the absence of proper sanitation and ineffective method of excreta collection. In essence, inadequate household latrines in endemic communities increases the risk of exposure to swamp and subsequent environmental contamination, which inturn, increases transmission rates. Obviously, the presence of toilet facilities at home could reduce out-door defecation which is currently being practised in some of the communities where residents dispose of fecal waste indiscriminately, particularly, in open swamps and nearby bushes, and sometimes downstream (Plate 5.3).

Plate 5.3: A lady covering her nose from the stench of excreta: note the fecal waste drained from an open latrine downstream

This unhygeinic behavior is likely the reason for the increased risk of infection and transmission of schistosomiasis as well as other related water-borne diseases in endemic communities. A similar situation was reported by Barreto, (2010) in his study of geographical and socio-economic factors of schistossomiasis prevalence where subjects from households without a flush or pit toilet and wastewater disposal facilities were found to be more infected with urinary schistosomisis than subjects from households with sanitary facilities in Brazil.

On the third canonical variate (Table 5.9), the linear combination of independent variables loads negatively on distance of place of work from nearest infection source (-0.52), and the third linear combination of dependent variables loads positively on level of exposure to stream (0.85) and on level of exposure to swamp (0.55). This implies that distance of place of work from the nearest infection source and level of exposure to stream and swamp has negative relationship. The nature of associations between these variables reveals that negative correlation exists between distance of place of work from nearest infection source, and level of exposure to stream and swamp. Thus, the result of the third canonical variate indicates that distance from place of work to nearest infection source, on the one hand and level of exposure to stream and swamp on the other, are inversely related. In other words, people near the swamps and streams (which constitute infection sources) are more exposed than those far away.

Table 5.9: Relationships between spatio-epidemiological factors and level of exposure

	Canonical loadings/variates		
Variables	1	2	3
Predictor variables			
Age of respondent	-0.4969	0.0137	-0.1823
Distance from home to nearest infection source	-0.0416	0.1156	0.1242
Distance from place of work to nearest infection source	0.4097	0.3630	-0.5172
Educational attainment	-0.1669	-0.0709	-0.0221
Estimated monthly income	-0.0159	-0.0590	0.3482
Movement to vector environment	0.1853	0.2758	-0.2029
household waste collection	0.3325	0.0389	0.0887
Duration of exposure	-0.0880	0.3673	0.1099
Household toilet quality	0.1581	-0.6828	0.3905
Household water supply	-0.3020	0.4035	0.3552
Household residential quality	0.5408	-0.0070	-0.3645
Criterion variables			
Level of exposure to stream	-0.0297	-0.5317	0.8464
Level of exposure to swamp	0.0076	0.8352	0.5500
Level of exposure to river	-0.9628	0.1311	-0.2364
Canonical correlation coefficient	0.278	0.210	0.044
Eigenvalues	0.0839	0.0462	0.0362
Multivariate tests			
Wilks' Lambda	3.93*		
Pillai's Trace	3.92*		
Hotelling-Lawley Trace	3.93*		
Roy's Greatest Root	5.98*		

[a]Values underlined with canonical loadings ≥0.50 are considered significant

*Significant at 1% confidence level

Source: Researcher fieldwork, 2013.

5.1.4 POPULATION SIZE AND PREVALENCE OF URINARY SHISTOSOMIASIS

Population size of communities affects schistosomiasis prevalence. Table 5.10 provides information on prevalence and the population size of endemic communities. The data shows that Adim has a total population of 19,584 inhabitants and a prevalence of 149 cases. Abini community has a total population of 5,706 persons and a prevalence of 71 cases. Okwel-Obudu, which has up to 8,024 persons, recorded a prevalence of 81 cases of urinary schistosomiasis.

Table 5.10 Population size and prevalence of urinary shistosomiasis

Endemic communities	2012 projected Population of communities (yrs.)	number of persons reporting blood in urine
Adim	19584	149
Abini	5706	71
Ijiman	6481	67
Assiga	5184	75
Okwel-Obudu	8024	81
Utukwang I	8171	78
Utukwang II	5763	75

Source: Researcher's Fieldwork, 2013.

Ijiman community has a total of 6,481 persons and a prevalence of 67 cases. Similarly, Assiga is made up of 5,184 inhabitants and has a prevalence of 75 cases of urinary schistosomiasis. Utukwang I has a total of 8,171 inhabitants and records a prevalence of 78 cases and Utukwang II comprised of 5,763 inhabitants and has a prevalence of 75 cases of urinary schistosomiasis. The Pearson's correlation was used to determine if there is a positive relationship between the number of persons infected with schistosomiasis and population size of endemic communities.

Table 5.11 Relationship between prevalence of schistosomiasis and population size

Variables	Number of persons infected	Population size of communities
Number of persons infected	1	
Population size of communities	0.092*	1

*Correlation is insignificant at the 0.05 level (2-tailed).

Source: Researcher fieldwork, 2013.

The Pearson's correlation result in Table 5.11 shows that the number of persons infected with schistosomiasis has a positive and insignificant association with the population size of endemic communities (r = 0.092, p>0.05). This result suggests that communities with comparatively large population have more prevalence of urinary schistosomiasis than those with smaller population. Although population size of communities does not have significant association with prevalence, yet it shows a positive relationship actually exists even if it is not significant. A similar observation was made by Babatemehin (2005) in north central Nigeria. He found a positive relationship between onchocerciasis prevalence and population size of communities.

CHAPTER SIX

SPATIAL PATTERN OF PERCEPTION OF URINARY SCHISTOSOMIASIS

6.0 INTRODUCTION

Populations vary in their perception of diseases. Perception of illnesses or diseases can be described as individuals shared beliefs, views and traditions concerning illnesses, their causes, symptoms and treatment. Illnesses such as schistosomiasis have been conceptualized differently in traditional beliefs resulting in a range of different interpretations and explanations. The perception of people about causes and ways of contracting schistosomiasis, modes of transmission and symptoms of urinary schistosomiasis can result in different preventive and curative behaviors. This chapter therefore, examines the spatial pattern of people's perception of schistosomiasis. It is particularly concerned with the spatial variation in people's perception of causes and symptoms of schistosomiasis as well as the possible ways in which the disease could be contracted, modes of transmission, schistosomiasis ailments, and the prevention and treatment of schistosomiasis in endemic communities.

6.1 RESPONDENTS KNOWLEDGE ABOUT SCHISTOSOMIASIS

Blood in urine is a well known screening method of schistosomiasis because it reveals the number of individuals potentially carrying eggs of shistosoma haematobium. In essence, self-reported blood in urine gives an approximate estimate of overall prevalence of schistosoma haematobium (WHO, 2002), and it has been established that the disease is endemic in Cross River State. Table 6.1 shows that 579(72.6per cent) of the respondents were aware of blood in urine (urinary schistosomiasis) as a disease of public health concern, and 347(43.5per cent) reported that they knew other household or community members who suffered from the disease. In the same vein, Table 6.1 shows percentatge awareness of urinary schistosomiasis by respondents in endemic communities.

Table 6.1 : Perception of urinary schistosomiasis as a public health disease

Aware of schistosomiasis	Abini No. (%)	Adim No. (%)	Ijiman No. (%)	Utukwang I No.(%)	Utukwang II No.(%)	Okwel-Obudu No. (%)	Assiga No. (%)	Total
Yes	81 (81.0)	139 (69.5)	61 (61.0)	65 (65.0)	75 (75.0)	69 (69.0)	89 (90.8)	579 (72.6)
No	19 (19.0)	61 (30.5)	39 (39.0)	35 (35.0)	25 (25.0)	31 (31.0)	9 (9.2)	219 (27.4)
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 result reveals that knowledge of blood in urine as a disease was highest in Assiga (90.8per cent), followed by Abini (81.0per cent), and Utukang II (75.0per cent), Adim (69.5per cent), Okwel-Obudu (69.0per cent), Utukang I (65.0per cent) and Ijiman (61.0 per cent) in that order. This result indicates that residents had a good knowledge base of the disease. This is because earlier interventions had given them information about the disease. Being cognizant of urinary schistosomiasis as a public health problem may have positive effect on the decision to use preventive measures.

Respondents also reported how they obtained knowledge of urinary schistosomiasis. The analysis is contained in Table 6.2. The result shows that 147(18.4per cent) of the respondents knew of urinary schistosomiasis through a previous intervention programme and 136(17.0per cent) of the respondents gained knowledge of the disease from folklores/oral tradition. This category of persons claimed that urinary schistosomiasis has been in existence since their forefathers settled in the communities. Those who knew about the disease through infected household members were 154(19.3 per cent) and 158(19.8per cent) of the repondents mentioned personal experience. Table 6.2 further reveals that 62(7.8per cent) of the respondents said organized pilot studies in which they participated as subjects was their source of information, 65(8.1per cent) acknowledged that information about schistosomiasis was conveyed to them through health extension workers, 64(8.0per cent) reported awareness campaign as the main source of information, while 12(1.5per cent) heard of the disease through friends and colleagues. This result suggests that respondents gained knowledge of urinary schistosomiasis from different sources. However, it is generally suggested that ignorance coupled with local beliefs about the disease still constitute a serious barrier to adequate knowledge and information flow, hence, its prevalence in endemic communities.

The assessment done on knowledge of schistosomiasis vector source indicates that 278(34.8per cent) of the respondents knew that exposure to stagnant water could result in schistosomisis infection, 232 (29.1per cent) and 69 (8.6per cent) were of the view that contact with slow and fast-moving water respectively constitute risk for schistosomiasis infection and 219(27.4per cent) did not know the suitable breeding site for the snail vectors of schistosomiasis. This finding reveals that majority of the respondents knew the areas where the transmission of urinary schistosomiasis could take place. However, Sangho *et al*., (2000) gave a contradictory report that schistosomiasis habitat was unknown in the area where their study was based.

Table 6.2: Knowledge of schistosomiasis

Perception of schistosomiasis	Categories	Frequency	%
Awareness of schistosommiasis as a public health problem	Aware of blood in urine as a disease of public health concern	579	72.6
	Not aware of blood in urine as disease of public health concern	219	27.4
	Total	**798**	**100**
knowledge of schistosomiasis vector habitat	Stagnant water	278	34.8
	Slow flowing water	232	29.1
	Fast flowing river	69	8.6
	Don't know	219	27.4
	Total	**798**	**100**
	Previous intervention	147	18.4
	Oral traditional/folk	136	17
	Infected members	154	19.3
Source of knowledge/awareness about schistosomiasis	Organized pilot service	62	7.8
	Health extension workers	65	**8.1**
	Awareness campaign	64	8
	Personal	158	19.8
	Others	12	1.5
	Total	**798**	**100**
knowledge of infected household members	Know infected house hold/community member	347	43.5
	Do not know infected household/community member	541	56.5
	Total	**798**	**100**

Source: Researcher's Fieldwork, 2013.

6.2 PERCEPTION OF SIGNS/SYMPTOMS OF SCHISTOSOMIASIS INFECTION

Concerning the symptoms of urinary schistosomisis, WHO (1988) pointed out that from two to 10 weeks of infection, a nonspecific illness with fever, aching, cough, diarrhea, headache, weakness of the body, abdominal pain, exercise intolerance, vomiting blood, joint and muscle pains, loss of appetite, weight loss, nausea, and cough may develop. Later on, passage of blood in the urine is characteristic of infection, but a range of intestinal, liver, kidney, lung or central nervous system problems can ensue. Many serious or chronic cases are the result of the worm ending up in an unusual location such as the brain or spinal cord. The established disease is quite unpleasant and cases of re-infections may occur due to continous exposure.

The assessment done on the length of time symptoms of urinary schistosomiasis are likely to occur after exposure (Table 6.3) shows that 407(51.0per cent) of the respondents stated within one month of water contact, 128(16.0per cent) respondents were of the view that infection may appear within 1 week of exposure, 91(11.4per cent) respondents reported 1-6 days after exposure, and 94(11.8per cent) repondents reported within 2 months of contact and 78 (9.8per cent) respondents mentioned 4 months and above. This result suggests that majority of the respondents could recognize symptoms of infection within one month of exposure. This is in accordance with biomedical practice. This indicates that people who may be victims of the disease could recognize the infection on time and possibly seek for prompt treatment in order to avoid complications associated with the disease.

TABLE 6.3: Perception of schistosomiasis infection

Variable	Categories	Frequency	%
	Within one month	407	51.0
Recognition of blood Urine after water contact	1-6days	91	11.4
	1 week	128	16
	Within 2 months	94	11.8
	Others	78	9.8
	Total	**798**	**100**
	None	324	40.6
	Once	223	27.9
	Twice	133	16.7
Schistosomiasis re-infection	3-4 times	82	10.3
	Others	36	4.5
	Total	**798**	**100**

Source: Researcher's Fieldwork, 2013.

Further information concerning the specific symptoms of schistosomiasis is shown in Fig. 6.1. The figure shows that 126(15.8per cent) of the respondents associated fever with urinary schistosomiasis. Majority 211(26.4per cent) of the respondents indicated pain on urination as a symptom, and others identified skin itching 74(8.4per cent), headache 62(6.8 per cent), weakness of the body 122(15.3 per cent), abdominal pain 51(15.3 per cent), exercise intolerance 3(.3 per cent), vomiting blood 28(2.5 per cent), joint and muscle pains 18(2.3 per cent), loss of appetite 14(1.8 per cent), malaria 17(1.5 per cent), weight loss 13(1.5 per cent), blood in stool 20(2.5 per cent), nausea 6(.8 per cent), cough 10(1.3 per cent) and 23(2.6 per cent) respondents did not have any knowledge of the specific symptoms of the disease. A large proportion of the respondents was aware of the clinical manifestation of urinary schistosomiasis and could identify the infection by specific correct symptoms, in accordance with the biomedical perspective. This implies that residents are well informed of the symptoms of urinary schistosomiasis. On the contrary, Mwanga *et. al.*, (2000) reported perceived symptoms of schistosomiasis to be inconsistent with scientific knowledge and that a number of the study participants found schistosomiasis to be associated with social stigma in Tanzania. The implication of this result is that infected persons in endemic communities could seek for early appropriate and effective treatment in order to avoid adverse conditions in future.

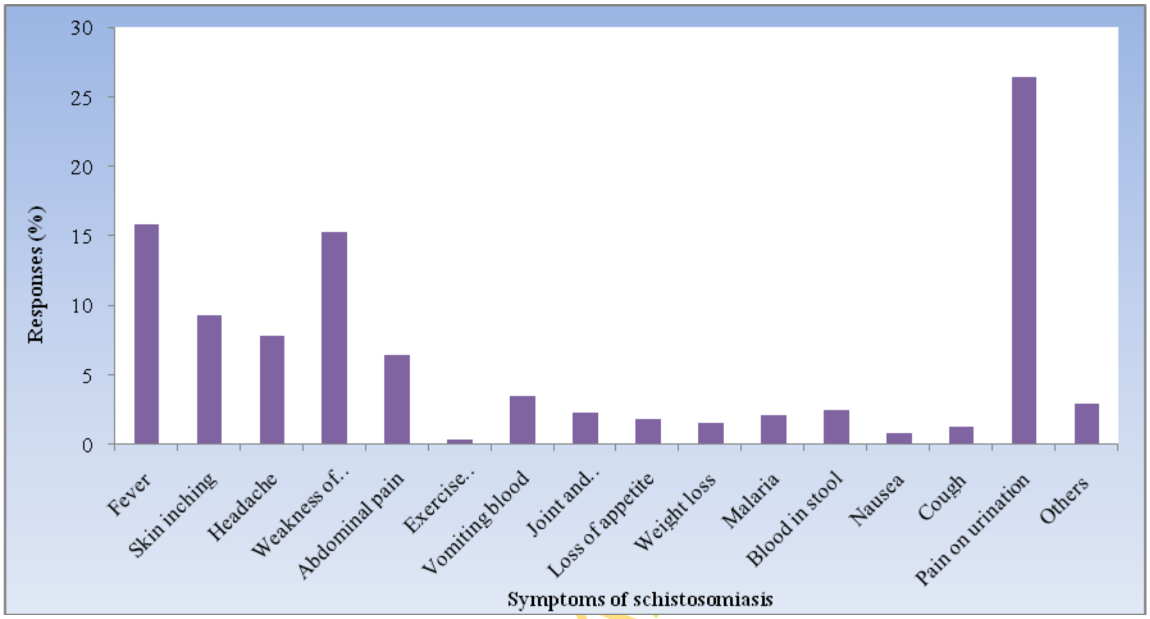

Fig. 6.1: Perception of symptoms of schistosomiasis

6.3: PERCEPTION OF THE CAUSE OF SCHISTOSOMIASIS

The World Health Organization (1993) reported that the parasites that cause schistosomiasis live in certain types of freshwater snails. The infectious forms of the parasite, known as cercariae, emerge from the snail and contaminate water. The cercariae can penetrate human skin and enter our bloodstream. In the bloodstream, they travel through the blood vessels of the lungs and liver, and then to the veins around the bowel and bladder. Some weeks later, the matured worms mate and start producing eggs. These eggs pass through the walls of the bladder and/or intestine and eventually leave the body through urine or feces; and thus the cycle starts again.

Despite the high prevalence of schistosomiasis in endemic communities, there are misconceptions about its cause. Hence, further enquiry to probe into knowledge of the cause of schstosomiasis as contained in Fig. 6.2 shows that only 212(26.6per cent) of the respondents had the correct knowledge of the cause of schistosomiasis by mentioning water worms from snails. Others adduced the cause of the disease to witchcraft 70(8.8per cent), venereal infection 140 (17.5per cent), HIV/AIDs 43(5.4per cent), promiscuity 182(22.8per cent) and 140(17.5per cent) of the respondents attributed blood in urine to be a sign of maturity especially in males which the infected person outgrows. Others representing 11(1.4per cent) of the respondents, did not seem to have any knowledge about the cause of schistosomiasis. Most of the subjects appeared to have no knowledge of the cause of Schistosoma haematobium. Although level of awareness about urinary schistosomiasis as a public health disease was high, it is worrisome to find out that majority of the respondents had a wrong notion about the cause of the disease and this could create a major challenge to the control of the disease. Poor perception of the cause of urinary schistosomiasis could be partly explained by the fact that the disease is frequently seen in endemic communities since the time of their ancestors. Babatemehin (2005) noted that supernatural explanation to health problems could be a great obstacle to effective disease control. It may be much easier to educate those who do not have any knowledge about the disease and those who attribute the cause to biological factors, but it is always very difficult to alter people's cultural belief as seen in the misconception of the cause of schistosomiasis, despite increasing awareness of the disease as a public health problem.

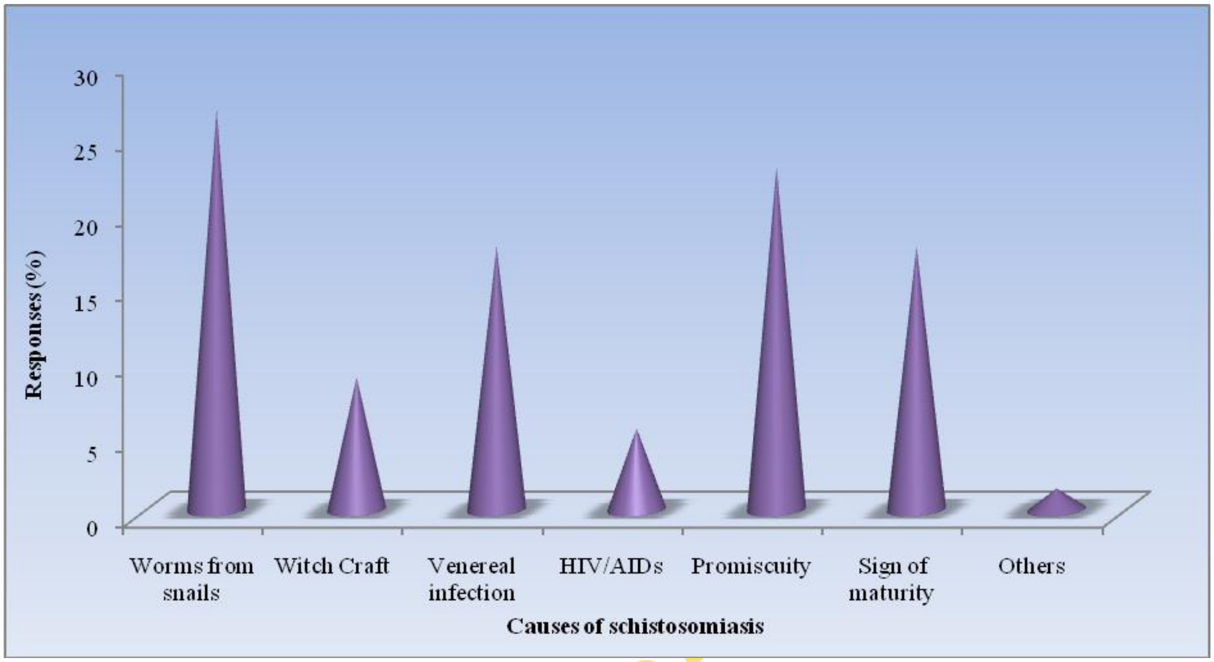

Fig.6.2: Cause of schistosomiasis

Despite the fact that inhabitants are aware of urinary schistosomiasis as an infection, majority still do not have adequate knowledge of the cause of the disease. The study's findings indicate that inhabitants of endemic communities hold multiple inaccurate aetiologies for schistosomiasis. Obviously, this could be due to ignorance and low level of education. Table 6.4 contains details on the spatial pattern of the perceived causes of schistosomiasis in endemic communities. The result shows that there is spatial variation in the perception of the causes of urinary schistosomisis. The result indicates that inhabitants in Adim community more frequently believed that worms from water snails are the cause of schistosomiasis. However, respondents in all the communities explain the cause of the disease the way it appears to them.

From the result, it can be deduced that certain cultural beliefs about the cause of urinary schistosomiasis still persist in some quarters, with responedents in Adim community peaking in the conception that urinary schistosomiasis is caused by worms from water snails, witch craft attack, venereal and HIV/AIDs infection. On the other hand, promiscuity as a cause of urinary schistosomiasis was popular among respondents in Utukang II and respondents in Ijiman, Assiga and Adim more frequently believed that blood in urine is a sign of maturity which the infected person outgrows. Although urinary schistosomiasis is a great public health problem in endemic communities, this result implies that people are yet to understand the cause of the disease. Similar misconceptions about the cause of the disease have been reported in other parts of Nigeria. For instance, the belief that blood in urine is a sign of maturity has been reported by Ejima and Daibo (2010) in the Niger Benue Basin and Useh and Ejezie (1999) pointed out that misconception that blood in urine is suggestive of promiscuity is a popular belief held by people in South South Nigeria. The implication of inadequate knowledge of cause of schistosomiasis is that inhabitants of endemic communities would not know how to protect themselves from infection. Also, they may not be able to take advantage of any intervention aimed at reducing the disease burden.

Table 6.4: Perception of causes of schistosomiasis across communities

Communities	Causes of Schistosomiasis										
	Worms from snails	Witch craft	Venereal infection	HIV/ AIDS	Promiscuity	Sign of maturity	Others	Total	df	χ	Sig.
Abini	57(7.1%)	1(0.1%)	8(1.0%)	2(0.3%)	23(2.9%)	1(0.1%)	8(1.0%)	100			
Adim	74(9.3%)	27(3.4%)	37(4.6%)	14(1.8%)	24(3.0%)	24(3.0%)	0(0.0%)	200	36	238.6	0.001
Ijiman	5(0.6%)	4(0.5%)	26(3.3%)	5(0.6%)	21(2.6%)	37(4.6%)	2(0.3%)	100			
Utukang I	18(2.3%)	15(1.9%)	23(2.9%)	9(1.1%)	19(2.4%)	15(1.9%)	1(0.1%)	100			
Utukang II	17(2.1%)	10(1.3%)	10(1.3%)	6(0.8%)	43(5.4%)	14(1.8%)	0(.0%)	100			
Okwel-Obudu	15(1.9%)	9(1.1%)	24(3.0%)	3(0.4%)	29(3.6%)	20(2.5%)	0(.0%)	100			
Assiga	26(3.3%)	4(0.5%)	12(1.5%)	4(0.4%)	23(2.9%)	29(3.6%)	0(.0%)	98			
Total	**212(26.6%)**	**70(8.8%)**	**140(17.5%)**	**43(5.4%)**	**182(22.8%)**	**140(17.5%)**	**11(100.0%)**	**798**			

Source: Researcher's fieldwork, 2013.

Figure 6.3 indicates that 90(11.3per cent) of the respondents thought that schistosomiasis could be contracted through contact with an infected person, 114(14.3per cent) cited sexual intercourse, 57(7.1per cent) suspected crossing an infected person's urine, 142 (17.8per cent) were aware that contact with vector environment could result in schistosomiasis infection, 195(24.4per cent) and 113(14.2 per cent) were also right by saying staying long in polluted or dirty water and drinking infected water respectively, and 80(10.0 per cent) had no knowledge of how a person could get infected with schistosomiasis, while 8(1.0per cent) gave other reasons such as contact with water snails and blood transfusion. This analysis indicates that 56.2 per cent respondents had adequate knowledge of the easiest ways the disease could be contracted and 43.8 per cent still did not understand the possible ways in which a person could get infected with schistosomiasis. From this result, it means that despite several years of exposure, some inhabitants still do not have appropriate knowledge of how urinary schistosomiasis could be contracted.

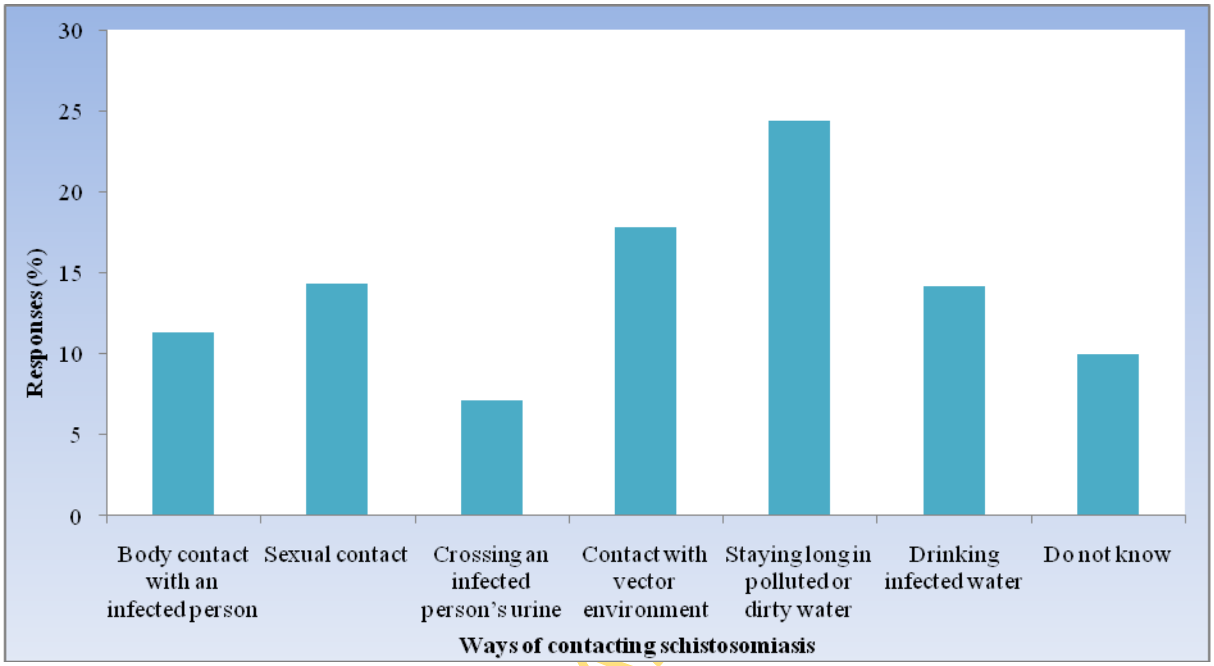

Fig. 6.3: Ways of contacting schistosomiasis

6.4 PERCEPTION OF MODES OF TRANSMISSION OF SCHISTOSOMIASIS

In terms of mode of transmission, transmission of urinary schistosomiasis occurs when an infected person urinates or defecates in water bodies which are used for swimming, drinking, farming, washing or bathing and so on, thereby introducing eggs which hatch into larva that infect snail hosts (WHO, 1993). From Fig. 6.4, 104(13.0per cent) of the respondents think that schistosomiasis is transmitted through mosquito bite, 150(18.8per cent) of the respondents faulted excreta disposal in fresh water, and 153(19.2per cent) respondents mentioned urine disposal in water source by an infected person, whereas 243(30.5per cent) respondents cited excreta and urine disposal in fresh water habitats by an infected person and 140(17.5per cent) do not have any correct knowledge of how the disease can be transmitted. A relatively good number of respondents (68.5 per cent) were able to link modes of transmission of schistosomiasis with excreta and urine disposal in fresh water habitats that constitute water collection points for community members. This result, however, negates the report of Oladejo and Ofoezie (2006) that investigated *Schistosoma. haematobium* endemicity in an eastern Nigerian community and found about 95per cent of the population not to have any knowledge of the modes of transmission and prevention of the disease. Given the level of understanding of the modes of transmission of schistosomiasis and a corresponding increase in prevalence, it seems that inhabitants in endemic communities have not applied themselves to the knowledge gained to cultivate habits that would reduce infection to a lower transmission level.

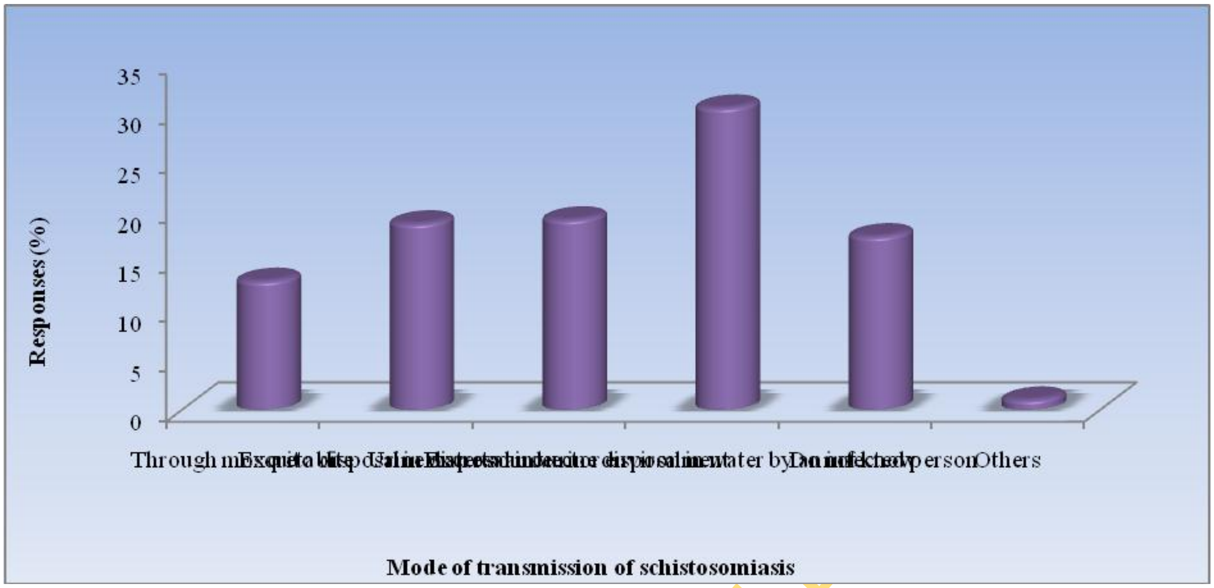

Fig. 6.4: Perception of modes of transmission

Information on the spatial pattern of perception of the modes of transmission of schistosomiasis is contained in Table 6.5. From the table, Adim had the highest percentage of respondents (7.1 per cent) who believed that schistosomiasis was transmitted through mosquito bite and 0.1 per cent of the respondents in Ijiman is the smallest to hold this view. Also, the belief that schistosomiasis is transmitted through excreta disposal into river source only was strogest among respondents 40(5.0 per cent) in Adim community and less so in Abini (0.9 per cent). In the same vein, the idea that urination in water source by an infected person is the only way schistosomiasis can be transmitted was strongest in Abini (5.3 per cent) and weakest in Ijiman 8(1.0 per cent). Also, Utukang II had the highest proportion of respondents 55(6.9 per cent) with the view that schistosomiasis is transmitted through both excreta and urine disposal in water source by an infected person. Respondents (5.3 per cent) in Ijiman took the lead among those that did not have any knowledge about the modes of transmission of schistosomiasis. This result shows that Utukang II community had the highest percentage of respondents with adequate knowledge of the modes of transmission of schistosomiasis compared to other communities, owing to the fact that majority of its inhabitants were able to associate transmission with excreta and urine disposal in water source by an infected person. Also, respondents in Adim more frequently believed that mosquito bites and excreta disposal into river are the commonest means of schistosomiasis transmission.

Table 6.5. Spatial analysis of modes of transmission

communities	perception of modes of transmission Through mosquito bite	Excreta disposal in river source only	Urination into water source only	Both excreta and urine disposal in water source by infected person	Do not know	Others	Total
Abini	7 (0.9%)	7 (0.9%)	42 (5.3%)	16 (2.0%)	24 (3.0%)	4 (0.5%)	100
Adim	57 (7.1%)	40 (5.0%)	37 (4.6%)	41 (5.1%)	24 (3.0%)	1 (0.1%)	200
Ijiman	1 (0.1%)	10 (1.3%)	8 (1.0%)	39 (4.9%)	42 (2.0%)	0 (0.00%)	100
Utukwang I	19 (2.4%)	20 (2.5%)	23 (2.9%)	21 (2.6%)	16 (2.0%)	1 (0.1%)	100
Utukwang II	6 (.8%)	16 (2.0%)	14 (1.8%)	55 (6.9%)	9 (1.1%)	0 (0.00%)	100
Okwel-Obudu	5 (0.6%)	29 (3.6%)	12 (1.5%)	45 (5.6%)	8 (1.0%)	1 (0.1%)	100
Assiga	9 (1.1%)	28 (3.5%)	17 (2.1%)	26 (3.3%)	17 (2.1%)	1 (0.1%)	98
Total							798

Source: Researcher’s fieldwork, 2013.

6.5 PERCEPTION OF SCHISTOSOMIASIS AILMENTS

Schistosomiasis is widespread with a relatively low mortality, but a high morbidity rate (WHO, 1993), causing severe ailments in people in endemic communities. Liver damage, intestinal pains, and kidney damage are some of the advanced cases. Bladder cancer is another possible late-stage complication. In women, the disease may cause genital lesions, vaginal bleeding, and pain during sexual intercourse and nodules in the vulva. In men, urinary schistosomiasis can induce pathology of the seminal vesicles, prostate and other organs. This disease may also have other long-term irreversible consequences, including infertility. In children, schistosomiasis can cause anaemia, diarrhea and a reduced ability to learn, although the effects are usually reversible with treatment. Prolong schistosomiasis infection may affect people's general health and in most severe cases can result in death. Due to the fact that if schistosomiasis is untreated in an infected individual especially at adolescence, it could lead to kiney failure and other chronic and life-threatening conditions at adult stage, attempt was made to probe into respondent's knowledge of the advanced forms of the disease.

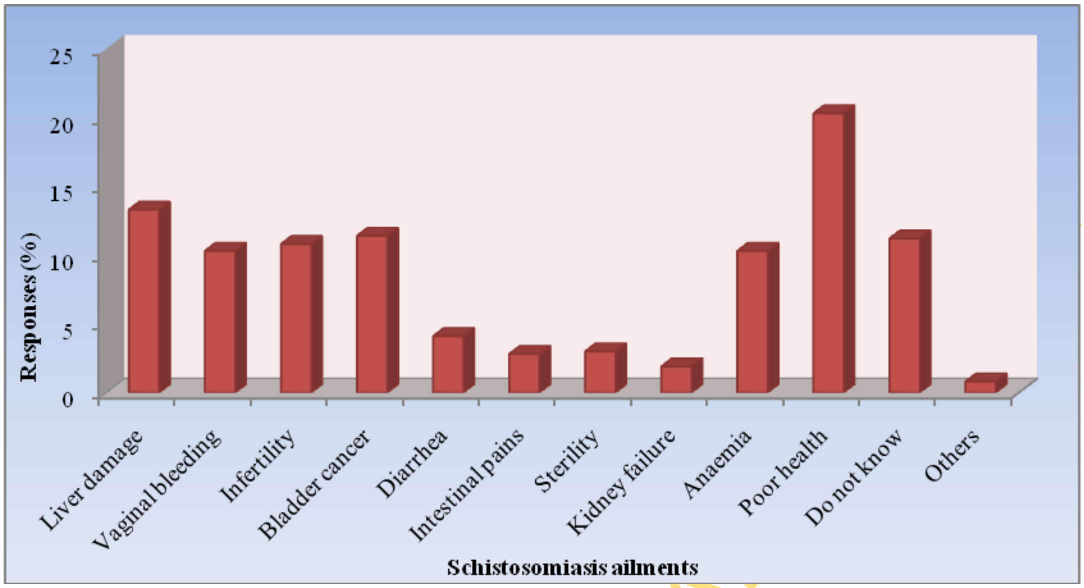

Fig.6.5: Perception of schistosomiasis ailments

The analysis is shown in Fig. 6.5. and the result shows that 106(13.3per cent) of the respondents were aware of liver damage to be a consequence of chronic schistosomiasis, 82(19.2per cent) of the respondents attributed vaginal bleeding to chronic schstosomiasis infection, 86(10.8per cent) and 91(11.4per cent) attributed infertility and bladder cancer to prolonged schistosomiasis infection, 33(4.1per cent) and 22(2.8per cent) of the respondents linked chronic conditions of the disease with diarrhea and intestinal pains respectively, 24(3.0per cent) and 15(1.9per cent) of the respondents opined that sterility and kidney failure were the advanced forms of urinary schistosomiasis respectively. Only 82(10.3per cent) and 162(20.3per cent) of the respondents claimed that anemia and poor health were ailments associated with protracted cases of blood in urine respectively. Others constituting 6(0.8per cent) mentioned other ailments and 89(11.2per cent) did not have any knowledge of schistosomiasis ailments. This result shows that 88.8per cent of the respondents understood specific severe ailments associated with schistosomiasis infection, and only 11.2per cent did not know the ailments that are likely to manifest if the disease remains untreated in an infected person. This result further suggests that a large number of inhabitants of endemic communities have specific information about chronic conditions of the disease. The high level of awareness of schistosomiasis ailments may be due to several years of exposure, and excruciating pains associated with prolonged infection.

Table 6.6: Perception of schiosomiasis ailment in endemic communities

Communities	liver damage	vaginal bleeding	infertility	bladder cancer	diarrhea	intestinal Pains	sterility	kidney failure	aneamia	poor health	do not know	others	total
Abini	10 (1.3%)	5 (0.6%)	5 (0.6%)	16 (2.0%)	2 (0.3%)	4 (0.5%)	3 (0.4%)	2 (0.3%)	4 (0.5%)	40 (5.0%)	7 (0.9%)	2 (0.3%)	100
Adim	66 (0.6%)	28 (3.5%)	13 (1.6%)	21 (2.3%)	7 (0.9%)	10 (1.3%)	4 (0.5%)	2 (03%)	4 (0.5%)	21 (2.6%)	24 (3.0%)	0 (0.00%)	200
Assiga	5 (0.6%)	7 (0.9%)	17 (2.1%)	7 (0.9%)	5 (0.6%)	0 (0.00%)	3 (0.4%)	3 (0.4%)	17 (2.1%)	23 (2.9%)	8 (1.0%)	3 (0.4%)	98
Ijiman	1 (0.1%)	9 (1.1%)	5 (0.6%)	6 (0.8%)	2 (0.3%)	3 (0.4%)	6 (0.8%)	5 (0.6%)	0 (0.00%)	24 (3.0%)	38 (4.8%)	1 (0.1%)	100
Okwel-obudu	6 (0.8%)	7 (0.9%)	10 (1.3%)	19 (2.4%)	5 (0.6%)	2 (0.3%)	2 (0.3%)	0 (0.00%)	28 (3.5%)	21 (2.6%)	0 (0.00%)	0 (0.00%)	100
Utukwang I	13 (1.5%)	19 (2.4%)	21 (2.6%)	10 (1.3%)	4 (0.5%)	1 (0.1%)	3 (0.4%)	3 (0.4%)	3 (0.4%)	15 (1.9%)	8 (1.0%)	0 (0.00%)	100
Utukwang II	5 (0.6%)	7 (0.9%)	15 (1.9%)	12 (1.5%)	8 (1.0%)	2 (0.3%)	3 (0.4%)	0 (0.00%)	26 (3.3%)	18 (2.3%)	4 (0.5%)	0 (0.00%)	100
Total	106 (13.3%)	82 (10.3%)	86 (10.8%)	91 (11.4%)	33 (4.1%)	22 (2.8%)	24 (3.0%)	15 (1.9%)	82 (10.3%)	162 (20.3%)	89 (11.2%)	6 (0.8%)	798

Source: Researcher's Field work, 2013.

Table 6.6 shows spatial pattern of perception of schistosomiasis ailments in endemic communities. The result reveals that Adim 66(8.3per cent) had the highest percentage of respondents who believed that the greatest effect of schistosomiasis is liver damage and only 1(0.1 per cent) respondent in Ijiman community holds this view. As regards vaginal bleeding, Adim had the highest proportion of respondents (3.5 per cent) who hold this view and the smallest number (0.6 per cent) was recorded in Abini. Also, Utukang I community had the most respondents (2.6 per cent) who think that the chronic condition of schistosomiasis is infertility, 5(0.6 per cent) and 5(0.6 per cent) in Abini and Ijiman respectively were the smallest numbers to hold this view. The highest proportion of respondents, constituting 21(2.6 per cent) reported bladder cancer to be the most chronic ailment of schistosomiasi in Adim community and 6(0.8 per cent) in Ijiman. Similarly, out of the 33 (4.1 per cent) respondents who believed that diarrhea ailment is an advanced form of schistosomiasis, 8(1.0 per cent) of the respondents who hold this view were in Utukwang II, whereas 2(0.3 per cent) and 2(0.3 per cent) in Ijiman and Abini respectively. Majority of the respondents 3(0.4 per cent) in Adim community strongly believed that intestinal pain was an outcome of urinary schistosomiasis and only 1(0.1 per cent) respondent in Utukwang I holds this view.

Furthermore, out the 24 (3.0 per cent) respondents who believed sterility is a complication of schistosomiasis, Ijiman had 6(0.8 per cent) and Okwel-Obudu had 2(0.3per cent). Concerning kidney failure as a chronic condition of schistosomiasis infection, Ijiman had the highest proportion of respondents (0.6 per cent), whereas respondents in Adim did not know kidney disorder associated with schistosomiasis. Also, 28(3.5 %) respondents in Okwel-Obudu believed that aneamia is a consequence of prolonged schistosomiasis and 3(0.4 per cent) in Utukwang I hold this view. In Abini, a great majority of the respondents were of the view that poor health condition is a manifestation of severe schistosomiasis infection. The result shows that liver damage, vaginal bleeding, bladder cancer; intestinal pains were the commonly known schistosomiasis ailments in Adim community. In Ijiman, sterility and kidney failure were well-known schistosomiasis ailments. Also, infertility was widely acclaimed to be the outcome of schistosomiasis infection in Utukwang I, and diarrhea was popular in Utukwang II. The belief that anaemia is an adverse condition of schistosomiasis infection was popular in Okwel-Obudu, and Abini community had the greatest proportion of respondents who hold the view that poor health is as a result of schistosomiasis infection. This result has shown that respondents knew the adverse ailments associated with schistosomiasis in endemic communities. The implication of increased awareness of the specific important ailments of schistosomiasis is that people would want to protect themselves against the disease and possibly seek prompt treatment when they are infected.

6.6 PERCEPTION OF PREVENTION OF SCHISTOSOMIASIS

The World Health Organization (2002) disclosed that the best way to prevent schistosomiasis is to avoid contact with infective water in areas where the disease occurs. Although schistosomiasis is not transmitted by drinking contaminated water, if one drinks the water containing the parasites, he/she could become infected. This is because water from swamps, lakes, rivers, streams, or springs may be contaminated with a variety of infectious organisms. In areas where schistosomiasis causes significant disease, preventive efforts should also focus on reducing the number of infections in people (mass treatment) and/or eliminating the snails that maintain the parasite's life cycle. For all species that cause schistosomiasis, improved sanitation could reduce or eliminate transmission of the disease. In some areas with lower transmission levels, elimination of schistosomiasis is likely to be possible through good public health practice. Community perception of prevention and treatment of schistosomiasis could be useful in designing culturally sensitive intervention programmes. Table 6.7 contains data on the perceived ways of preventing schistosomiasis infection.

Table 6.7 Perception of prevention of urinary schistosomiasis

Variables	Categories	Frequency	%
Perception of prevention	Avoid contact with potentially contaminated fresh water	209	26.2
	Avoid excreta/urine disposal in vector environment	154	19.3
	Ownership of household sanitary facilities	49	6.1
	Elimination of water dwelling snails	72	9.0
	Avoid contact with infected person	52	6.5
	Avoid contact with snail vectors	70	8.8
	Water treatment & hygiene	87	10.9
	Do not know	96	12.0
	Others	9	1.1
	Total	**798**	**100.0**

Source: Researcher's field work, 2013

The table shows that 209(26.2 per cent) of the respondents know that schistosomiasis can be prevented by avoiding contact with potentially contaminated fresh water, 154(19.3per cent) of the respondents are of the view that the most efficient form of prevention against schistosomiasis is by avoiding excreta and urine disposal in water sources that serve as water-contact points for community members, 49(6.1per cent) suggested that the presence of household sanitary facilities is a good preventive measure, 72(9.0per cent) believed that elimination of water dwelling snails could be the best prevention against active penetration by the cerceriae, 52(6.5per cent) said it is good to avoid contact with an infected person, 70(8.8per cent) were of the opinion that it is proper to avoid contact with fresh water snails, and 87(10.9per cent) of the respondents prefered water treatment & hygiene. Most of the subjects appeared to have proper knowledge of prevention of urinary schistosomiasis. This result shows that 80.3 per cent of the respondents were aware of the specific methods by which schistosomiais can be prevented. Only 96(12.0per cent) respondents did not know how schistosomiasis infection can be prevented and 10(1.3per cent) believed that nothing can be done to prevent the infection since the parasite is endemic in their communities. To this end, it can be said that given the prevailing belief pattern, the inhabitants of schistosomiasis endemic communities have a good knowledge of schistosomiasis prevention. However, it was observed that despite their knowledge of prevention, no extra effort was made to prevent them from schistosomiasis since their livelihood was linked with the vector environment. Given the level of knowledge of schistosomiasis prevention, one would have expected that inhabitants in endemic communities would reduce engaging in activities that predispose them to schistosomiasis. Nonetheless this finding has important implications for identifying different behavioral factors that influence the use and nonuse of preventative measures in endemic communities.

Table 6.8 shows the spatial pattern of perception of schistosomiasis prevention. An average of 209(26.2 per cent) respondents believed that schistosomiasis can be prevented by avoiding contact with vector environment. However, the highest percentage respondents 71(8.9 per cent) who hold this view are in Adim and the least are in Ijiman (0.3 per cent). Also, knowledge of prevention of schistosomiasis by avoiding excreta and urine disposal in vector environment was highest in Adim (5.8 per cent) and low in Abini

6(0.8 per cent). Moreover, 18(2.3 per cent) respondents in Abini have the strongest belief that the presence of household sanitary facilities is the best way of preventing exposure to schistosomiasis and the weakest 2(0.3 per cent) was recorded in Assiga. Respondents in Assiga 18(25.0per cent) had the strongest belief that elimination of water-dwelling snails was the best means of preventing schistosomiasis infection and respondents in Abini 4(0.5 per cent) had the weakest belief.

Moreover, the highest percentage of respondents 15(1.9 per cent) who believed that prevention against schistosomiasis infection is by avoiding contact with an infected person were in Okwel-Obudu and (0.1 per cent) respondents in Abini were the lowest to hold this view. An average of 70(8.8 per cent) respondents believed that the best way to prevent schistosomiasis infection is by avoiding contact with infective water snails. However, most of the respondents who hold this view are in Assiga 21(2.6 per cent) and respondents in Okwel-Obudu 4(0.5 per cent) and Utukwang II 4(0.5 per cent) were the smallest numbers to hold this view. For those that regard water treatment and hygiene as a means of schistomiasis prevention, 22(2.8per cent) of the respondents in Adim had the strongest belief and the weakest in Utukang I 5(0.6 per cent). The highest percentage of respondents who reported that they did not know the prevention against schistosomiasis was recorded in Ijiman 44(5.5per cent) and the lowest in Utukwang II 4(0.5 per cent).

The result shows that inhabitants of Adim community seem to have adequate knowledge of schistosomiasis prevention compared to other endemic communities owing to the fact that more of its respondents frequently acknowledged that schistosomiasis can be prevented by avoiding contact with vector environment, and by water treatment and hygiene. Similarly, 18(2.3 per cent) of the respondents in Abini strongly believed that schistosomissis can be prevented through the presence of household sanitary facilities only. Elimination of water-dwelling snails as a means of prevention against schistosomiasis infection was a widely held view in Assiga 18(2.3 per cent). In the same vein, 15(1.9 per cent) of the respondents in Okwel-Obudu ranked the highest in the belief that prevention of schistosomiasis infection is by avoiding contact with infective water snails, whereas majority of the respondents in Ijiman (5.5 per cent) did not know the most efficient means of prevention against schistosomiasis. This result indicates that inhabitants were well-informed of how to protect themselves against schistosomiasis. However, knowledge of prevention varies widely among endemic communities.

Table 6.8 Spatial pattern of perception of prevention

Communities	Perception of prevention									
	Avoid contant with vector environment	Avoid excreta/urine disposal in vector environment	Presence of household sanitary facilities	Elimination of water-dwelling snails	Avoid contact with infected person	Avoid contact with infective snails	Water treatment and hygiene	Do not know	Nothing	Total
Abini	40 (5.0%)	6 (0.8%)	18 (2.3%)	4 (0.5%)	1 (0.1%)	8 (1.0%)	12 (1.5%)	11 (1.5%)	0 (0.0%)	100
Adim	71 (8.9%)	46 (5.8%)	11 (1.4%)	10 (1.3%)	7 (0.7%)	16 (2.0%)	22 (2.8%)	17 (2.1%)	0 (0.0%)	200
Ijiman	2 (0.3%)	8 (5.2%)	3 (0.4%)	5 (0.6%)	8 (1.0%)	12 (1.5%)	17 (2.1%)	44 (5.5%)	1 (0.1%)	100
Utukwang I	24 (3.0%)	35 (4.4%)	6 (0.8%)	10 (1.3%)	8 (1.0%)	5 (0.6%)	5 (5.7%)	5 (0.6%)	2 (0.3%)	100
Utukwang II	33 (4.1%)	28 (3.5%)	6 (0.8%)	9 (1.1%)	5 (0.6%)	4 (0.5%)	8 (1.0%)	4 (0.5%)	3 (0.4%)	100
Okwel-Obudu	26 (3.3%)	21 (2.6%)	3 (0.4%)	16 (2.0%)	15 (1.9%)	4 (0.5%)	8 (1.0%)	5 (0.0%)	2 (0.0%)	100
Assiga	13 (1.6%)	10 (1.3%)	2 (0.8%)	18 (2.3%)	8 (1.0%)	21 (2.6%)	15 (1.9%)	10 (1.3%)	1 (0.1%)	98
Total	209 (26.2%)	154 (19.3%)	49 (6.1%)	72 (9.0%)	52 (6.5%)	70 (8.8%))	37 (10.9%))	96 (12.0%)	9 (1.0%)	798

Source: Researcher's Fieldwork, 2013

The findings of the study indicate that inhabitants in endemic communities understand best practices by which schistosomiasis infection can be minimzed; however, considering the number of persons who reported blood in urine in endemic communities, it appears that knowledge of disease prevention is not made use of. The fact that several respondents of the study indicated they knew the means of preventing schistosomiasis, and yet did not use preventative means to protect themselves suggests either a lack of alternative means of sustenance or lack of capacity to cope with the disease. A similar observation was made by Gazzinelli *et al*. (1998) that although the majority of the inhabitants in Brazil where their study was based related transmission to infective water, they did not take any prompt action to prevent against infection since their sustenance was highly dependent on activities that were directly related to water. At present, it could be argued that the prevention of schistosomiasis is not possible, given the fact that inhabitants in endemic communities depend on schistosomiasis infested water for their livelihood. For now, in Cross River State, there is no concerted effort directed towards reducing man-vector contact in endemic communities; but currently, effort is directed towards treating infected school-age children in order to reduce the parasite load in the body and the burden of the disease.

6.7 PERCEPTION OF TREATMENT OF SCHISTOSOMIASIS

Schistosomiasis ailments are many and varied, depending on the sex and age of the patient. Apart from praziquantel that has been developed for the treatment of the disease, inhabitants in endemic communities use traditional means of treating schistosomiasis ailments. For now, there is no widely acclaimed herbal or traditional drug that can be used for the effective treatment of the disease. At present, praziquantel is the only safe and effective drug used during mass treatment for treating urinary schistosomiasis. The drug is taken for 1-2 days to treat infections caused by all schistosoma species. Cognitive representations of schistosomiasis in most local communities is based on common sense, and since patients are not experts, their ideas and perception of treatment of schistosomiasis are based on their own experience, self-knowledge and other sources. People's perception of schistosomiasis affects their health-seeking behavior and the number of persons living with the disease. Hence, perception of treatments for the ten schistosomiasis ailments was explored (Table 6.9).

Table 6.9 Perception of treatment of schistosomiasis ailments

Variable	Category	Frequency	%
Perception of treatment of liver damage	Orthodox treatment	313	39.2
	Traditional treatment	149	18.7
	Orthodox/traditional treatment	136	17.0
	Do not know	190	23.8
	Nothing	10	1.3
	Total	**798**	**100.0**
Perception of treatment of vaginal bleeding	Orthodox treatment	326	40.9
	Traditional treatment	192	24.1
	Orthodox/traditional treatment	133	16.7
	Do not know	137	17.2
	Nothing	10	1.3
	Total	**798**	**100.0**
Perception of treatment of infertility	Orthodox treatment	250	31.3
	Traditional treatment	255	32.0
	Orthodox/traditional treatment	143	17.9
	Do not know	134	16.8
	Nothing	16	2.0
	Total	**798**	**100.0**
Perception of treatment of bladder cancer	Orthodox treatment	322	40.4
	Traditional treatment	200	25.1
	Orthodox/traditional treatment	114	14.3
	Do not know	150	18.8
	Nothing	12	1.5
	Total	**798**	**100.0**
Perception of treatment of diarrhea	Orthodox treatment	276	34.6
	Traditional treatment	222	27.8
	Orthodox/traditional treatment	99	12.4
	Do not know	178	22.3
	Nothing	23	2.9
	Total	**798**	**100.0**
Perception of treatment of intestinal pains	Orthodox treatment	343	43.0
	Traditional treatment	183	22.9
	Orthodox/traditional treatment	103	12.9
	Do not know	131	16.4
	Nothing	38	4.8
	Total	**798**	**100.0**
Perception of treatment of sterility	Orthodox treatment	285	35.7
	Traditional treatment	197	24.7
	Orthodox/traditional treatment	139	17.4
	Do not know	162	20.3
	Nothing	15	1.9
	Total	**798**	**100.0**
Perception of treatment of kidney failure	Orthodox treatment	293	36.7
	Traditional treatment	225	28.2
	Orthodox/traditional treatment	133	16.7
	Do not know	129	16.2
	Nothing	18	2.3
	Total	**798**	**100.0**
Perception of treatment of Anemia	Orthodox treatment	327	41.0
	Traditional treatment	198	24.8
	Orthodox/traditional treatment	106	13.3
	Do not know	149	18.7
	Nothing	18	2.3
	Total	**798**	**100.0**
Perception of treatment of poor health	Orthodox treatment	257	32.2
	Traditional treatment	213	26.7
	Orthodox/traditional treatment	168	21.1
	Do not know	133	16.7
	Nothing	27	3.4
	Total	**798**	**100.0**

Source: Researcher's fieldwork, 2013

The table shows that 313(39.2per cent) of the respondents belief in orthodox medicine for treatment of liver damage, 149(18.7per cent) said that the use of traditional medicine produces the desired results, whereas 136(17.0per cent) reported that they believed in combining both orthodox and traditional treatment and 190(23.8per cent) of the respondents did not know how liver damage can be treated. The data also shows that 326(40.9per cent) of the respondents believed in orthodox medication for the treatment of vaginal bleeding, 192(24.1per cent) had absolute belief in traditional medicine, and 133 (16.7per cent) believe in a combination of orthodox and traditional treatment and 137 (17.2per cent) respondents do not know the appropriate treatment for vaginal bleeding. Concerning the treatment of infertility, 250(31.3per cent) of the respondents believed in the efficacy of orthodox medicine, 255 (32.0per cent) thought that traditional medication could produce the desired result, 143(17.9per cent) believed in the combination of both orthodox and traditional medicine and 137(17.2per cent) of the respondents do not know how infertility can be treated.

Furthermore, 322(40.4per cent) of the respondents were of the view that bladder cancer could be treated with orthodox medicine. The respondents that had a feeling that traditional medicine could be the best means of treating bladder cancer accounted for 200(25.1per cent), whereas 114(14.3per cent) of the respondents considered orthodox and traditional treatment, and 150(18.8per cent) respondents do not know the correct treatment for bladder cancer. The analysis further shows that 276(34.6per cent) of the respondents were of the opinion that orthodox medicine could be the most effective means for the treatment of diarrhea. Those that had strong belief in traditional medicine for the treatment of diarrhea account for 222(27.8per cent) and 99(12.4per cent) of the respondents prefer orthodox and traditional care, while only 178(22.3per cent) of the respondents did not know any treatment for diarrhea.

Table 6.9 also shows that 343(43.0per cent) of the respondents believed in the use of orthodox medicine for the treatment of intestinal pains, 183(22.9per cent) respondents believe in traditional care, 103(12.9per cent) prefer to combine both orthodox and traditional medication and 131(16.4per cent) do not have accurate knowledge of the treatment of intestinal pains. For those that regard sterility as a consequence of schistosomiasis infection, 285(35.7per cent) of believe that the ailment can be treated by orthodox means, 197(24.7per cent) have strong belief in traditional medicine, 139(17.4per cent) think that the combination of orthodox and traditional treatment can produce the expected health outcome and 162(20.3per cent) do not know appropriate treatment for sterility.

For the treatment of kidney failure, 293(36.7per cent) respondents use orthodox treatment, respondents that strongly believe in the efficacy of traditional medicine account for 225(28.2per cent), 133(16.7per cent) of the respondents prefer to combine both orthodox and traditional medicine and 129(16.2per cent) respondents do not know how kidney failure can be treated. The result further shows that 327(41.0per cent) of the respondents believed that orthodox medication is the most effective means of treating anemia, 198(24.8per cent) respondents strongly believe that traditional treatment of anemia would produce the desired health outcome, 106(13.3per cent) consider both orthodox and traditional medication and, 149(18.7per cent) did not know how anemia can be treated. With respect to the treatment of poor health, 257(32.2per cent) respondents strongly believe in the efficacy of orthodox medical care, 213(26.7per cent) prefer traditional medicine, 168(21.1per cent) prescribe a combinination of both orthodox and traditional care and 133(16.7per cent) respondents did not know how poor health can be medically handled.

The findings of the study on the perception of treatment of schistosomiasis show that majority of the inhabitants in endemic communities believe in the efficacy of othordox medicine. Others use local herbs together with conventional medicine. Interview with a key informant in Adim community reveals that in the case of modern medicine, infected persons are treated with praziquental during mass drug administration or buy the drug from patent medicine dealers or drug vendors. A similar situation was reported in other communities where patent medicine dealers find endemic communities as suitable locales for business. For some of the respondents, herbal medication was used during the early stages of infection before using modern medicine when complications develop. A similar observation was made in Tanzania where Kumbuti (2007) reported that the inhabitants use herbs as the first treatment or purchase the tablets from shops before visiting the formal health sector if the previous treatment had not produced the expected results.

Tables 6.9 (i) – (x) present the perceived treatment options in the different communities. Table 6.9(i) shows the spatial pattern of perception of treatment of liver damage. The table reveals that Adim (68.5 per cent) has the highest percentage of respondents who believed in the use of orthodox medicine for the treatment of liver damage, and respondents in Ijiman (2.0 per cent) have the lowest percent to hold this view. The belief in the use of traditional medicine in treating liver damage was strongest in Okwel-Obudu (33.0 per cent) and weakest in Abini (11.0 per cent). Although majority of the respondents in Ijiman (39.0 per cent) believed in the combination of orthodox and traditional medicine in the treatment of liver damage, 43.0 per cent of them (respondents in Ijiman) do not know the appropriate treatment for liver damage, and 3.0 per cent of the respondents in Utukwang believed that nothing can be done.

Table 6.9(i): Spatial pattern of perception of treatment of liver damage

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	38	38.0	137	68.5	2	2.0	27	27.0	36	36.0	16	16.0	57	58.2
Traditional treatment	11	11.0	21	10.5	15	15.0	28	28.0	31	31.0	33	33.0	10	10.2
Orthodox/traditional treatment	21	21.0	8	4.0	39	39.0	19	19.0	6	6.0	31	31.0	12	12.2
Don't know	29	29.0	31	15.5	43	43.0	23	23.0	25	25.0	20	20.0	19	19.4
Nothing	1	1.0	3	1.5	1	1.0	3	3.0	2	2.0	0	0	0	0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researchers Field Work, 2014.

Table 6.9(ii) shows the pattern of perception of treatment of vaginal bleeding in endemic communities. It reveals that Adim (55.5 per cent) has the highest percentage of respondents who believed in the use of orthodox medicine for the treatment of vaginal bleeding and 1.0 per cent respondents in Ijiman is the smallest to hold this view. Concerning traditional treatment of vaginal bleeding, Utukwang II (44.0 per cent) has the highest proportion of respondents and the lowest are respondents in Assiga (13.3 per cent). Ijiman (40.0 per cent) has the largest percentage of respondents who believed in orthodox and traditional treatment of vaginal bleeding and the smallest number is in Utukwang II (8.0 per cent). Majority (37.0 per cent) of the respondents in Ijiman do not know the most effective treatment of vaginal bleeding and 3.0 per cent in Utukwang I believed that nothing can be done to effectively tackle the disease. This category of persons has poor information about the treatment of the ailment and this calls for more health education in the area.

Table 6.9(ii): Spatial pattern of perception of treatment of vaginal bleeding

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	39	39.0	111	55.5	1	1.0	41	41.0	36	36.0	45	45.0	53	54.1
Traditional treatment	18	18.0	32	16.0	21	21.0	33	33.0	44	44.0	31	31.0	13	13.3
Orthodox/traditional treatment	15	15.0	24	12.0	40	40.0	13	13.0	8	8.0	20	20.0	13	13.3
Don't know	27	27.0	30	15.0	37	37.0	10	10.0	11	11.0	3	3.0	19	19.4
Nothing	1	1.0	3	1.5	1	1.0	3	3.0	1	1.0	1	1.0	0	0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013

Table 6.9(iii) shows the pattern of perception of treatment of infertility in endemic communities. It reveals that Adim (47.5 per cent) has the highest percentage of respondents who believed in the use of orthodox medicine for the treatment of infertility and respondents in Ijiman (5.0 per cent) have the lowest percent to hold this view. The strongest belief in traditional medicine for the treatment of infertility was recorded in Okwel-Obudu (64.0 per cent) and the weakest in Adim (14.5 per cent). However, Ijiman (30.0 per cent) has the largest number of respondents who believed in orthodox and traditional treatments of infertility; the smallest number is in Utukwang II (8.0 per cent). A large percentage of 43.0 respondents in Ijiman do not know the correct treatment for infertility, and only 3.5 percent of them in Adim strongly believed that nothing can be done to cure the disease.

Table 6.9(iii): Spatial pattern of perception of treatment of infertility

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Orthodox treatment	41	41.0	95	47.5	5	5.0	23	23.0	27	27.0	17	17.0	42	42.9
Traditional treatment	21	21.0	29	14.5	20	20.0	50	50.0	51	51.0	64	64.0	20	20.4
Orthodox/traditional treatment	16	16.0	40	20.0	30	30.0	17	17.0	8	8.0	13	13.0	19	19.4
Don't know	20	20.0	29	14.5	43	43.0	7	7.0	13	13.0	5	5.0	17	17.3
Nothing	2	2.0	7	3.5	2	2.0	3	3.0	1	1.0	1	1.0	0	0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013.

Table 6.9(iv) shows the spatial pattern of perception of treatment of bladder cancer. The table shows that Assigha (55.1 per cent) has the highest percentage of respondents who believed in the use of orthodox medicine for the treatment of bladder cancer and 5.0 per cent of respondents in Ijiman is the lowest to hold this view. Belief in the use of traditional medicine for the treatment of bladder cancer was strongest among respondents in Okwel-Obudu (51.0 per cent) and less so in Abini (5.0 per cent). However, Ijiman (26.0 per cent) has the highest percentage of respondents who believed in orthodox and traditional treatments of bladder cancer, and 6.0 per cent of respondents in Utukwang II is the smallest to hold this view. Also, 43.0 percent of the respondents in Ijiman do not know the correct treatment for bladder cancer, and 4.0 percent respondents in Utukwang I strongly believed that nothing can be done to successfully treat the disease.

Table 6.9(iv): Spatial pattern of perception of treatment of bladder cancer

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Orthodox treatment	48	48.0	100	50.0	5	5.0	39	39.0	39	39.0	37	37.0	54	55.1
Traditional treatment	5	5.0	27	13.5	25	25.0	32	32.0	43	43.0	51	51.0	17	17.3
Orthodox/traditional treatment	22	22.0	26	13.0	26	26.0	13	13.0	6	6.0	11	11.0	10	10.2
Don't know	24	24.0	43	21.5	43	43.0	12	12.0	10	10.0	1	1.0	17	17.3
Nothing	1	1.0	4	2.0	1	1.0	4	4.0	2	2.0	0	0	0	0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013

Table 6.9(v) provides information on the spatial pattern of perception of treatment of diarrhoea. The data show that majority (48.1 per cent) of the respondents in Adim believed in modern treatment of diarrhea and 5.0 per cent of respondents in Ijiman is the smallest to hold this view. With ragards to the traditional means of treating diarrhea, 56.0 per cent of the respondents in Okwel-Obudu had the strongest belief, and the weakest is Abini (4.0 per cent). Ijiman (27.0 per cent) has the largest number of respondents who prefer to combine both orthodox and traditional medicine for the treatment of diarrhea; Abini (8.0 per cent) and Okwel-Obudu (8.0 per cent) have the lowest percent to hold this view. Also, the highest percentage (46.0) of the respondents in Abini do not know the treatment for diarrhea and 6.5 per cent of the respondents in Adim strongly believed that nothing can be done to treat the illness successfully.

Table 6.9(v): Spatial pattern of perception of treatment of diarrhea

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Orthodox treatment	38	38.0	96	48.0	5	5.0	32	32.0	34	34.0	29	29.0	42	42.9
Traditional treatment	4	4.0	40	20.0	24	24.0	38	38.0	35	35.0	56	56.0	25	25.5
Orthodox/traditional treatment	8	8.0	21	10.5	27	27.0	12	12.0	13	13.0	8	8.0	10	10.2
Don't know	46	46.0	30	15.0	43	43.0	15	15.0	17	17.0	7	7.0	20	20.4
Nothing	4	4.0	13	6.5	1	1.0	3	3.0	1	1.0	0	0	1	1.0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013

Table 6.9(vi) provides information on the pattern of perception of treatment of intestinal pains in endemic communities. It reveals that Assiga (59.2 per cent) has the largest number of respondents who believed in the use of orthodox medicine for the treatment of intestinal pains and respondents in Ijiman (5.0 per cent) have the lowest percent to hold this view. Respondents in Okwel-Obudu (44.0 per cent) have the strongest belief in the use of traditional medicine in treating intestinal pains and less so in Adim (3.0 per cent). However, Ijiman (32.0 per cent) has the highest percentage of respondents who prefer to combine orthodox and traditional medicine in treating intestinal pains and respondents in Utukwang II (7.0 per cent) have the lowest percent to hold this view. Also, majority (45.0 per cent) of the respondents in Ijiman do not have any knowledge of effective treatment for intestinal pains, and 11.0 percent respondents in Abini strongly believed that nothing can be done to tackle the ailment.

Table 6. 9(vi): Spatial pattern of perception of treatment of intestinal pains

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	52	52.0	106	53.0	5	5.0	32	32.0	44	44.0	46	46.0	58	59.2
Traditional treatment	3	3.0	27	13.5	17	17.0	37	37.0	40	40.0	44	44.0	15	15.3
Orthodox/traditional treatment	14	14.0	27	13.5	32	32.0	8	8.0	6	6.0	7	7.0	9	9.2
Don't know	20	20.0	24	12.0	45	45.0	17	17.0	9	9.0	2	2.0	14	14.3
Nothing	11	11.0	16	8.0	1	1.0	6	6.0	1	1.0	1	1.0	2	2.0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013

Table 6.9(vii) shows the spatial pattern of perception of treating sterility. The data reveal that Adim (51.0 per cent) and Assiga (51.0 per cent) have the largest proportion of respondents who prefer orthodox treatment of sterility, and the smallest number of respondents (3.0 per cent) is in Ijiman. Utukwang II (43.0 per cent) has the highest respondents who believed in traditional treatment of sterility, and 14.3 per cent of respondents in Assiga is the smallest number to hold this view. Similarly, Ijiman (33.0 per cent) has the highest percentage of respondents who believed that the combination of orthodox and traditional medicine in the treatment of sterility would bring the desired results. Respondents in Assiga (10.2 per cent) have the lowest percent to hold this view. Meanwhile, many of the respondents in Ijiman (47.0 per cent) do not know the right therapy for sterility, whereas 3.5 per cent in Adim had the strongest belief that nothing can be done treat the disease. This result suggests that advocacy on the appropriate treatment of sterility should focus more in Ijiman.

Table 6.9(vii): Spatial pattern of perception of treatment of sterility

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	36	36.0	102	51.0	3	3.0	30	30.0	33	33.0	31	31.0	50	51.0
Traditional treatment	19	19.0	27	13.5	15	15.0	40	40.0	43	43.0	39	39.0	14	14.3
Orthodox/traditional treatment	15	15.0	29	14.5	33	33.0	15	15.0	11	11.0	26	26.0	10	10.2
Don't know	30	30.0	35	17.5	47	47.0	12	12.0	11	11.0	4	4.0	23	23.5
Nothing	0	0	7	3.5	2	2.0	3	3.0	2	2.0	0	0	1	1.0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013

Table 6.9(viii) concerns the pattern of perception of treatment of kidney failure in endemic communities. The analysis reveals that majority of the respondents in Abini (64.0 per cent) prefer orthodox means of treating kidney failure, and respondents in Ijiman (2.0 per cent) have the lowest percent to hold this view. Respondents in Okwel-Obudu (56.0 per cent) have the strongest belief in the use of traditional medicine in treating kidney failure, and 6.0 per cent of the respondents in Abini are the lowest to hold this view. However, Ijiman (32.0 per cent) has the highest percentage of respondents who prefer orthodox and herbal medication in the treatment of kidney failure, and respondents in Abini (7.0 per cent) have the lowest percent to hold this view. Also, a large number of respondents in Ijiman (30.0 per cent) do not have adequate knowledge of treatment of kidney failure and only 4.5 percent of the respondents in Abini strongly believed that nothing can be done to cure the ailment.

Table 6.9(viii): Spatial pattern of perception of treatment of kidney failure

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	64	64.0	102	51.0	2	2.0	24	24.0	30	30.0	25	25.0	46	46.9
Traditional treatment	6	6.0	26	13.0	32	32.0	45	45.0	40	40.0	56	56.0	20	20.4
Orthodox/traditional treatment	7	7.0	32	16.0	34	34.0	14	14.0	15	15.0	18	18.0	13	13.3
Don't know	21	21.0	31	15.5	30	30.0	14	14.0	14	14.0	1	1.0	18	18.4
Nothing	2	2.0	9	4.5	2	2.0	3	3.0	1	1.0	0	0	1	1.0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013

Table 6.9(ix) shows the spatial pattern of perception of treatment of anemia. The table reveals that Abini (51.0 per cent) has the highest percentage of respondents who believed in the use of orthodox medicine for the treatment of anemia and respondents in Ijiman (3.0 per cent) have the lowest percent to hold this view. In Okwel-Obudu, 45.0 per cent of the respondents have very strong belief in the use of traditional medicine in treating anemia and 17.0 per cent respondents have the lowest to hold this view in Ijiman. Majority of the respondents in Ijiman (34.0 per cent) believed in the combination of orthodox and traditional medicine in the treatment of anemia but 45.0 per cent do not know the appropriate treatment of the disease and 4.5 per cent in Adim believed that nothing can be done.

Table 6.9(ix): Spatial pattern of perception of treatment of anemia

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	51	51.0	103	51.5	3	3.0	38	38.0	36	36.0	43	43.0	53	54.1
Traditional treatment	20	20.0	24	12.0	17	17.0	37	37.0	45	45.0	39	39.0	16	16.3
Orthodox/traditional treatment	10	10.0	26	13.0	34	34.0	7	7.0	6	6.0	15	15.0	8	8.2
Don't know	16	16.0	38	19.0	45	45.0	14	14.0	12	12.0	3	3.0	21	21.4
Nothing	3	3.0	9	4.5	1	1.0	4	4.0	1	1.0	0	0	0	0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher's fieldwork, 2013.

Table 6.9(x) sets out the pattern of perception of treatment of poor health in endemic communities. It reveals that Adim (49.0 per cent) has the highest number of respondents who believed in the use of orthodox medicine for the treatment of poor health, and respondents in Ijiman (2.0 per cent) have the lowest percent to hold this view. Many of the respondents in Okwel-Obudu (54.0 per cent) have stronge belief in the use of traditional medicine in treating poor health and only 4.0 per cent of the respondents in Abini hold this view. However, majority (40.0 per cent) of the respondents in Abini prefer to combine orthodox and traditional medicine in treating poor health and respondents in Utukwang II (12.0 per cent) have the lowest percent to hold this view. Also, 42.0 per cent of the respondents in Ijiman do not have any knowledge of effective treatment of poor health, and 5.5 percent in Adim strongly believed that nothing can be done to tackle the ailment.

Table 6.9(x): Spatial pattern of perception of poor health

Category	Communities													
	Abini		Adim		Ijiman		Utukwang I		Utukwang II		Okwel-Obudu		Assiga	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Orthodox treatment	35	35.0	98	49.0	2	2.0	27	27.0	21	21.0	27	27.0	47	48.0
Traditional treatment	4	4.0	26	13.0	16	16.0	46	46.0	50	50.0	54	54.0	17	17.3
Orthodox/traditional treatment	40	40.0	32	16.0	38	38.0	15	15.0	12	12.0	15	15.0	16	16.3
Don’t know	15	15.0	33	16.5	42	42.0	8	8.0	15	15.0	4	4.0	16	16.3
Nothing	6	6.0	11	5.5	2	2.0	4	4.0	2	2.0	0	0	2	2.0
Total	**100**	**100.0**	**200**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**100**	**100.0**	**98**	**100.0**

Source: Researcher’s Fieldwork, 2013

The analysis shows that there are variations in the perceptions of treatment of urinary schistosomiasis, relfecting the different ways people understand the ailments in endemic communities. For instance, the people of Adim more frequently utilize orthodox medicine in treating liver damage, vaginal bleeding, infertility, diarrhea, sterility and poor health. Meanwhil, Assiga is the leading community in preferring modern medicine in treating bladder cancer, intestinal pains and sterility. Also, Abini has the largest number of respondents with the strongest belief in the use of orthodox medicine in treating anemia and kidney failure. In terms of traditional medication, respondents in Okwel-Obudu strongly believed in its efficacy for the treatment of a number of schistosomiasis ailments such as liver damage, infertility, bladder cancer, diarrhea, intestinal pains, kidney failure and anemia. In the same vein, Utukwang II is well-known in the use of traditional medicine in treating vaginal bleeding and sterility only. For those that combine both orthodox and traditional medicine in treating schistosomiasis ailments, Ijiman takes the lead in all the ailments, with the exception of poor health in Abini.

The prevailing pattern of treatment of schistosomiasis ailments shows that there are differences in the perception of treatment of urinary schistosomiasis in endemic communities. Notwithstanding, there is a discernible pattern across the state in the use of modern medicine, on the one hand, and a combination of herbal and orthodox medicine in treating schistosomiasis ailments, on the other. A cursory look at the analysis shows that Adim and Abini located in the southern part of Cross River State mostly use modern medicine in treating a number of schistosomiasis ailments. Assigha and Ijiman representing the central part of Cross River State are noted for the combination of modern and traditional medication in tackling schistosomiasis ailments. Also, Okwel-Obudu and Utukwang II situated in the northern part of Cross River State have high preference for traditional medicine.

In order to ascertain whether or not people's perception of schistosomiasis varies significantly among the endemic communities, the One-Way Analysis of Variance (ANOVA) test was conducted. The result obtained is presented in Table 6.10.

TABLE 6.10: Perception of schistosomiasis among endemic communities

		Sum of Squares	df	Mean Square	F	Sig.
Perception of cause of Schistosomiasis	Between Groups	307.017	6	51.170	15.332*	0.001
	Within Groups	2639.876	791	3.337		
	Total	2946.893	797			
How Schistosomiasis is contacted	Between Groups	382.937	6	63.823	21.065*	0.001
	Within Groups	2396.561	791	3.030		
	Total	2779.499	797			
Perception of modes of transmission	Between Groups	157.406	6	26.234	16.751*	0.001
	Within Groups	1238.831	791	1.566		
	Total	1396.237	797			
Perception of Schistosomiasis ailments	Between Groups	1369.010	6	228.168	18.787*	0.001
	Within Groups	9606.955	791	12.145		
	Total	10975.965	797			
Perception of prevention	Between Groups	932.091	6	155.349	27.448*	0.001
	Within Groups	4476.871	791	5.660		
	Total	5408.962	797			
Perception of treatment of liver damage	Between Groups	186.509	6	31.085	23.541*	0.001
	Within Groups	1044.460	791	1.320		
	Total	1230.969	797			
Perception of treatment of vaginal bleeding	Between Groups	134.331	6	22.388	18.696*	0.001
	Within Groups	947.229	791	1.198		
	Total	1081.560	797			
Perception of treatment of infertility	Between Groups	95.377	6	15.896	13.624*	0.001
	Within Groups	922.885	791	1.167		
	Total	1018.262	797			
Perception of treatment of bladder cancer	Between Groups	117.869	6	19.645	15.453*	0.001
	Within Groups	1005.600	791	1.271		
	Total	1123.469	797			
Perception of treatment of diarrhea	Between Groups	111.672	6	18.612	13.320*	0.001
	Within Groups	1105.255	791	1.397		
	Total	1216.927	797			
Perception of treatment of intestinal pains	Between Groups	157.783	6	26.297	18.391*	0.001
	Within Groups	1131.039	791	1.430		
	Total	1288.822	797			
Perception of treatment of sterility	Between Groups	128.029	6	21.338	16.602*	0.001
	Within Groups	1016.653	791	1.285		
	Total	1144.683	797			
Perception of treatment of kidey failure	Between Groups	80.170	6	13.362	10.623*	0.001
	Within Groups	994.878	791	1.258		
	Total	1075.048	797			
Perception of treatment of Anemia	Between Groups	141.467	6	23.578	18.142*	0.001
	Within Groups	1028.028	791	1.300		
	Total	1169.495	797			
Perception of treatment of poor health	Between Groups	119.391	6	19.899	15.784*	0.001
	Within Groups	997.195	791	1.261		
	Total	1116.586	797			

*Significant at 1% alpha level

The table shows that the between groups value of Fisher's (F) which are 15.33, 21.06, 16.75, 18.78, 27.44, 23.54, 18.69, 13.62, 15.45, 13.32, 18.39, 16.60, 10.62, 18.14 and 15.78 are significant at 0.05 (95 percent) confidence level. This suggests that there is a significant variation in the perception of schistosomiasis in the study area. The result therefore supports the hypothesis that perception of schistosomiasis varies significantly among endemic communities.

CHAPTER SEVEN
SUMMARY AND CONCLUSION

This chapter presents the synopsis of the findings on the prevalence of urinary schistosomiasis as well as factors of vulnerability to the disease. It examines the results of the study in relation to theoretical postulations and discusses the policy implications of the findings.

7.1 SUMMARY OF FINDINGS

Urinary schistosomiasis is one of the most prevalent water-borne diseases in Nigeria vis-à-vis Cross River State. The prevalence of the disease is a function of the physical environment which provides suitable breeding sites for the snail vectors and of human perception/behavior towards the disease in endemic communities. The disease affects people due to limited access to safe water supply. Therefore, this study was designed to examine the prevalence of urinary schistosomiasis as well as determine the spatial pattern of perception of the disease in order to understand its cognitive aspects and the epidemiological situation in endemic communities. The background theories of disease ecology, Triangle of Human Ecology of Disease and Health Belief Model (section 2.3) were used to define key categories of physical and human behavioural factors interacting in different ways to influence exposure and level of infection of urinary schistosomiasis.

The study examined the spatial and temporal changes in the prevalence of urinary schistosomiasis. The study showed that urinary schistosomiasis is a disease of public health concern in Nigeria and Cross River State in particular. A total of 499,143 cases were reported, but the number decreased by 56.4 percent from 1981 to 1990 and by 33.32 percent between 1991 and 2004. The time factor was important and significant in explaining the prevalence of urinary schistosomiasis (R^2= 0. 628, $p<0.05$). Over the past 23 years, Nigeria experienced a marked decline in the reported cases of urinary schistosomiasis (-0.792). However, focal areas of the disease still persist in some parts of the country. The reported cases of urinary schistosomiasis indicate that states in the northern region are highly infected, while states in the southern part of the country had low prevalence. The disease is endemic in Cross River State, with overall prevalence of 31per cent. Endemicity of the disease ranged from meso to hyper endemic situations. Although the disease is prevalent in Cross River State, prevalence situation seems to be significantly higher in the northern (61 per cent) and central (54 per cent) parts than the southern (22 per cent) district. However, there was zero prevalence of urinary schistosomiasis in Akpabuyo, Bakassi and Akamkpa, all located in the southern part of Cross River State. The study observed variations in prevalence among individuals of different age groups with school-age children and young adults between 11-20 years having the highest infections. Among the individuals infected, males were found to have comparatively high prevalence than their female counterparts in all the eighteen LGAs with the exception of Yala.

In order to determine the effects of risk factors on the prevalence of urinary schistosomiasis, the logistic regression analysis was conducted. The results of the analysis showed that swimming, fetching, bathing, washing, farming in swampy areas, sand mining, fishing, snail gathering, eating of snails, defecation into river, age and education of infected household members significantly explained the prevalence of urinary schistosomiasis ($R^2 = 0.376$; $p<0.05$). 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, $p<0.05$).

The study explored the relationship between spatio-epidemiological factors and exposure to schistosomiasis. The method of canonical correlation was used because of the multidimentional nature of the dependent and independent variables. The result shows that household residential quality (0.54) and level of exposure to river (-0.96) are inversely related; implying that those who live in good houses are less exposed to urinary schistosomiasis. Also, household toilet quality (-0.68) and level of exposure to stream (-0.53) exhibit an inverse correlation, while household toilet quality and level of exposure to swamp (0.84) also showed an inverse association. Furthermore, distance from place of work to nearest infection source (-0.52) and level of exposure to stream (0.85) and exposure to swamp (0.55) had inverse relationship. Distance from community centre to vector environment did not seem to have any significant effect on the prevalence of schistosomiasis ($r = -0.361$, $p>0.05$). Prevalence of schistosomiasis had a positive and insignificant association with the population size of endemic communities (r = 0.092, p>0.05).

The study examined the perception of urinary schistosomiasis with respect to awareness and knowledge. The result showed that almost one-third of the respondents were aware that stagnant and slow-moving natural water are suitable breeding sites for the snail vectors of urinary schistosomiasis. Also, the inhabitants had adequate knowledge of specific symptoms of schistosomiasis in accordance with biomedical practice. However, despite several years of exposure and awareness of schistosomiasis, the inhabitants of endemic communities still do not have appropriate knowledge of the cause of schistosomiasis and how the disease is contracted. On the ailments associated with urinary schistosomiasis, 89 per cent of the respondents rightly identified specific severe conditions such as kidney failure, vaginal bleeding, bladder cancer and many more, and only 11.2per cent of the respondents did not know the ailments that are likely to manifest if schistosomiasis remains untreated in an infected individual. A large proportion of the inhabitants, representing 86.7per cent of the respondents were aware of the best ways by which schistosomiais can be prevented. However, only 96(12.0per cent) respondents did not know how schistosomiasis infection could be prevented and 10(1.3per cent) believed that nothing can be done to prevent the infection since the parasite is endemic in their communities. Apart from orthordox medicine that is widely used for the treatment of the disease, inhabitants in endemic communities also use traditional medicine in treating the disease. The study found that some respondents prefer to combine both modern and traditional medicine in treating the disease but with a large proportion of them more frequently using modern medicine. The perceptions of treatment of schistosomiasis ailments differ among the different endemic communities. Adim and Abini located in the southern part of Cross River State are popular in the use of modern medicine in treating a number of schistosomiasis ailments. Assigha and Ijiman representing the central part of Cross River State are well-known for the combination of modern and traditional medication in tackling schistosomiasis ailments. Also, Okwel-Obudu and Utukwang II situated in the northern part of Cross River State are noted for traditional medication.

Although, people in endemic communities recognized urinary schistosomiasis as a public health problem, the result of the One-Way Analysis of Variance showed significant variations in the perception of urinary schistosomiasis among endemic communities. The hypothesis, which states that perception of urinary schistosomiasis varies significantly among endemic communities, was confirmed. As a result, the study concluded that people's perception of urinary schistosomiasis varies significantly among the seven endemic communities. Precisely, most of the residents in endemic communities had appropriate knowledge of symptoms of schistosomiasis, modes of transmission and schistosomiasis ailments. They also had good understanding of prevention. Notwithstanding, most residents held inaccurate popular views about the cause of schistosomiasis and even differ in their perceptions of treatment of schistosomiasis ailments.

7.2 THEORETICAL IMPLICATIONS OF FINDINGS

This study clearly confirms that the fresh water bodies are the habitats (reserviour) where schistosomiasis vectors live and develop, and exposure to these vector environments makes people susceptible to the disease. Population exposure to vector habitats is determined by their age, sex and occupation which inturn affects their behavior and susceptibility. The males in the subgroup of the population below the age of 20 years that is found to be highly infected corresponds with the population that is known to be most vulnerable to urinary schistosomiasis. These findings lend credence to the disease ecology and Triangle of Human Ecology of Disease which state in part that the presence of suitable breeding habitats and population characteristics such as sex, age, occupation, and education affect exposure, infection and susceptibility to diseases. This means that the variables suggested by the two models are highly useful in this study.

The findings of this study have shown that although reserviour or habitat (natural and built environment) factor may be present for vectors to thrive, it is the population's behaviour (exposure to the vector) that determines whether or not the person gets infected. Looking at the results of the logistic regression analysis, it can be deduced that human cognition of urinary schistosomiasis is a very important factor to consider within the context of ecology of diseases. One factor that supports the Triangle of human ecology of disease is the finding that farming in swampy areas (Odd ratio: 1.58; $p<0.05$) was the most significant behavioural factor influencing the prevalence of urinary schistosomiasis in endemic communities. This goes to buttress the fact that swamps are the suitable breeding habitats for the snail vectors of urinary schistosomiasis, whereas behaviours like farming in swampy areas predispose people to the disease. The variables explained 74.7 per cent accuracy of the model (see p. 112), which means that the theory is highly useful. However, it should be stressed that although the overall logistic regression model that resulted in identifying farming in swampy areas was significant, other variables considered were insignificant and their odd ratios were low, compared to farming in swampy areas. It is apparent from this result that variables of the Triangle of Human Ecology of Disease other than those considered in this study need to be investigated.

Moreover, the findings of this study are to a great extent in line with the Health Belief Model. The HBM proposes that health-related activities of populations can be predicted from the individuals' motivations and their perceptions of susceptibility to illness, severity of illness, and the probability that a behavioral change will reduce the risks of illness. This study shows that individuals are compelled to farm in swampy areas despite the risk of having contact with such potential sources of infection, because the swamps (water sources) are linked to their livelihood. In addition, poor perception of the cause of urinary schistosomiasis affects how residents put the knowledge gained on prevention into use, hence, the prevalence of the disease in endemic communities. The HBM states that the direction of action people choose to prevent or treat diseases would be influenced by the perceived causes. Despite the fact that majority of the people have heard of urinary schistosomiasis from previous interventions, knowledge of the cause of the disease was poor.

7.3 POLICY IMPLICATIONS OF FINDINGS

The study has shown that urinary schistosomiasis is a public health problem. To effectively control the disease, de-worming and routine mass treatment of infected persons should be organized. The control strategy of de-worming and mass treatment of school-aged children should focus more in hyperendemic areas. Since most of the inhabitants believed in the efficacy of modern medicine, up-take of praziquantel by those already living with the disease should be pursued vigorously. The popular use of orthodox medicine for the treatment of urinary schistosomiasis indicates that the control of the disease is likely to be successful. It also shows that people in endemic communities believed in the efficacy of modern medicine. Mass treatment of infected persons would help to cure the disease for those living with the infection and hence reduce the transmission of the disease to uninfected persons.

The current intervention strategy which focuses mainly on primary school children looks promising, but it may hamper progress because infected adults who have lived with the ailment untreated and infected non-school children in endemic communities are most times ignored. Thus, it is also important to recognize and include these categories of persons in intervention programmes so as to reduce the burden of the disease.

Farming in swampy areas was identified to be the dominant behavioural risk factor predisposing people to urinary schistosomiasis in endemic communities. Based on this finding, 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.

Enlightenment campaign should address wrong beliefs and perceptions that would encourage good behaviour and throw light on the misconceptions held by residents on the causes of urinary schistsosomiasis. The study has shown that even though the inhabitants of the study area recognized urinary schistosomiasis as a public health problem, knowledge of the cause of urinary schistosomiasis was poor and so needs to be improved by health education. A situation in which people claim to be aware of urinary schistosomiasis but have inaccurate knowledge of the cause of the disease is disturbing. Effective public health intervention on any disease requires that infected persons and the vulnerable population have adequate understanding of the cause of the disease to facilitate prevention and treatment options.

The significant variation in people's perception of schistosomiasis means that the real situation of adequate knowledge of schistosomiasis in endemic communities requires more attention. This should be in the form of building community awareness as part of the control programme. A culturally sensitive strategy is also paramount in engaging the local communities in the implementation process of interventions so as to effectively reduce the burden of the disease. Community participation in schistosomiasis intervention programmes would bring about greater knowledge of health-seeking behavior and sanitation-related practices that are central to healthy habits in endemic communities.

The findings of this study, like those of other studies in Nigeria and elsewhere, showed that orthordox medication was the most preferred means of treating urinary schistosomiasis and so needs to be encouraged. It is likely that the reported good use of modern medicine, which includes mass treatment of infected persons and the belief in its efficacy, made it of more proven value than traditional medicine. Although some inhabitants prefer to combine both modern and traditional medicine, the potential dangers of traditional and other related home therapies, especially herbs are obvious and so should not be encouraged without proper scientific proofs. Findings of a series of discussions had with a parent of an infected community member, a patent medicine dealer and a health extension worker, confirmed that infected persons consult dispensaries and traditional healers for treatment, and so the advantages of training and maximizing knowledge of patent medicine dealers and health extension workers are obvious. The reason is they are close to the people and so can easily give early diagnosis and treatment or even refer an infected person to the nearest hospital. Besides, knowledge of the medicinal plants (which the traditional healers that were contacted during the survey were willing to disclose) used in the treatment of schistosomiasis ailments can have marked effects on the success of scientific efforts.

7.4 AREAS FOR FURTHER RESEARCH

Due to the relatively non-existent case registry data of urinary schistosomiasis for some specific time periods (2006 to 2010), further studies can be conducted in future to provide updated information on the trend and distribution of urinary schistosomiasis in locations and time periods for which case data are now available. Such studies can provide guide on the amount of intervensions needed to effectively control the disease. Although the logistic regression model identified farming in swampy areas as the only factor influencing the prevalence of urinary schistosomiasis in endemic communities, there is need to investigate other risk factors of schistosomiasis as proposed by the Triangle of Human Ecology of Disease other than those investigated in this study. In doing so, the measures of exposure need to be better defined among the hyper and meso endemic communities in order to identify the most important factors shaping exposure and prevalence of schistosomiasis in endemic communities.

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APPENDICES

Appendix I: Reported cases of urinary schistosomiasis in geo-political zones, nigeria

GEOPOLITICAL ZONES	STATES	YEARS															
		1982	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
NORTH EAST	Gongola	9180	16260	0	19780	17005	17017	13157	8760	7926	5254	-	-	-	-	-	-
	Adamawa	-	-	-	-	-	-	-	-	-	-	-	-	5737	4870	879	53
	Bauchi	2052	3182	0	2369	101	-	167	157	5	22	-	-	86	96	49	95
	Borno	11353	6412	0	1492	3375	6195	7494	125	519	-	-	-	760	332	850	202
	Gombe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	33
	Yobe	-	-	-	-	-	-	-	-	-	-	-	-	277	30	560	-
	Taraba	-	-	-	-	--	-	-	-	-	-	-	-	2133	7869	2865	5415
	Total	**22585**	**25854**	**0**	**23641**	**20481**	**23212**	**20818**	**9042**	**8540**	**5367**	**0**	**0**	**9098**	**13,292**	**5319**	**5789**
NORTH WEST	Kaduna	175	585	1	735	156	567	-	108	189	493	-	-	1487	124	37	-
	Kano	3207	278	8	172	-	958	794	453	2497	964	-	-	2344	-	597	733
	Katsina	-	-	-	-	-	-	-1553	-	67	24	-	-	30	-	256	616
	Kebbi	-	-	-	-	-	-	-	-	-	-	-	-	990	38	1479	1603
	Jigawa	-	-	-	-	-	-	-	-	-	-	-	-	821	-	64	-
	Sokoto	1553	11	2	2127	3004	3991	7954	2580	4870	5214	-	-	60	1020	-	-
	Zamfara	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**4935**	**874**	**11**	**3034**	**3160**	**5516**	**10301**	**3141**	**7632**	**6695**	**0**	**0**	**5732**	**1182**	**2433**	**2952**
NORTH CENTRAL	Benue	1290	2322	-	1143	943	581	-	422	90	246	-	-	91	1077	661	-
	Kwara	450	985	-	333	-	229	454	261	50	8	-	-	-	52	14	-
	Kogi	-	-	-	-	-	-	-	-	-	-	-	-	13	12	127	413
	Nassarawa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	210
	Niger	681	111	7	336	267	68	269	95	118	24	-	-	1269	284	-	-
	Plateau	9075	-	17	2928	1253	572	382	306	-	263	-	-	383	1079	912	388
	FCT	-	-	-	-	-	2	-	-	153	-	-	-	1	6	26	-
	Total	**11496**	**3418**	**24**	**1740**	**2463**	**2463**	**1105**	**1084**	**411**	**541**	**0**	**0**	**1757**	**2510**	**1740**	**1011**
SOUTH SOUTH	Akwa Ibom	0	0	0	0	-	-	6	1	17	7	-	-	0	0	15	1
	Cross River	53	12	21	5	68	-	33	31	634	81	-	-	26	26	14	23
	Edo/Delta	247	29	-	24	17	1	1	-	122	64	-	-	9	6	17	40
	Rivers	-	111	-	-	-	-	41	32	-	2	-	-	-	-	2	-
	Bayelsa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	-
	Total	**300**	**152**	**21**	**29**	**85**	**1**	**81**	**64**	**773**	**154**	**0**	**0**	**35**	**32**	**71**	**64**
SOUTH WEST	Lagos	-	46	25	2	0	-	-	-	19	74	-	-	80	75	35	39
	Ondo	259	-	-	124	69	368	158	-	649	76	-	-	70	10	-	193
	Osun	-	-	-	-	-	-	-	-	-	-	-	-	53	32	69	60
	Ogun	392	-	-	104	29	84	327	272	82	-	-	-	-	203	-	-
	Ekiti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	Oyo	5	-	-	17	8	9	34	40	14	214	-	-	141	76	32	428
	Total	**656**	**46**	**25**	**247**	**106**	**461**	**519**	**312**	**764**	**364**	**0**	**0**	**344**	**396**	**136**	**722**
SOUTH EAST	**Abia**	12	2	2	28	91	37	19	2	94	95	-	-	25	30	53	-
	Ebonyi	-	-	-	-	-	-	-	-	-	-	-	-	17	2	-	-
	Anambra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Imo	124	42	-	40	59	75	131	52	22	79	-	-	1	-	-	-
	Enugu	-	-	-	-	-	-	-	-	-	-	-	-	187	32	-	-
	Total	**154**	**44**	**2**	**68**	**150**	**112**	**150**	**54**	**116**	**174**	**0**	**0**	**230**	**64**	**53**	**0**

Appendix II: Community diagnosis procedure for schistosomiasis and soil-transmitted helminth infections through schools

Soil-transmitted helminth infection

Community category	Result of school survey	
	Prevalence of any infection (%)	Moderate to heavy infection
High prevalence of high intensity	>70%	> 10%
Moderate prevalence and low intensity	>50% but >70%	<10%
Low prevalence and low intensity	< 50%	< 10%

Schistosomiasis infection

Community Category	Prevalence in School Survey
Hyper endemic	> 30% visible Haernaturia (Haematobium, by questionnaire) or > 50% infected (S. Mansoni S. Haematobium by Parasitological methods)
Meso endemic	> 20% visible Hearnturia (S. Haemalobium, by questionnaire) or >10% but <50% infection (S. Mansoni S. Haematobium by Parasitological methods)
Hypo enedemic	< 10% infected (S. Mansoni S. Haematobium by Parasitological methods)

SOURCE: WHO, 2002.

Appendix III : Intensity of urinary schistosomiasis by blood in urine, in LGA, Cross River State, Nigeria.

	Pupils examined with respect to sex					Pupils infected with respect to sex				Mean oval/10ml of urine		Pupils infected	
	Total no of	Male		Female		Male		Female		Male	Female	No	%
Age in years	Pupils examined	No	%	No	%	No	%	No	%				
5-10	488	278	57	210	43	17	3.4	14	2.8	40	32	31	6.3
11-15	444	181	43	263	59	31	6.9	28	6.3	43	37	59	13.2
16-20	406	198	49	208	51	23	5.6	19	4.6	37	31	42	7.6
>21	182	93	51	89	49	5	2.7	7	3.8	22	16	12	6.6
	1520	750	49	770	51	76	5.0	68	4.7	36	29	144	9.47

Source: Adie *et al*, 2013.

Appendix IV: Result of logistic regression analysis (SPSS output)

Omnibus Tests of Model Coefficients

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

*Significant at 5% alpha level

Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
	880.803[a]	.027	0.376

Hosmer and Lemeshow Test- *goodness-of-fi t test statistic*

Step	Chi-square	df	Sig.
1	10.922	8	.206

	Predicted		
	Prevalence of Schistosomiasis		
Observed	No	Yes	Percentage Correct
No	0	202	.0
Yes	0	596	100.0
Overall Percentage			74.7

a. The cut value is .500

Variables in the equation

	B	S.E.	Wald	df	Sig.	Exp(B)

Appendix V: Result of canonical correlation analysis (SPSS output)

Multivariate Statistics and F Approximations

Statistics	Value appox.	F-value	d.f.	p-Values
Wilks' Lambda	0.85095	3.93	33	0.000
Pillai's Trace	0.15660	3.92	33	0.000
Hotelling-Lawley Trace	0.16641	3.93	33	0.000
Roy's Greatest Root	0.08395	5.98	11	0.000

Eigenvalues and canonical correlations

Root no.	Eigenvalue	Pct.	Cum. Pct	Canon. Corr	Sq. Cor
1	0.0839	0.5044	0.5044	0.278	0.077
2	0.0462	0.2778	0.7823	0.210	0.044
3	0.0362	0.2177	1.0000	0.187	0.035

Canonical redundancy analysis

Canonical Variate	Their own canonical variables		The opposite canonical variables	
	Proportion (%)	Cum. Proportion (%)	Proportion (%)	Cum. Proportion (%)
Dependent				
1	0.3093	0.3093	0.0240	0.0240
2	0.3325	0.6417	0.0147	0.0387
3	0.3583	1.0000	0.0125	0.0512
Independent				
1	0.0914	0.0914	0.0071	0.0071
2	0.0905	0.1819	0.0040	0.0111
3	0.0825	0.2647	0.0029	0.0140

Appendix V: Questionnaire

DEPARTMENT OF GEOGRAPHY, FACULTY OF SOCIAL SCIENCE, UNIVERSITY OF IBADAN, IBADAN, NIGERIA

Topic: Spatial pattern and perception of urinary schistosomiasis in Cross River State, Nigeria

Instruction: Dear respondent, I am a postgraduate student from the above named department and institution. I will be grateful if you cooperate and respond honestly to the questions contained in this questionnaire. The questionnaire is designed to enable the researcher obtain relevant information on the topic above. Whatever information that is collected from you shall be treated as confidential. Please tick (√) as appropriate or comment where appropriate. Thank you for your time.

Section A

Demographic and physical Risk factors of SchistosomiasisInfection

1. Age: (a) Less than 10 yrs ( ) (b) 11-20 yrs ( ) (c) 21-30yrs ( ) (d) 31-40yrs ( ) (e) 41-50yrs ( ) (f)51-60 ( ) (g) 60yrs and above ( )
2. Sex : (a) Male ( ) (b) Female ( )
3. Occupation: (a) Agriculture ( ) (b) Non-Agriculture ( )
4. Educational Background: (a) non formal education ( ) (b) primary education ( ) (c)Secondary education ( ) (d) tertiary education ( ) others specify ....
5. Estimated monthly income: (a) 0-N10,000 ( ) (b) 11,000- N20,000 ( ) (c) 21,000 – 30,000 ( ) (d)N40,000 and above ( ) (e) others specify ....

Section B

6. Movements to infection source: (a) daily ( ) (b) periodic ( ) (c) seasonal ( )
   If seasonal, which of the seasons? (a) dry season ( ) (b) rainy season ( )
7. How long do you work/stay in the water source/vector environment? (a) < 1hr ( ) (b) 1 hr ( ) (c) 1-2 hrs ( ) (d) 3-5 hrs ( ) (e) 6hrs and above ( )
8. Do you live near any of the water sources? (a) Yes ( ) (b) No ( )
   if yes, which of them (a) stream ( ) (b) spring ( ) (c) river ( ) (d) swamp ( ) (e) others specify ....
9. What is the distance of home from water source? (a) 100-200m( ) (b) 300-400m ( ) (c) 500-600m ( ) (d) 5-6km ( ) (e) 700-800m ( ) (f) 900m-1km ( ) (g) 11/2-2 ( ) (h) above 2km( )
10. What is the distance of place of work from water sources? (a) <1km ( ) (b) 1-2km (c) 3-4km ( ) (d) 5-6km (e) 7-8km ( ) (f) 9-10km ( ) (g) 11 and above ( )

11. What season of the year do you mostly get infected with schistosomiasis? (a) Don't know ( ) (b) dry season ( ) (c) rainy season ( )
12. Which period(s) do you mostly experience high snail vector population? (a) Don't know ( ) (b) dry season ( ) (c) rainy season ( ) (d) both rainy and dry season ( )

Section C

Household/community exposure factors

13. Type of toilet system in household: (a) None ( ) (b) open latrine ( ) (c) pit toilet ( ) (d)pour flush ( ) (e) hand cistern ( ) others specify ....
14. Household water supply system: (a) tap ( ) (b) Borehole ( ) (c) well ( ) others specify ....
15. Household residential quality: (a) zinc –mud ( ) (b) thatch ( ) (c) bungalow ( ) (d) duplex ( ) (e) others specify ....
16. Is there any modern public toilet in your locality? (a) Yes ( ) (b) No ( )
17. If yes who provided it for the community? (a) individual ( ) (b) community ( ) (c) government ( ) (d) others specify …..................................
18. What is the most accessible water source available in your community? (a) Stream ( ) (b) spring ( ) (c) river ( ) (d) pond ( ) (e) public tap ( ) (f) Borehole ( ) (g) Well ( ) (h)others specify ....
19. Method of household waste collection: (a) None ( ) (b) Basket ( ) (c) Nylon ( ) (d) Bucket ( ) (e) Basin ( ) (f) Others specify ....
20. Household waste disposal: (a) None ( ) (b) Nearby bush ( ) (c) Open dump site ( ) (d) dumpsters ( ) (e) River disposal ( ) (f) others specify ....
21. Which of this fresh water source do you frequently use? (a) swamp ( ) (b) River ( ) (c) Stream ( ) (e) Others specify ....
22. If use any of the fresh water sources specified in item (23) above in the last one month, please complete the table below

Type of Vector source	**Levels/Intensity of exposure based on number of days in month**		
	Low (0-10 days)	**Medium(11-20days)**	**High (21days and above)**
stream			
swamp			
river			

SECTION D

Behavioural risk Factors and knowledge of Schistosomiasis

23. Have you swum in the river in the last one month? (a) Yes ( ) (b) No ( )
24. Have you fetched water from the river source in the last one month? (a) Yes ( ) (b) No (
25. Have you bathe\d in the river in the last one month? (a) Yes ( ) (b) No ( )
26. Have you done laundry in the river source in the last one month? (a) Yes ( ) (b) No ( )
27. Have you farmed in swampy areas in the last one month? (a) Yes ( ) (b) No ( )
28. Have you engaged in sand mining in the last one month? (a) Yes ( ) (b) No ( )
29. Have you engaged in fishing in the last one month? (a) Yes ( ) (b) No ( )
30. Have you engaged in snail gathering in the last one month? (a) Yes ( ) (b) No ( )
31. Have you engaged in the eating of snails in the last one month? (a) Yes ( ) (b) No ( )
32. Have you defecated in the river source in the last one month? (a) yes () (b) no ()
33. How many number of dam and/or irrigation projects are provided by government to your community? State ……………………………………………………………
34. How many number of government owned rice farms are found in your locality? State…..
35. Are you aware that blood in urine (shistosomiasis) is a disease of public health concern (a) Yes () (b) No ()
36. If yes, how did you come about the knowledge (a) previous intervention () (b)oral tradition/folk prescription() infected family members ( ) (c)Organized pilot studies ( ) (d) Health Extension Workers/ Disease Surveillance Officers ( ) (e) Awareness campaign ( ) (f) Personal (g) others ( )
37. Have you ever urinated blood (a) Yes ( )(b)No()

38. Age at infection: (a) Less than 10 yrs ( ) (b) 11-20 yrs ( ) (c) 21-30yrs ( ) (d) 31-40yrs ( ) (e) 41-50yrs ( ) (f)51-60 ( ) (g) 60yrs and above ( )

39. If yes, when did you start experiencing blood in urine after water contact? (a) within a month ( ) (b)l-6 days () (c) 1 week () (d) within 2 months ()(e) others specify

40. How many times in your life have you ever experienced blood in urine (a) none () (b) once( ) (c) twice ( ) (d) 3-4 times () (e) others specify ……………………………………………………………..

41. Which of the types of schistosomiasis listed below have you ever suffered from? (a) Intestinal ( ) (b) urinary (c) Don't know ( )

42. Does any member (s) of your household (resident in the village) suffer from any of the types of schistosomiasis listed above? (a) yes ( ) (b) No ()

43. lf yes to the above question, complete the following table for the disease person

S/N					
	Disease Type	**Age**	**Sex**	**Occupation**	**Education**

SECTION D

PERCEPTION OF SCHISTOSOMIASIS

44. Commonest symptom of schistosomiasis?

(a) fever() (b) skin itching() (c) headaches() (d)weakness of the body () (e)malaria () (f) exercise intolerance() (g) vomiting blood () (h) joint and muscle pain ()(i) loss of appetite ( ) (j)weight loss () (k) abdominal pain ()(l) blood in stool () (m) nausea () (n) cough () (o) pain on urination ((p)others specify………………………………………………………….

45. Perceived Cause of schistosomiasis?

(a) Water snails () (b) Witch craft () (c) Worm in body () (d) HIV/AIDs ( ) (e) promiscuity ( ) (f) a sign of maturity () (g) others specify

…………………………………………………………………………………………………..

46. Easiest way of contracting schistosomiasis?

(a)Body contact with an infected person () (b) Sexual contact () (c) Crossing an infected person's urine () (d) () contact with vector environment (e) Staying long in polluted or dirty water ( ) (t Drinking infected water (d) don't know () others specify

47. Perception of the easiest mode of transmission of schistosomiasis?

(a) Through mosquito bite () (b) Excreta disposal in river only () (c) urine disposal in vector environments by an infected person only ( ) (d) both excreta and urine disposal in water by infected person ()(e) don't know ( ) others specify

48. Perception of most chronic ailment of schistosomiasis?

(a) Liver damage () (b) Vaginal bleeding () (c) Infertility () (d) bladder cancer () diarrhea () (e) intestinal pains ( ) (0 Sterility () (g) kidney failure ( ) (h) anemia ( ) (i) Poor Health (j) don't know () others specify ( )

49. Perception of the most efficient means of Prevention against schistosorniasis?

(a) Avoid contact with potentially contaminated fresh water ( ) (b) Avoid excreta/urine disposal in vector environment () (c) ownership of household sanitary facilities ( ) (d) Elimination of water dwelling snails ( ) (e) Avoid contact with infected person () (f) Avoid contact with snail vectors ( ) (g) water treatment and hygiene ( ) (h) don't know () (i) Nothing can be done

50. Perception of Treatment of Schistosomiasis

Schistosomiasis ailments	**Perception of Treatment**				
	Orthodox treatment	**Traditional treatment**	**Orthodox Traditional treatment**	**Don't know**	**Nothing**
Liver damage					
Vaginal bleeding					
Infertility					
Bladder cancer					
diarrhea					
Intestinal pains					
Sterility					
Kidney failure					
Anemia					
Poor Health					

51. Perception of the suitable breeding ground for schistosomiasis nail vector?

(a) Stagnant water () (b) slow-flowing river () (c) fast-flowing river () (d) don't know (