EFFECT OF INTERVENTIONS ON KNOWLEDGE, RISK PERCEPTION AND PREVALENCE OF SCHISTOSOMIASIS INFECTION AMONG SCHOOL PUPILS OF TWO RURAL COMMUNITIES IN OSUN STATE

PROJECT SUBMITTED TO THE FACULTY OF PUBLIC HEALTH OF THE NATIONAL POST GRADUATE MEDICAL COLLEGE OF NIGERIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF F.M.C.P.H. (PART II FINAL)

BY

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DECLARATION

I DR. MRS.YETUNDE ABISOLA OYEKENU-AGORO, hereby declare that this work was carried out by me, under the supervision of Dr J.O. Bamidele and Dr. T. M. Akande and that it has not been submitted in part or in full for any other examination.

…….

Dr. (Mrs.) Yetunde A. Oyekenu –Agoro

DEDICATION

This project is dedicated to GOD ALMIGHTY , the Giver of life, to my late Grandmother Ahlaja Nusiatu Adetilewa Aduke , my late Mother Elizabeth Asabi Odeneye , my Late Husband Samuel Gbolahan Oyekenu and our children.

CERTIFICATION

We hereby certified that this project has been carried out by DR. (MRS.) YETUNDE. ABISOLA. OYEKENU-AGORO in the department of Community Medicine, LAUTECH Teaching Hospital, Osogbo under our supervision.

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SUMMARY

Since the construction of a dam across Erinle River at Igbokiti in Osogbo Local Government Area of Osun State in the year 1981, schistosomiasis has emerged as a major health burden in the five villages located along the river. The comprehensive health centre in Ilie has recorded a large number of cases within the past two decade. The study was conducted to compare the prevalence of schistosomiasis infection among primary school pupils in two of the villages, and to determine the effect of chemotherapy and health education intervention on the prevalence, knowledge and risk perception of schistosomiasis infection among primary school pupils in Ilie the study village, while Ore serves as the control village. One primary school each was randomly selected out of the two primary schools in each village using the ballot method. A total of 452 pupils aged between 6 – 15years were selected, 230 from the study group in Ilie and 222 from the control group Ore. A semi-structured questionnaire was administered on the pupils on the control and study groups, their urine samples were examined for haematuria using the uristrip and also microscopically for eggs of S. haematobium. Praziquantel was administered on symptomatic subjects among the study group. Also two health education sessions were conducted for the study group at the school assembly within an interval of one week. After a period of three months, the same questionnaire was re-administered to the study and control groups, urine examination for haematuria using the uristrip and microscopic examination for eggs of S. haematobium were also repeated for both groups.

At the pre-intervention stage, overall prevalence in Ilie the study group was 80.9% while that of Ore the control group was 81.1%. High rate of terminal haematuria was observed among subject in both groups. Post interventions, in the study group there was a reduction in the prevalence of schistosomiasis to 7.8%, and also reduction in terminal

haematuria. However, the prevalence of 75.7% was observed in the control group in Ore, and also there was an increase in the number of patients that developed haematuria during the interval. At pre-intervention, majority 90.4% of subjects in the study group and 71.6% in the control group were aware of schistosomiasis as a disease in their community. Majority of respondents 87.0% in the study group and above half 57.7% in the control group have knowledge of signs and symptoms of schistosomiasis, however there was a significant reduction in the number of those who mentioned the correct answer in both groups post intervention and three months later more respondents mentioned dysuria and this was statistically significant ($p = 0.00$). Majority of respondent claim that the disease is transmitted through water 84.4% in the study group and 71.1 % in the control group at pre intervention. At post intervention, there is no significant difference in response in the study group ($p = 0.06$). In the control group however there was a significant increase in the level of knowledge on mode of transmission ($p = 0.03$). Majority of pupils in both groups know that wading lead to disease 84.4% in the study group and 83.8% in the control group there is a numerical increase in positive response in the study group and a significant increase in the control group. The was also high level of knowledge that urinating and defecating in the river can transmit disease to other water users 92.2% in the study group and 89.2% in control group, there was a significant increase in both groups post intervention and three months later of

Despite the prior knowledge and health education intervention, there was no appreciable change in water contact activities because there was no alternative water supply. Only water contact activities for entertainment like swimming were significantly reduced in both groups. Many of them74.8% in the study group and 57.5% in control group had noticed terminal haematuria in their urine and majority of them know some other members of the communities who passed blood in urine.

This study concludes that schistosomiasis infection is highly endemic in these two communities and that high level of awareness and knowledge about signs and symptomatologies of the infection do not translate to the pupils not contacting the disease. However, praziquantel was found to be a very effective drug in the treatment of schistosomiasis in the study area. The major tools for the control of schistosomiasis should be (1) human behavioral change through continuous and sustained health education, communication participation (2) mass- chemotherapy and (3) clean water supply and adequate sanitation.

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CHAPTER ONE

1.1 INTRODUCTION

Schistosomiasis also commonly known as bilharzia is one of the most important parasitic infections in the tropics. It is a disease of the urinary bladder and the large intestine caused by flatworms of the genus Trematoda. Human infection is due to three main species namely Schistosoma haematobium (S. haematobium), Schistosoma mansoni (S. mansoni) and Schistosoma japonicum (S. japonicum), [1] they live in the veins of the affected organs. S. haematobium is known as urinary schistosomiasis because eggs are excreted through the urinary channel, it is prevalent in Egypt and sub Sahara Africa.[2] Infection with any of the species of schistosoma worm is rarely fatal, but they cause progressive damage to parenchymatous host cell of various organs,[3] leading to chronic illness and complication in adult life.

In developed countries Schistosomiasis infection is found only among immigrants. The disease has been reported in 79 countries worldwide mainly in the tropical and sub tropical regions e.g. Africa, Asia Middle East, South America, Central America, and the Carribeans, where the intermediate host live in streams, lakes, ponds, and moist vegetations. It has been established that worldwide 600million people are at risk of contacting Schistosomiasis, 300million are infected and complications of the disease are responsible for 500,000 deaths yearly.[4, 5, 6, 7, 8]

Schistosome infection is acquired by wading in polluted water. Poverty, ignorance, unacceptable hygienic practices, poor sanitary facilities and human activities around water bodies are major contributory factors to transmission of infection.[1,3,9,10] In the past two decades construction of dams introduction of irrigation schemes and environmental changes such as deforestation quarry mines have led to proliferation of intermediate host snail. Epidemics of schistosomiasis were reported to have followed construction of large dams such as those built at Lake Volta, Kainji Kassou, Kariba and Aswan in Africa[2]

Schistosomes infect both sexes, although male are affected more than females, due to the difference in exposure.[1,9] In endemic areas the peak of prevalence and intensity of infection usually falls between the school age of 10 and 17 years, often parallel to age related water contact pattern[1.] Epidemiological evidence suggests that some degree of immunity to schistosome infection occur in man.[1, 11]

Patients suffering from schistosomiasis infection frequently present with haematuria (S. haematobium) or bloody stool (S. mansoni and S. japonicum). Other symptoms include abdominal pain and dysuria due to superimposed urinary tract infection. In advanced cases complications, like growth failure,[12] chronic renal failure, obstructive uropathy and cancer of the bladder may occur.[1,13,14.] Recently it is thought to enhance Human Immunodeficiency

Virus infection.[15] schistosomiasis infection can be detected and graded by urine or fecal count of schistosome eggs[1]. Praziquantel is the drug of choice for treatment and control of schistosomiasis. [1]

Schistosomiasis remains one of the most prevalent parasitic infection and a significant public health problem. While the distribution has changed over the last fifty years and there have been successful control projects, the number of people estimated to be infected or at risk of infection is increasing due to population growth and increased water development projects in endemic areas. Where control has been successful, the number of people infected and at risk of infection is very small. This is the situation in most formerly endemic countries in Asia and America. On the other hand in sub-Sahara Africa where there have been few attempts at control and the population is increasing a greater number of people are infected or at risk of infection[16]

Schstosomiasis is one of Tropical Disease Research (TDR) diseases. Globally the consequences of schistosomiasis and other water related diseases were recognized, leading to the designation of the 1980's as the international water supply and sanitation decade.[17] Schistosomiasis is endemic in many African countries though its significance as a public health problem lacks sufficient recognition in many areas.[5]

Nigeria is the most affected country in Africa, and also one of the most affected worldwide;[8] the seriousness of the disease prompted the Federal Ministry of Health to establish a National committee on Schistosomiasis in August 1988.[18] A national prevalence survey was carried out in 18 out of 21 states in 1989 and the disease was found in all the 18 states.[18] In 1999 the National Schistosomiasis control programme was launched in Nigeria by the Cater Center in conjunction with the Federal Ministry of Health; Nasarawa, Plateu and Delta States are presently benefiting from the programme.[8]

1.2 Magnitude of the problem

Globally the prevalence of Schistosomiasis is on the increase. The introduction of water development programmes, and the increase in world population are contributory factors. The disease is the second most common and socio-economically devastating parasitic disease in the world[7] after malaria.

It is estimated that 600 million people are at risk and 300 million people mostly in developing countries are infected in 79 countries in the tropics and sub-Tropics.[6, 7, 8] The disease estimated to be responsible for the loss of 1.5 million disability adjusted life years(DALYs) annually,[2] and complications of schistosomiasis are responsible for 500,000 deaths annually. Half of the affected live in Africa. These complications include kidney dysfunction, obstruction of the urethra, hydronephrosis, acute polypoid granulomatous lesions (more common in young adults), frank gross heamaturia,[19] renal failure, carcinoma of the bladder and respiratory failure.[5]

In Egypt carcinoma of the bladder is the primary cause of death among men aged between 20-24 years. [14] In some regions of Africa where schistosomiasis is prevalent the incidence of carcinoma linked to Schistosomiasis is 32 times higher than the incidence of primary cancer of the bladder.[8, 14, 20]

Nigeria is the most Schistosomiasis endemic country in Africa and is also among the most affected world wide.[8] .In a pilot survey conducted in Nasarawa State in 1999 by the Federal ministry of Health and Carter Center, five Schools were found to have prevalence of 95%.[8] In many Nigerian rural communities, the prevalence of Schistosomiasis is very high and virtually every adult has experienced haematuria at one time or the other, This is regarded as a symbol of growing from childhood to maturity especially among males.[2] In

some parts of Nigeria and Cameroon, women believe that Schistosomiasis is sexually transmittable.[8]

Osun state is one of the schistosomiasis endemic states of Nigeria as schistosomiasis has been documented in many parts of the State among communities located along Osun River and its tributaries. Ilie the study area is one of the schistosomiasis endemic villages around Erinle river. A comprehensive Health Center is located in the village; it is the practice area of Ladoke Akintola University Teaching Hospital. Schistosomiasis has emerged as a major cause of morbidity in the community since the construction of Igbokiti dam. This constitutes a burden on health service delivery. Extreme poverty, unawareness of the risks, and unsanitary conditions, in which they lead their daily live are contributory factors.[4, 21-26]

1.3 Justification for the study

Schistosomiasis in Nigeria and its prevalence remains high in most part of Western Nigeria. It is most prevalent and severe in children and young adults who are at maximum risk of suffering from acute and chronic sequelae of the disease. School age children were chosen for the study because they are actively excreting schistosome eggs and there is a general consensus that they are most representative of the community in an endemic area.[1, 21]

There is no documented report of any study on schistosomiasis in Olorunda LGA, despite the high prevalence and incidence of terminal haematuria among children living in villages situated along Erinle river. Most studies on schistosomiasis in children in Nigeria are mainly on the prevalence of the infection in various communities. Ilie, the study area is the practice area for the Department of Community Medicine, Ladoke Akintola University Teaching Hospital. Schistosomiasis has emerged as a major health burden at the Comprehensive Health Center located within the village since the construction of Igbokiti dam.

Data obtained from the study will add to existing data on the disease prevalence and epidemiology, it will assist the State and Federal Government to developing a feasible control Strategy.

1.4 Hypothesis for the study.

1. There will be no significant difference in the prevalence of haematuria among primary school pupils in the study group before and after intervention.

2. There will be no significant difference in knowledge, risk perception and practice of preventive measure for Schistosomiasis infection among pupils in the study group pre and post intervention.

3. There will be no difference in reduction of haematuria of Schistosomiasis infection among affected pupils in the study group three months after the administration of a single dose of Praziquantel.

1.5 Objectives.

(a) Broad/General.

To assess the effect of health education intervention on knowledge, risk perception and prevalence of Schistosomiasis infection among pupils in Ilie and compare with a selected control.

(b) Specific Objectives.

1. Compare the prevalence of Schistosomiasis infection among primary school pupils in the study group and the control group.

2. To assess the Knowledge, risk perception and practice of preventive measures for Schistosomiasis infection among primary school pupils in the study group and the control group.

3. To evaluate the effect of the health education intervention among the study pupils and the reduction in haematuria among affected pupils in the study group in Ilie three months followings a single dose treatment with Praziquantel.

CHAPTER TWO

1 LITRATURE REVIEW

2.1 Historical Back Ground.

Schistosomiasis is a human disease syndrome caused by the infection from species of parasitic trematode of the genus Schistosoma. Schistosoma infection was common in Nile valley for several thousands of years.[27, 28, 29] Kennet[28] reported that Rufer demonstrated the presence of the terminal spine of the eggs of the organism in the kidney of mummies belonging to the 20th dynasty (220 – 100BC). Historian of medieval Egypt told stories of a disease, which made the men of Egypt menstruate like women[27.]

Papyrus archives written by Egyptians almost 3500years ago clearly described the link between swimming and working in fresh water, lakes, ponds, rivers or streams and blood observed in urine. The first case of schistosomiasis documented in Europe was the case of

Francis of Assisi, an evangelist who lived in the 13th century. He went to Egypt and later developed symptoms suggestive of Schistosomisis.[30]

The worm was first recovered by a German doctor Theodore Bilhaz (and the disease was named after him as Bilhazia) from the mesenteric veins of an autopsied case in Kasr-el Anni Hospital in Cairo in 1852.[31] In 1854 according to Kennet[28]Wellan proposed the term schistosomiasis for the parasite because of the gyneacophoric canal that simulated a longitudinal split[28.] The discovery of the lateral spine egg in the feces by Manson in 1893 in Egypt suggested that there were two species of human schistosomiasis and Sambon in 1907designated the second specie with lateral spine as schistosoma Mansoni.[28] Sixty-two years after Bilharz discovered the parasite, the mode of infection and life cycle of schistosoma japonicum was described.[32] Leiper [30]described the life cycle of S. haematobium and S. mansoni as reported by Kennet.[28] He was a parasitologist working in Egypt after a visit to Japan he went back to Egypt from where he described the life cycle of S. haematobium and S. mansoni. While the original focus of vesical schistosomiasis was probably the headwaters of the Nile valley, today there are extensive endemic areas, including the greater parts of Africa.[4, 5, 33.]

In Nigeria the disease is thought to have been brought to the Northern part of the country by immigrants from the upper Nile valley during the Trans-Sahara trade.[34] The work of Ramsey [35] in Northern Nigeria shows that the disease is common and historically linked to menstruation in males. A German traveler, Gasar Nachtgal commented on the high incidence of haematuria in Bornu province as long as 1881[36]. S. haematobium has been reported in other parts of the country. Nnochiri, [36] Giles et al, [37] Akinkugbe[38] and Cowper [39] reported that the infection is present in both western and eastern parts of the country.

The Federal ministry of health in conjunction with the Carter Foundation conducted a pilot study of schistosomiasis among pupils randomly selected primary schools in Nasarawa, Plateu and Delta states of Nigeria prevalence ranging from 50% to 85%.[8] Studies conducted by Useh [40] also revealed similar findings. High prevalence of in school age population has also been observed by other authors.

The prevalence of urinary and intestinal schistosomiasis, the knowledge attitude and practice (KAP) regarding the disease among children and their parents were investigated in Djikoroni para, a sub-urban area of Bamako Mali The prevalence of S. haematobium and S. mansoni were 69.8% and 8.7% respectively and boys were significantly more affected by S. haematobium but no diference was observed for S. mansoni.[49]

Schistosoma Organisms

Five schistosoma species infest man[1, 50, and 51] these are:

1. S. haematobium, which causes urinary disease, has a terminal spine eggs.
2. S. mansoni, which causes intestinal disease, has a lateral spine eggs.
3. S. japonicum also causes intestinal disease, but occur only in the Far East-China, Japan and the Phillippines.
4. S. intecalatum causes intestinal and systemic disease in humans, out the eggs have a terminal spine like those of schistosoma haematobium.
5. S. mekongi causes intestinal disease.

An expert committee for the WHO in 1966 recommended the use of the term schistosomiasis for the diseases caused by these organisms, with the urinary schistosomiasis being referred to as schistosoma haematobium infection.[52] S. haematobium lives in the veins surrounding the urinary bladder ureters and other pelvic organs (vesical plexus), S. mansoni in the inferior mesenteric veins and S. japonicum in the superior mesenteric veins. Less

importantly, other Schistosomes with avian or other mammalian primary host can cause severe dermatitis in humans e.g. swimmer's itch secondary to Trichobilhazia ocellata.[1, 3]

Microscopy

Sexes are separate (they are diasious). The female worm is about 100mm in length, the male worm is slightly shorter and the body is folded to form a gyneacophoric canal inside which the female permanently resides, and this is referred to as the longest coital session in the animal kingdom. The flat worm can live for 20-30years in the vesical venous plexus of man.[3] The eggs are large spindle shaped with rounded anterior and conical posterior end. They have spines which may be located at the terminal end as in case of S. heamatobium, or on the sides as in case of S. mansoni and japonicum. The eggs are yellowish brown in colour non-operculated and each contains fully developed miracidium size 112-170 x 40-70 micron. The female can lay up to 3500 eggs daily and individual worm may survive for only 4-5years.[2,3]

Reservoir.

Schstosomiasis are flat worms of the genus Trematoda. They live in the blood streams of man. Man is the main reservoir of S. heamatobium and S. mansoni, but naturally acquired infection with S. mansoni has been found in other mammals (cats, dogs, cattle, pigs and rats) and may constitute part of the reservoir. In contrast, animal reservoirs both wild and domestic contribute significantly to human S. japonicum infection[1].

2.2 Epidemiology of Schistosomiasis.

The epidemiology of schistosomiasis is changing with the environment and socio economic development[5]. Throughout the world Schistosomiasis is endemic in 79 countries. An estimate of 200 million people are infected with schistosoma mainly in Africa and the

eastern Mediteranean.[5] Schistosomaisis is the second most common disease in the tropics and sub tropics; it is one of the Tropical Disease Research(TDR) diseases. S. haematobium is highly endemic in the entire Nile Valley and has spread over practically all of Africa and the islands of Malaga, Muritius Zanzibar,[33] S. japonicum occur in China the Phillipines and other foci in the Far East, while S. mecongi is South East Asia. S. mansoni is found in the Nile Delta, West East and central Africa South America and the Carribeans.[1, 3]

The infection is increasing in distribution as snails are carried from infected areas to new irrigation projects or as appropriate snails in previously uninfected areas become infected from eggs discharged into the streams, pools and canals by infected individuals. Survival of the parasite depends on human persistence in polluting water with their organic wastes.

Schistosomiasis infection is acquired by wading into infected water. It follows therefore that the incidence of infection is bound to be high in those whose occupation exposes them to frequent contact with water, namely fishermen, famers, and agricultural laborers, especially when working in rice fields and on irrigated land or near dams. Women washing clothes in the steams, children bathing or wading in water are all subject to infection. In most endemic areas children are more heavily exposed and infected than adults[5]. In such cases ignorance, poverty, poor water supply and sanitary conditions are prevalent. The high rate of infection among children including those of the elite class is not surprising; children enjoy paddling, wading, or swimming in ponds, streams and pools. Under the scorching heat of the sun during the hot dry seasons[53], they find going into these pools of water, some of which harbor infected snails, quite irresistible. Many of these streams, rivers and ponds exist in many of our towns[47]. A study conducted by Agbolade, revealed that human schistosomiasis transmission occur mainly in the dry season.[53]

S. heamatobium infection tends to occur more readily early in life in endemic areas up to 45% of children become infected by the age of 10years the maximum incidence tends to

occur from the 16 to 20 years.[48,54,55] A lower prevalence rate of active infection is observed among adults who show late manifestations an sequellae1.[1,3] Both sexes are affected, but males usually show the highest rates and the most intense infections, particularly in the second decade of life.[5]This appears to reflect occupational and recreational differences. Rather than age or sex related resistance to infection.[1,5] In Surinam where both sexes work in the field equal prevalence was found in them.[5]

Prevalence and intensity of infection vary greatly from one focus to another, the intensity of infection is determined by the duration of exposure and the surface area of the body exposed. Only a small proportion of infected population is heavily infected. The risk of developing complications is proportional to the intensity of infection. Epidemiological evidence also suggested that some degree of immunity to all Schistosoma infection occur in humans.[1, 56, 57]

2.3 Transmission

Man is infected while swimming, wading and bathing in water infected by cercariae which easily penetrates the skin or mucus membrane. Arm and leg are frequent sites of penetration. Simply crossing an infected water or stream can be sufficient. In China, Jihan[58] using a mathemathecal model predicted that buffalos cattle and other domestic animals are responsible for 75% of human schistosomiasis transition An exposure index based on the product of frequency, duration and surface area of the body in contact with water can be used to predict infection in endemic areas.[1]

Transmission of schistosomiasis occur mainly in the dry season[53] and is usually focal within an endemic zone, but population growth, migration and socio- economic water resource development like dams and irrigation programmes also aggravate and expand transmission.

Quarry mining activities in some parts of Nigeria (Isiagu area Abia State) have been incriminated as a factor in the local epidemiology of urinary Schistosomiasis, with water bodies that form in the abandoned quarry pits serving as the principal factor.[59]

2.4 **Life cycle of Schistosomiasis**.

All intermediate host of schistosomiasis are fresh water snails of the gastropoda class of the order Pulmonata and Prosobronchiata. Various species of Bulinus snails are the vectors of S. heamatobium while species of Biomphilaria are the intermediate host of S. Mansoni, they breed in swamps drains, dams, lakes ponds, and irrigation canals. Onchomelina species, the intermediate hosts of S. Japonicum are amphibious snails living in moist vegetations.[1, 3]

Eggs of S. heamatobium are passed in urine, while the eggs of S. mansoni and S. Japonicum are passed in feaces. The eggs hatch on getting into water within one hour. The miracidium escapes and they chemotacticaly enters the intermediate snail host. The miracidium can only survive for 32 hours inside water. In the snail a process of asexual multiplication produces thousands of cerceriae from a mother sporocyst via daughter sporocyst within 4-8 weeks[3]. Cercarae are arrow like fork tailed and aggressive free-swimming larvae approximately 1mm in length they are invisible to the naked eye. A snail sheds 200-2000 cerceriae per day for 6weeks or more (until the snail dies) a snail may shed 6000,000 cerceriae.[2] They leave the snail and return to water to penetrate the skin of the definite host (man). Cercarae can survive up to 24hrs.

The Cercarae penetrate human host utilizing the oral and ventral suckers, they migrate through intact skin to the sub-cutanious tissue and over several days to the pulmonary vasculature during this migration the cercarea metamorphosis, shedding the tail and outer glycocalyces while developing double lipid bilayer teguments that are highly resistant to

immune responses. At this stage the organism now called Schistosomula incorporate host proteins including histocompatibility to and blood group antigens in their integumens, their metabolism shifts to glycolisis.[3]

The worms track through pulmonary capillaries to the systemic circulation which carries them to the portal veins where they travel within the portal vasculature, male and female adult pair off and the thin female enters and remains in the gyneacophoric canal of the stockier 8mm male worm. Together they migrate along the endothelium and against the blood flow of the mesenteric (S. japonicum) or vesicular (S. haematobium) veins where they begin to lay eggs. It takes 8-10 weeks for the worm to mature and start laying eggs. The individual female Schistosome lays up to 35,000 eggs daily and can live up to 4-12 years, sometimes up to 30years.[2, 3]

The eggs, which are highly antigenic and can, induce intense granulomatous response; migrate through the bowel or bladder wall to be shed in urine or feaces. Only less than half of eggs penetrate the tissue into lumen Passage of eggs from the vesicle plexus to the bladder and intestine provokes a great deal of tissue damage and bleeding leading to blood in urine or blood in feaces. The eggs that are not shed successfully may remain in the tissues. Or be swept back to the portal circulation to the mesenteric Vessels or to the pulmonary circulation from the vesicular vessels via the inferior vena cava.

The eggs that get in contact with fresh water immediately hatch into miracidia. The free swimming miracidia survive for 2-3 days during this period they must enter a susceptible snail to complete the life cycle. Within the infected snail, two generations of sporocysts multiply and mature into free swimming cercariae, and exit the snail to seek a human host and begin a new cycle.[2, 3]

2.5 PATHOGENESIS, PATHOLOGY AND SYMPTOMATOLOGY

The retained eggs rather than the worms cause the pathology of schistosomiasis, while the clinical manifestation reflect developmental stages of the parasites and the host responses toxic and antigenic substance derived from the parasites and eggs.

The pathogenic effect of S. haematobium consists of: [60]

1 Generalized and localized reaction to metabolites of growing and mature worms.

2 Trauma with hemorrhage, as eggs escape from the venules and

3 Pseudo-abscess and pseudo tubercle formation around eggs lodged in perivascular tissues.

The clinical aspect of this infections are divided into three stages, which are incubation, eggs deposition and extrusion, tissue proliferation and repair.[61]

Incubation Period: This covers the time from skin exposure to cercariae to the period when eggs are first laid by the females and lasts about ten to twelve weeks. The earliest manifestations are associated with the entry of cercariae into the skin and consist of a nettling irritation, varied in severity depending on intensity of exposure and on sensitiveness of the individual. Mild marculoparpular skin lesions may develop in acute infection within hours of exposure to cercariae, significant dermatitis is rare in major human schistosomiasis infection probably because the invading and developing cercariae are minimally immunogenic. However abortive human infection with species that rely on other primary host may cause marked dermatitis or swimmer's itch. This self-limiting process may recur more intensively with subsequent exposure to the same specie.

Commonly, no further indications of the infection develop until near the end of the incubation period, where there is either a gradual or a sudden onset of toxic symptoms consisting of anorexia, headache, malaise, generalized pain in the back and the limbs and late afternoon fever, followed by rigors and night sweating.

Acute schistosomiasis (Katayama fever) is a serum sickness like illness that develops after several weeks in some individuals with new schistosoma infection; it may correspond to the first cycle of egg deposition and is also associated with marked peripheral eosinophilia and circulating immune complexes, it is most common in S. japonicum and S. mansoni infection and is most likely to occur in heavily infected individuals after primary infection. Symptoms usually resolves over several weeks, but the symptoms can be fatal in some cases. There is frequently a pronounced urticaria, at first on the limb, and later more generalized in distribution. The blood shows a leucocytosis, with remarkable eosinophilia.

Early treatment with cidal drugs may exacerbate this syndrome and necessitate concomitant glucocorticoid therapy. In endemic populations where re-infection is common, the physician does not commonly see this uncomplicated first stage[61]. It can penetrate lung and liver during this phase, clinical sign asthma and cough can be observed if lung is affected. Jaundice and liver enlargement when liver involved.

Period of egg deposition and extrusion: Several months after deposition of eggs and they appear in the urine. This usually occurs as painless passage of a small volume of blood at the end of micturation, in few cases gross haematuria may be present.[19, 61] If untreated blood can be found in urine for up to 30 years after initial infection. This repeated bleeding is often responsible for anemia and severe fatigue.

Eventually abdominal pain dysuria, fever and frequency of micturation may set in. Generally there is a positive blood culture. Patient with heavy bowel wall involvement may have increased rate of recurrent salmonella infection. Cystoscopic examination characteristically reveals hyperplasia and inflammation of the mucous membrane of the urethra and lower segment of the bladder and initial papilomatous growth. Likewise, inflammation and indurations of the prostatic region may have developed as a result of infiltration of eggs.

Period of tissue proliferation and repair: This stage is initiated soon after that of eggs deposition and extrusion is underway. The development of pseudo-abscesses and pseudo-tubercles around eggs is accompanied by generalized hyperplasia of the bladder wall, with consequent fibrosis and development of sandy patches in the mucosal wall, as well as secondary infection. The symptoms resemble those of chronic cystitis. At this stage, the lower part of the urethras may be involved and they tend to be dilated rather than constricted and the process may even ascend to the pelvis of the kidneys. The lesion in male may extend into the penis with fibrosis of the sheath and elephantiasis of the organ caused by blockage of the scrotal lymphatic. Pyogenic organisms[62] may invade the periurethral or perivesical tissues, causing abscesses that open into bladder or produce fistula into the rectum or scrotum. Purulent discharges may resemble those of gonorrhea. The involvement of female genital organ may be observed in S. haematobium infection. As a disease entity, female genital schistosomiasis has been neglected, despite the fact that female genital schistosomiasis was reported from Egypt as early as 1899.[27] It has generally been considered that the presence of S, haematobium eggs is not common in female genital organs as in male genital organ. However, the lesions involving the vulva, vagina, cervix and less commonly the ovaries fallopian tubes and the uterus have been described.[27] Granuloma formation may latter lead to sand like lesion in the urinary and genital tracts. Community based studies from various countries in sub-Sahara Africa indicated that between 32% and 75% of women infected with S. haematobium have infection - associated lesions in the lower reproductive tract. Lesions in males occur more commonly in the seminal vesicles and prostate glands. A community based study in an S. haematobium endemic area in Madagascar showed the presence of eggs in the ejaculate of 43% of boys and men aged 5-49 years.[16]

In a study conducted among rural Zimbabwean women, it was observed that women with genital schistosomiasis had an almost threefold risk of having HIV. It is also an important risk factor for bi-directional transmission of HIV[27, 63, 64]

In addition to involvement of the urogenital organs, eggs may be carried into the inferior mesenteric veins, and produced schistomsomal appendicitis or involvement of the caecum, colon and particularly the rectum, [61] In such cases the eggs may be passed in the faeces. Small number of eggs is consistently being swept back through the portal vessels into the liver where they induce granuloma reaction, abscess, and pseudo- tubercle formation. Consequent fibrosis occur a characteristic pipe stem pattern in the periportal tissues leading to chronic hepatic disease. Although hepatocelluler function is spared, periportal fibrosis can lead to portal hypertension, with the usual possible sequellea including splenomegaly, ascites, esophageal variceal bleeding, and the development of porto-systemic collaterals. Through these collaterals (or directly from the inferior vena cava (IVC) in case of bladder wall Schistosome involvement, eggs can reach the pulmonary circulation. The resulting pulmonary granulomatosis and fibrosis can lead to pulmonary hypertension and frank cor pulmonale with high mortality rate, co-infection with hepatitis can accelerate hepatic dysfunction and raise the risk for hepatocellular carcinoma beyond that seen for hepatitis alone[15]. Likewise eggs and even worms are carried through the hypogastric and common iliac-veins, inferior venal cava and the right heart to the lung, where they filter out.

2.6 DIAGNOSIS

Indirect method for the diagnosis depends on clinical symptoms and signs and biochemical or immunological analysis. Specific diagnosis can be made only after eggs are discharged into the lumen of the bowel and bladder and examined microscopically for eggs after compression or suctioning[65] S. haematobium ova with their terminal spines can be

looked for in the sediment of centrifuged urine examined under the lower power of a microscope.[62]

The quantitative urine filtration technique developed by Pugh[66] can only be efficiently used in screening for infection or in defining the intensity of infection. For filtration of Urine, Filter Paper polycarbonate polyamide or membrane derived from other synthetic fibers maybe used, and staining of the egg is required. Usually 10ml of urine are filtered, but a larger volume can be examined will increase the sensitivity of the test.

Currently available immunodiagnostic techniques are not species specific, this include measuring eggs and adults schistosoma antigenic levels and using enzymes linked immunosorbent assay (ELISA)[60,67] to measure the level of antibodies to the eggs of adult worms. All these may be useful in diagnosing a difficult case or conducting prevalence survey. However, they are not to be used as the sole criteria for diagnosis of an individual case and treatment should not be given until ova have been demonstrated.

Another indirect method includes direct observation for gross haematuria and is a simple and reliable indication of heavy S. haematobium infection in children in endemic areas.[5] It can be used effectively at the primary health care level.[5] Detection of micro haematuria by reagents strips[67] is a valuable method for determining prevalence for identifying infected individuals and for accessing the effectiveness of intervention in control programmes,[68] a single high positive value for haematuria is a useful indicator for identifying patients for selective population chemoteraphy.[69] Mott and colleagues[70] compared reagent strip urine test for haematuria and associated S. haematobium infection with eggs count for detecting S. haematobium infection. They found that reagent strips for haematuria identified a high proportion of infected individuals.

2.7 TREATMENT

Until 1970 the treatment of schistosomiasis is nearly as dangerous as the disease itself. The specific drugs used in the treatment of schistosomiasis before the advent of newer drugs are emantine, a number of trivalent antimony preparation, lucanthone, niridazole, and pararosaniline.[31] Ementine given as ementine hydrochloride, dihyroementine hydrochloride or ementine periodide was the most effective specific remedy before the value of antimony was discovered.[31] Ementine has been largely abandoned in favor of antimony, lucanthone or niridazole, which are more effective and safer. Ementine is a general protoplasmic poison, which acts on all tissues and is cumulative and only slowly excreted.[31]

Antimony is a very toxic substance and side effects can be disagreeable and sometimes severe.[31] They may include nausea vomiting and anorexia, constriction of the chest and dypnea, arthralgia diarrhea, herpes zoster's skin eruption, collapse, temporal changes in the ECG or heart failure.

Lucanthone hydrochloride is the first effective oral schistosomicide discovered since after ementine per iodide. Side effect are often more severe in adult than in young patients and are seldom so severe as to warrant abandonment of treatment[31].

Niridazole (Ambihar), the neuropsychic side effects can occasionally be alarming and include acute confusional state, psychosis, hallucination, convulsion, suicidal depression or comma.[31]

Schistomiasis can be treated with relative ease today since a number of goods drugs several of which can be taken orally have become available. The major anti-schistosomal drugs that have been or still are in use against infestation with schistosomes are metrifonate, oxamoquine and praziquantel and all three are included in the World Health Organization list of essential drugs.[5]

Oxamoquine is a monospecifc drug effective only against S. mansoni.

Metrifonate, generally given, as 7.5mg/kg on three occasions at intervals of three weeks is an organophosporus cholinesterase inhibitor, used for the treatment of S. haemotobium infection. Metrifonate, like other organophosphorus compounds, inactivates the enzyme that destroys acetylcholine.

Praziquantel is the newest and most effective drug for treating schistosomiasis occurring in man.[5] It is effective orally in a single dose (40mh/kg) yielding 70% to 90% cure rates against all species of schistosomes infecting man and reduction of 90-95% in the average number of excreted eggs(WHO 1998). With no significant side effect and no adverse reaction on liver, renal, haematopoietic or other body functions, praziquantel is undoubtedly the most advanced in antihelminthic chemotherapy of recent decades.[5, 8]

The new drugs are more consistently effective, less toxic and applicable orally there by making field trials of mass chemotherapy feasible.[5]

Athesunate: Athesunate is highly effective against S. japonicum infection; it is one of the most effective drugs against immature S. mansoni[71] and is also used as prophylaxis.

Extracts of some plants are used in the treatment of schistosomiasis. In Mali fifty five plants belonging to thirty families are reported to be used for treatment of urinary and intestinal schistosomiasis.[72] Also in Egypt the efficacy of purified oleo-resin extract of myrrh derived from Conmiphora molmol tree (known as Mirazid) has been studied and found to be a very promising anti-schistosomal drug.[73]

2.8 Complications

Anemia may result from cytokine-mediated dyserythropoesis as seen in anemia of inflammation. Other features of chronic schistosomiasis are those of proteinuria, particularly albuminuria which has been shown to have a positive correlation with prevalence and intensity of the infection.[70, 74-77.] The effect of other contributing factors such as malaria and malnutrition which are common in regions where S. haematobium is endemic have to be re-

evaluated before any significant conclusion can be drawn concerning the effect of S. haematobium on anaemia and growth Forsyth and Bradley[78] found no significant association between anaemia and S. haematobium infection and the work of Abdel Salaam et al[79] and other workers in Ghana [80]showed no difference between growth of those infected with S. Haematobium and uninfected.

Ernest[61] and later workers in Egypt[81] demonstrated that many cases have malignant growths of the bladder. Most common type of tumor is the squamos cell carcinoma S. haematobium associated tumors usually arises in the bladder neck, lateral walls or fundus.[60] Various theories have been propounded regarding the possible mechanism of schistosomal vesical carcinogenesis. The most obvious been chronic irritation of the epithelium of the bladder by the passage of ova during muscular contraction or following its reaction to the inflammation processes stimulated by their retention. The presence of a miracidal toxin has also been considered.[60] A survey in Tanzania showed that S. haematobium was rampant, causing hydronephrosis, ureteric lesion or non functioning kidneys in more than 20% of the child population and in over 10% of the adults[65]. Forsyth and Bradley[78] reported significant morality in young men from the renal complications.

In a study conducted in Ghana by Sehiff [20]and others using ultrasound to monitor bladder abnormalities it was observed that there is an increasing association between age and severe bladder abnormalities. Papanicolaou-stained smears were seen to have squamous metaplasia. Schistosomiasis associated bladder cancer is an important concern in areas where S. haematobium is prevalent.[20] Endogenous mutagenic and carcinogenic products are detected in increased concentration in the urine of people infected with S. heamatobium. In small series of patients mutation at the p53 gene in squamous cell carcinoma are found in association with S. heamatobium.[20]

There is limited evidence to suggest that S .japonicum causes colorectal cancer, however it is a risk factor for hepatocellular cancer. S. mansoni may still be linked with hepatocellular cancer.[14] Ectopic eggs deposited can lead to additional clinical syndrome, including the involvement of skin, lung, muscle, adrenal gland, and eyes. Central nervous system involvement can result in transverse myelitis (best described for S. heamatobium and S. jmansoni) and cerebral diseases (most common in S. japonicum infection).

Genital diseases associated with schistosomiasis haematobium occur frequently in women and men. Community based studies from various countries in sub-Sahara Africa indicate that between 32% and 75% of women infected with S. haematobium have infection-associated lesions in the lower reproductive tract. Lesions in males occur more commonly in the seminal vesicles and the prostate gland. Community based study in an S. haematobium endemic area in Madagascar showed the presence of eggs in the ejaculate of 43% of boys and men aged 15-49 years.[16, 82]

There is circumstantial evidence that genital schistosomiasis in women is a risk factor for bi-directional transmission of HIV, and that schistosomiasis of the cervix, with or without human papilloma virus infection, predispose to the development of cervical cancer. [16]

2.9 FACTORS CONTRIBUTING TO THE SPREAD OF SCHSTOSOMIASIS

Factors contributing to the spread of schistosomiasis include: [83]

1. **Poor sanitary conditions:** Many rural communities have no safe system of sewage disposal. Human excreta can pollute water sources when

   . deposited directly into open water.

   . washed from land by rain.

   . carried on animal's feet when they go to drink .

   . washed from the peri-anal region during bathing

   . excreted from animal feces

People continue to contaminate water source when they

. do not have any alternative

. have a cultural reason for not using a latrine

. Do not know how schistosomiasis is transmitted[83]

Portable water is scarce in most rural communities. In Ilie pipe born water supply is very irregular, the pumps of bore holes often brake down and are not repaired by the Local Government Authority on time, many of the shallow wells either dry up during the dry season, or do not yield adequate water.

2. <u>Avalability of snail intermediate host:</u> Schistosomiasis occurs only when the snail host are infected by miracidia hatched fom eggs.[83] In both villages snail shells of the Bulinus and Biomphalaria species can be identified along the river bed. Moji et al[2] reported that proliferation of snail host and epidemic of schistosomiasis has followed construction of large dams such as those built at Lake volta, Kainji, Kossou, and Aswan in Africa.

3. <u>Human contact with water:</u> The transmission is complete when schistosome . cercariae penetrates human skin when they go to

. Collect water for use in the home

. Wash cloths and utensils

. Bath, wash and fish

. launch and land boats

. working in agricultural or irrigation schemes[83]

Water contact studies lead to the identification of a wide range of human behavioral activities associated with exposure to schistosomiasis infection[10] Different water activities have been found to vary in weight as risk factors. The load of infection is found to be related to the surface area of the body; length of time is also positively related. An exposure index

based on product of frequency and duration, proportion of body area exposed, time of the day and type of activity, can be used to predict infection. [1, 10]

Behavioral change is very difficult especially when such behavior has a socio-cultural or occupational nature and there are logical reasons for it. In the villages of Nile delta, irrigation canal are main sources of plentiful water human/snail contact is maximal in summer months. Fisherman, farmer, rice harvesters, processors, and wheat washers are at high risk. Sometimes people are engaged to remove vegetations from irrigation dams.[1] An in depth study conducted in two villages around the Nile found many socio cultural factors behind persistent use of canals for domestic purpose even when safe water supply is provided.[10] Egyptians go to the canal together in groups[10]to do ablution (washing before prayer) many times daily. Children and young adults enjoy swimming in or playing in fresh water streams ponds and lakes in hot summer months.

Knowledge regarding transmission of schistosomiasis is still very limited in many endemic communities.[2, 84] In some parts of Africa the onset of haematuria due to urinary schistosomiasis is so common in adolescent boys that it is seen as normal, [84,85]many Nigerians regard it as a sign of maturation to puberty, especially in males. In Cameroon it is regarded that haematuria result from having sexual intercourse or excessive exposure to sunlight.[8] Such myths and misconceptions are often worse than simple ignorance and should be addressed though health education and behavioral change communication in schools[85].

Many cannot benefit from health related information through the mass media because most villages do not have electricity. Majority of the villagers cannot read posters because they are illiterates. It is the responsibility of all cadres of health workers to health educates the community at every available opportunity.

2.10 SOCIO-CULTURAL, HEALTH AND ECONOMIC IMPACT OF SCHISTOSOMIASIS:

Although schistosomiasis in some cases may result in minimal pathology, there are significant proportions of infected patients who experience moderate to severe morbidity. Population in schistosomiasis endemic areas experience high incidence of storage iron deficiency anemia, [86] due to chronic blood loss, inflammatory urinal tract pathology, dysuria, fever and lethargy that leads to absenteeism from work. Complications of schistosomiasis like cancer of the bladder and fibrosis leading to hydronephrosis and renal pathology can lead to disability and loss of income into the family especially when the bread winner is affected there by leading to poverty. The disease is estimated to be responsible for the loss of 1.5 million disability adjusted life years, and mortality was estimated to exceed 100,000 per year.[2] This constitutes financial drain and poverty at individual and family level, 78, and 87

These create a lot of on the individual and the family. The government also is obliged to respond to the health burden by providing manpower and materials for health service delivery.

Nutritional status may be compromised in schistosomiasis infection.[88] In the Philippines a study was conducted by Coutinho and others[12] it was observed that nutritional status of children and adolescents with S. japonicum infection improved after treatment. Annual treatment interval was recommended.

In China and Japan, the high morbidity and mortality due to S. japonicum led to disintegration of communities and consequent reduction in agricultural production. In Brazil schistosomiasis was among the three top public health problems. Control was initiated in Egypt because irrigation is the mainstay of agriculture and it was felt that morbidity due to schistosomiasis would reduce production.[16]

2.11 Global status of schistosomiasis

Progress has been made in the control of schistosomiasis over the last twenty years. Elimination and/or eradication of the infection are within reach in the Caribbean islands, Iran, Japan, Mauritius and Tunisia. Morbidity and mortality control is being achieved in Brazil, Cambodia, China Egypt, Laos and the Philippines. Control has also been successful in Botswana, Iran, and Morocco where prevalence of infection is low though transmission continues. Schistosomiasis remains a public health problem in sub-Sahara Africa because very few countries have undertaken sustainable control.[16]

In Nigeria the Cater Centre in partnership with Nigeria's health authorities are currently implementing Schistosomiasis in Delta, Nasarawa and plateau states.[8] In May 3007 the delivery of 1 million praziquantel treatments was celebrated[89]. The programme is in the rudimentary stage in Osun state.

2.12 PREVENTION STRATEGIES

The control of Schistosomiasis involves interrupting the life cycle, of the schistosoma. It also depends on a deep understanding of the epidemiology of the disease complex, that is the clinical aspect[41] and in particular of the biology, ecology, and distribution of the parasites, their snail intermediate host and mammalian reservoir host. A sound knowledge of the role of humans and their behavior in maintaining the infection is crucial; moreover the ultimate success of any control programme is dependent upon full understanding of the local socio-economic conditions, upon appreciation by the health authorities as well as by the community of the benefits of the proposed measures[1].

There are six basic approaches:

1. **Elimination of the reservoir** A Lancet[90] editorial and WHO[4] noted that the

emphasis in schistosomiasis control has been shifting from control of the snail intermediate host towards a direct attack on the parasite by chemotherapy. Chemotherapy is an effective form of control that reduces both the number of eggs in the urine and within the body. Jordan[91] in his book, schistosomiasis – The St. Lucia project explained that chemotherapy was the most inexpensive method of control and resulted in the most rapid reduction of infection.

One of the recent drugs used in chemotherapy is praziquantel, a schistosomicide that has the advantage of being effective in a single dose against the three major schistosoma species. WHO [16, 91]confirms that praziquantel is currently the most important drug in treating schistosomiasis. It is effective and is widely used drug for the control of schistosomiasis. A single oral dose of 40mg/kg is generally sufficient to give a cure rate of 60-90% and reduction of 90-95 % in the average number of excreted eggs.[16] Children with initially high pre-treatment egg load may show poorer therapeutic response that may necessitate retreatment.

Longitudinal surveys of ultrasound studies[92, 93] have shown that Praziquantel therapy is rapidly effective in reversing urinary tract abnormalities among children. The benefit of treatment in adult is less well-known. Some people are at special risk of morbidity, for them more intensive repeated therapy should be provided. Various lesions like polyps, ulcers patches and calcification of the wall of the urethra, bladder and reproductive organ, hydronephrosis may disappear within weeks of treatment in young adults. Late complications like hydronephrosis may take 1 – 2 years to show improvement particularly in males. Elimination of infection does not terminate the immune response to eggs, trapped in tissues; therefore fibrosis may progress for some time after successful cure of infection, persistent dysuria or urinary track infection.[93]

There is need for repeated annual therapy during high-risk period of life, that is childhood and early adolescent to minimized risk of late complication. Regular treatment of school children can result in more than 50 percent reduction in an individual cumulative pathology.[92]

The price of praziquantel is low and affordable by most endemic country governments and successful campaigns have been carried out in Brazil, Egypt China, several countries in Africa and elsewhere. Integration with primary health services is increasingly occurring.[91]

However, Eugene[94] noted earlier that prazinquantel is costly for poorer nations, especially since the chance of re-infection is high. A study conducted by Kardaman and colleagues[95] in Geizeria schistosomiasis project, reports that 12 months after praziquantel treatment, 73% of the treated children were again passing S. mansoni eggs due to re-infection. While praziquantel is the drug of choice, species-specific drugs are also effective. For example, metrifonate is effective against haematobium. Warren[96] noted that metrifonate is a relatively inexpensive drug and is excellent for treating S. haematobium infection.

Chemotherapy is also useful for targeted mass treatment, this involves of the most heavily infected segments of the population to reduce the eggs burden in the environment thereby offering some measures of control. It prevents the development of the disease in patients with heavy infection and ensures high rate of resolution of infection, it arrests the progression of existing severe disease and enables the patient to recover from reversible lesion particularly in children.[16]

A study conducted in Mswambweni Kenya[97] an endemic community for S. haematobium have suggested that anti- parasite therapy targeted at the school age children should have a significant impact on local parasite transmission, their experience from 1984-1991 has shown overall decrease in transmission within 2yrs following initiation of annual treatment of school age groups[97]

Chemotherapy helps the whole community, even when reduction in transmission is incomplete the fall in disease risk may still be considerable. Thus chemotherapy is a tool for both primary and secondary control of Schistosomiasis.[1] The object of primary control is to end output, especially in those most likely to pollute transmission sites. It is not known at what level the persisting egg excretion ceases to be public health problem, but some epidemiological models suggest that even a small residual percentage of egg output is sufficient to maintain transmission at a considerable level.

Secondary control is aimed at minimizing the pathological effect of the infection, the severity of schistosomiasis with rising egg output and intensity of infection. An appreciable proportion of patient with low egg excretion rate also show severe lesions, this may be due to previous heavy infection or greater susceptibility to pathological consequences. It is desirable to treat all infected individuals.

Chemicals such as chlorine added to water for disinfection, also kill the schistosoma in the cercarial stage. Warren[95] indicated chlorine at the level used in swimming pool is effectives

Athemiter is an effective new agent for chemoprophylaxis against schistosomiasis.[98]

2. **Avoidance of pollution of surface water**

Schistosomiasis and water are closely linked and the high prevalence of schistosomiasis in many parts of the world is directly related to human contact with natural water bodies. Some water contact is occupational and, to some extent, necessary, but most transmission of schistosomiasis occurs during water contact for some domestic or recreational purposes. The provision of safe and adequate water supplies and sanitation contributes to reducing the prevalence and severity of schistosomiasis. Snail infected water is contaminated by carriers urinating or defecating into the water or along it's margin, storm water following heavy rain may carry feces of the top soil into the water source.[83] A proper

water carriage sewage system is naturally ideal. Where this is not available the provision of urinals and latrines of the bored holes trench or pour- flush type should prove satisfactory.[99]

Most major control projects use a combination of chemotherapy molluscicides, and education of the population at risk to lower the incidence of schistosomiasis.

3. Elimination of the vector:

a. Chemical method: The snail, as the intermediate host, is considered the weakest link in the disease cycle. The most popular means of reducing the snail population is with molluscides. The molluscide that is predominantly used is Baylucide[28] and Niclosamide.[100] It is commonly used in programs. Laughin, [101] noted that while snail control is a rapid and effective method of schistosomiasis control, it requires a prolonged effort. In addition, Warren[96] warned that molluscides are potentially toxic chemicals. They are usually absorbed into the soil and water causing damage to the environment, fish and other aquatic life form.

Mulluscides of plant origin supposedly cause less environmental damage than those of synthetic origin. Akilu[102] noted that the highly potent suponnins, a group of plant glycosides in the berries of phytolacca dodecandra[100] and swatzia madagascarieusis appears to be the most promising chemicals of plant origin for snail control. The successful use of plants as molluscicides depends on abundant growth of the plant in the endemic areas as well as early extraction of the plant chemical.[5, 100]

Molluscicides can be applied focally or area wide depending on the situation, administration must be carried out under the direction of those who have expert knowledge and experience to ensure effective action against snails, and minimal risk to humans and other living things. Selective focal mollusciciding is generally preferred. Even though controlling snail population would prevent schistosoma reproduction, WHO[5]1indicated that snails are impossible to completely eradicate, even with the most potent molluscicidesd[5]. To

be effective, application must be repeated indefinitely since snails from other locations can become established in a previously snail-free environment.

b. Physical: Alteration of the habitat e.g. drainage of swamps may solve the problem by eliminating the breeding site of the snail where such a radical cure is not feasible, the situation can be improved by rendering the environment hostile to the snails for example removal of aquatic vegetation, altering the flow rate of the stream or building concrete lining to the walls of drains.[100]

c. Biological: - An alternate to use of molluscides is the biological control of snail, by using various natural predators, such as other snails, fishes[100] ducks, and turtles. A study by Daffalla et al[103], in Khartoum, Sudan, suggests that protopterus annectans a snail eating lungfish could successfully reduce the snail population in areas where molluscicides cannot be used.

Experiences have shown that this method is only successful in some specific habitats. Biological control is not a practical option presently.[1]

(4) **Prevention of human contact with infected water**.

Anti-schistosomal clothing includes water-proof boots and leg coverings

Where contact with infected water or swamps are unavoidable. Army uniforms give some protection but no ordinary cloth is entirely cercaria-proof. Thick gloves should protect hands in contact with infected water; this may prove impractical for peasant farmers or subsistence fisherman. Personal protection against cercarial penetration can also be effected by the use of ointments creams or sprays applied to the skin. Benzyl benzoate ointment, tetmosol or copper oleates have been recommended. Provision of alternative supplies of save water coupled with health education.

(5) **Health education**

The control of urinary schistosomiasis in developing countries by presently available and affordable strategies can be approached most effectively by a combination of human behavioral change through health education, communication, and community participation, mass-chemotherapy and safe water supply.[2] Many models theories and approaches to health education and behavioral chanhe communication are available. Graeff et al[104] listed the following five models of health education although all have certain limitation, each of them promote desirable behavioral changes that enhance diseases control.

The provision of knowledge approach: Provision of knowledge is the core of the heath education. People's awareness, attitude and behavior will not change without knowing something new. Knowledge regarding schistosomiasis is still very limited in many endemic communities,[84] Myths and misconceptions based on rumors and information from unconfirmed sources are effluent and are often worse than simple ignorance. Without proper knowledge, autonomy and sustainability of healthy behavior cannot be guaranteed. Knowledge and education is a basic human right and should be given by all heath care providers.

People should understand and be convinced that they can avoid the disease and its transmission by changing their behavior; they should know what to do and who to do it. Health education for urinary schistosomiasis control should stress avoiding contact with cercarial infested water sources, avoiding urinating in and near river/canal, and the need for urinary examination and mass chemotherapy.

It is not always easy to stimulate interest in health education of schistosomiasis control, especially in rural communities in developing countries where the disease is chronic, not life threatening in the short period, and public health impact if the disease is difficult to see.[2, 105-6]

Limitation: there may be assumptions or prejudices in this approaches that ignorance causes disease. But there are many factors of epidemics other than ignorance. Outsiders often tend to force their value, their education and their knowledge to people without hearing from them. Provisions of knowledge alone often do not induce behavioral change effectively. Some people already know about diseases and risky behaviors. Yet, they are taking risky behaviors. Some of them are fed up with being given such information.

The KAP / KAPB study-Based approach: In order to make a better and effective health education programme, people's knowledge, attitude, perception and behavior, and relation among them must be analyzed . If a less preferable attitude is associated with risky behavior such an attitude must be a target of the health education and communication programme. If insufficient knowledge of some aspect of a disease is related with less preferable attitude and behavior, health education should concentrate on that aspect. This approach can make a better planning for effective health education. One can identify the target population, the subjects, and the appropriate approach through the KAPB study.

In Zimbabwe a studied community was aware of schistosomiasis but their knowledge on transmission was limited.[107]About 80% of people in another endemic community in Zimbabwe thought that schistosomiasis was a dangerous disease with blood in urine, but only 12% knew that snail was involved in transmission. [108] In this case education about the life cycle and mechanism of infection may be effective in enhancing behavioral change. In the Nile villages where S. mansoni has almost completely replaced S. haematobium, education about the differences between the two forms of the disease for health unit staff and local people is needed. A study on perception of risk of schistosomiasis in Malawi[109] observed that those who perceived risks tend to keep preventive guidelines. In this case health education should be focused on increasing risk perception.

Limitation: people may not answer the KAPB interview properly. Individual based KAPB study may not take into account the socio-cultural background. The result, of KAPB studies tend to be interpreted according to the outsider's value system.

The health Belief Model: By seeing the relative strength of people's perceived risks, benefits from health behavior, cost of not taking health behavior, and costs of health behavior health educators can understand why people do and not take a behavior psychologically. Perception of risks, benefits and costs may change with the socio-cultural background. With this information, health education can take better approaches to change people's behavior.

Adherence to preventive guidelines for schistosomiasis is influenced by personal perception of risk and controllability.[110] Villagers may perceive that the benefit of participating in a urine examination and mass chemotherapy is less than going to their farm to work. This problem can be solved by changing the conditions (e.g. closer stand pipes for quicker urine examination and by communication to change their perception. If facilities cannot be improved immediately, health education needs to focus on changing perception of risk, benefits and cost through discussion and though giving appropriate knowledge.[2]

Limitation: understanding the reasons why people behave differently from what specialists expect may not have direct impacts on improvement of a control programme.

The PRECEDE/PROCEED Model: The PRECEDE/ PROCEED model provides a total process of a disease control and improvement of the quality of life. It integrates health education into disease/ health promotion programmes, and provides an idea of health education centered disease control programmes. It combines educational diagnosis with environmental diagnosis and also classifies behavioral factors into predisposing, reinforcing, and enabling constructs. The precede model deals with non behavioral environmental factors as an important target of health promotion activities. Desirable behavioral changes could result when knowledge is supported by enabling and reinforcing factors.[111]

Limitation: in developing countries, it is difficult to improve enabling and reinforcing factors in the short term. These factors include poor rural community health service, lack of man power, poor water supply weak transportation, poor environmental sanitation hygiene low school enrolment high unemployment rate, frequent migration, poverty, lack of national control programme, and social discrimination. Administrative and policy diagnosis may figure out the constrains of changing such situations (especially without any donor sponsored projects).

The community Participation approach: Positive participation of the community is the base of rural development and autonomy. It is indispensable to improve and sustain health and living conditions (especially in developing countries). It will also increase the effectiveness of the disease control as well as that of the health education programmes. Community participation must be organized as an integrate part of the basic health care activities and the primary health care workers must be prepared to assume their responsibilities at the local level.

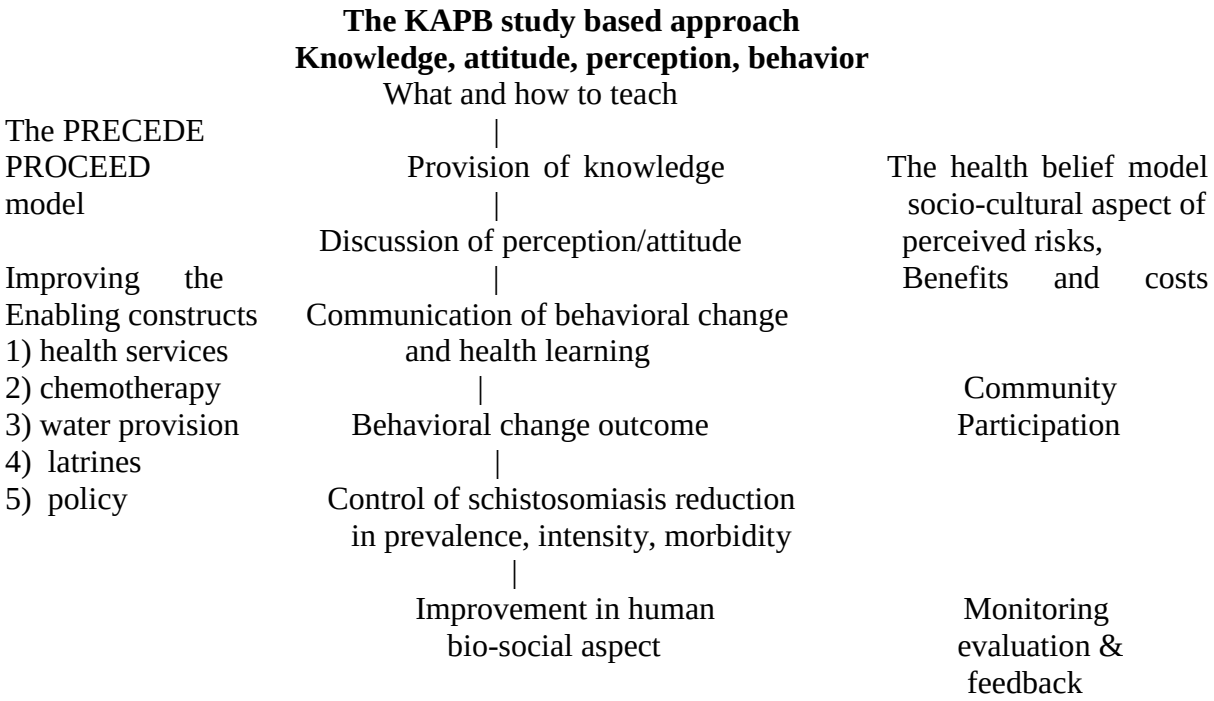
National and political interest should be promoted once the schistosomiasis problem is considered to be serious public health problem. Recognition of the problem by local population, and the awareness of the risks and possible consequences of infection must be the basis of its co-operation. Governments and community implementing Schistosomiasis Control Programme have the responsibility of organizing national and local effort through mechanisms acceptable to the communities' concerned. Simple inexpensive and appropriate technology should be carefully selected and transmitted to those members of the community most involved in schistosomiasis control.

Limitation: community participation is difficult to organize naturally in the present situation in developing countries. 'Forced' community participation may finish with the end of support from the outside. People may ask/demand more (and different) service as a result

of health education and community participation instead of doing what they can do by themselves. Fostering the sound leadership is very difficult where life itself is economically harsh. There may be antagonism in a community (between rich and poor, Male and Female etc). The community itself may be weakened in the process of modernization.[2]

The relationships between the five approaches are summarized in figure 2. Education should be oriented by KAPB studies. Then information of people's perception and attitudes toward the schistosomiasis should be collected through communication and discussion with people based on the Health Belief model. In the next step, proper knowledge and message for behavioral change and disease control should be provided in a culturally acceptable and effectively manner. Those core parts of health education should be backed up using findings of the PRECEDE/ PROCEED model. At the same time health education should stimulate community participation, which in turn enhances the health learning processes of community members. All those processes with available public health and basic human need services should work together for effective behavioral change and for better health participation and reduction in infection and re-infection rates of schistosomiasis though avoidance of contaminated water.

Figure 1: Relationship between health education approaches and the control of schistosomiasis:



KAP: knowledge, attitude, and practice; KAPB: knowledge, attitude, perception, and behavior.

Inadequate perception of schistosomiasis contributes to maintain a high level of prevalence in Djikoroni para where a study was conducted by Sangho et al[49] on prevalence and perception of schistosomiasis in a peri-urban school in Bamako Mali 88% of the children considered haematuria as pathology but did not know anything about intestinal schistosomiasis, the symptoms and mode of transmission of S. haematobium were generally well understood but not for S. mansoni, the parasite, intermediate host and their interactions were unknown. Their main man-water contact were bathing and playing in Woyowayanko and Niger river.

Hu Guanghan[112] conducted a study on the role of health education for schistosomiasis control in an endemic area of Poyang lake Region in China. Health education implemented the study pupils by showing video tapes on schistosomiasis control, exhibiting the samples of

schistosomes and pasting up the pictures about schistosomiasis control. Lectures were given on technique of protection from infection, demonstrating how to wear appliances and smear anti-schistosomal cream. Behavior encouragement was done with the support of the school authority, formulating school discipline and class rule about schistosomiasis control to limit pupils' non- hygienic behavior, rewarding the pupils who do not contact infested water and those who protect themselves when contacting infested water, otherwise, giving punishment.

Post intervention the pass rate of anti-schistosomiasis knowledge among the pupils increased significantly by 89.5% compared with the control group. The frequency of various infected water exposure modes among the pupils in the study group decreased remarkably education. The same study was conducted among adult men and women it was observed that the frequency of infested water exposure due to amusement decreased significantly but the frequency of infested water exposure due to production (fishing) increased significantly.

A study using a school based health education model on schistosomiasis was conducted in the rural area of Egypt by M. Kotb et al[113], The objective was to evaluate the effectiveness in changing knowledge, attitudes and schistosomiasis infection rate among Egyptian primary school children. High coverage with safe water supply and sewage disposal was one of the criteria specified when the villages were selected because an increase in knowledge and favorable attitude will not lead to behavioral changes unless the environmental facilities that influence the transformation of knowledge and attitude into the desirable behavior are assured.

The content of the health education model for the school children were divided into three modules each had its own objectives sequence of events, and evaluation. The model involved various educational approaches including health talks, group discussions, case histories and role playing and was reinforced with a package of slides

1. The first module focused on orientation to the problem of water risks and contaminating practices.

2. The second module was directed to the identification of the life cycle, symptoms and complications of schistosomiasis.

3. The third module stressed the importance of healthy behavior and of seeking medical care when necessary.

The effectiveness of the intervention was assessed one month post intervention through a quasi-experimental design involving three pairs of comparable primary schools in Kaliubia Governorate. The mean scores of both knowledge and attitude significantly improved (p less than 0.01). Indicating the potential value of the developed model.

Schistosomiasis infection was reassessed one year after intervention, When the results were compared with that of baseline data, it became obvious that there was reduction in the occurrence of schistosomiasis infection in both intervention and comparison schools of the three pairs. However, the reduction was dramatic and statistically significant in the intervention schools of pairs 1 and 11. There was also a parallel and significant improvement in knowledge and attitude score of children in the intervention schools of pair 1 and11 were used. The increase in the children's knowledge in the intervention school of pair 111 was not coupled either a significant improvement of attitude or a reduction of schistosomiasis infection. Failure to document such might be due to the presence of social or environmental barriers which interfere with the establishment of favorable attitude and habits. A type 11 error due to relatively small number of children in pair 111 is also a possible explanation. The possibility of confounders not addressed in the study design cannot be ruled out.

Health education can also play an important role in schistosomiasis control.

Jordan [91]found that instituting a health education program in five settlements in the Richfond valley area of St. Lucia caused a significant decline in water contact and lowered the

incidence of schistosomiasis. Lansdown et al in Tanzania[85] and Eline et al[114]in Moroccan oasis also reported similar achievements.

Human attitudes towards water and water borne disease transmission need to be modified frequently particularly in areas with endemic schistosomiasis. Health education should be the responsibility of health workers, and should be based on a clear understanding of the people's perception of disease and it's relation to the environment. Effort should be directed towards those groups that are at greatest risk and most involved in transmission usually young children. It is recommended that whenever possible efforts are positive rather than negative in orientation. It is better to encourage children to refrain from polluted water source than try to prevent water contact. Infection is likely to be associated with certain types of water contact behaviors. If a link is established between specific activities and schistosomiasis transmission the activities should be discouraged.

An effective health education programme should promote active community participation in installing its own water supply to community, and simply co-operating with authorities in reducing contact with unsafe water.

Presumably, however, the ultimate control will be a vaccine to prevent the disease. Although development of schistosomiasis vaccine is still in its infancy. It is highly active areas of research and investigators are confident that a vaccine will provide the best protection against schistosomiasis.

CHAPTER THREE

3. METHODOLOGY

3.1 1. Description of study area.

The study was conducted in Ilie and Ore, the two rural villages are located in northern parts of Olorunda, and Isokan L.G.A respectively in Osun State about twelve kilometers apart. The Erinle River marks the dividing line between the two local government areas. Both local governments were carved out of the former Osogbo L.G.A in 1988. The two villages fall within longitude 04-3^0 746 and latitude $07^0$58.268^{40}. Both areas situated about 70km to Olorunda L.G.A secretariat in Osogbo, the state capital.

Each community has a population of about 5000 as indicated by the Local Government Authorities and also the de joure census conducted by medical students on posting to Ilie in the year 2007. Each village has a secondary school and two primary schools. A comprehensive Health center situated in Ilie is the practice area for Ladoke Akintola University Teaching Hospital. The environment, the geographical location in relation to the dam, socio economic condition, educational level, occupation and living conditions of the two villages are similar.

2. The people

The traditional ruler Chief Regent Ibrahim Akinrinmade is acting as the Eesa of Ilie while Ore village, is headed by the traditional ruler of Ore, known as the Olore.

The people are predominantly farmers they grow both food and cash crops; while some are artisans (5%) who render various services to the community. Fishing as an occupation became prominent in the two communities after the construction of the dam over Erinle River that separates the two communities. This has made fishing activities feasible, as

at now the two communities supply most of the fresh fish that is consumed in Osogbo the state capital.

3. Water supply: Water is supplied to Ilie from Ede water works, There are about 5 public water taps located at various parts of the village. Within Ore community there are 8 public taps; water supply is from Otin dam. Pipe borne water is irregular and far in between, it usually comes for one day in a month in both communities. There are two bore holes in each town, which are strategically located, usually the pumps often break down and it takes a long time to repair because they are maintained by the Local Government Authority. Many individual shallow wells located within the two villages do not bring appreciable yield of water due to the topography of the area, as a result the people of the village resort to fetching water from river Erinle.

The river extended beyond its original banks when a dam was constructed at Igokiti to create a reservoir for Ede water works in 1988. The dam provides water for the major towns and the state capital. Indigents from the two communities visit the river daily to fetch water for domestic purpose and also to wash clothes. On Sundays a large number of the villagers go to the river, some come with their lunch, to do one thing or the other, this include Okada men who go to wash their motorcycles. The daily water contact has made the river a major source of schistosomiasis infection to the indigents of the two communities.

3.2 Study design: The study is an analytical, comparative cross sectional study with two intervention components carried out in Ilie in Olorunda LGA and Ore in Isokan LGA.

3.3 Study Population and Sampling Methods[115]

The pupils in the study group were selected from the randomly selected primary school in Ilie, while the pupils in the control were selected from the randomly selected primary school in Ore. Both are rural communities and are located near the dam along Erinle River. Both villages are comparable on basis of geographical location with relation to the dams, their environment, socio-economic condition, education level, occupation and living conditions which are similar. They are also similar in their coverage of safe water supply, sewage disposal system and overall prevalence of schistosomiasis infection. The target populations are primary school pupils. Each village has two primary schools; one primary school was randomly selected using the ballot method in each of the two villages. The population of the randomly selected primary school in Ilie is 317, while that of Ore is 349 as indicated by the headmasters. The total number of pupils in each of the schools serve as the study population. All the pupils in each school were included in the study except those that fall within the exclusion criteria.

3.4 SAMPLE SIZE DETERMINATION.

Taylor's Monograph was used to calculate the sample size[116]

$$\frac{[u+v]^2[p_1(1-p_1)p_2(1-p_2)]}{(p_1-p_2)^2}$$

N pairs = desired sample size

Z = standard normal deviate

$Z_{\&}$ = 1.9 i.e. 95% confidence level

Z_B = 0.8 for 80% statistical power

Expected frequency 10% prevalence of disease or health problem and 10% difference (∧) in the study group pre and post intervention

$$N = \frac{(0.84+1.96)^2 \{0.5[1-0.5]+0.95[1-0.95]\}}{[0.5-0.95]^2}$$

$= 107.3 \quad = 107$

The Calculated sample size is 107. However, this was raised to 250 for each of the study and control groups to take care of incomplete response, and those that will be lost to follow-up (attrition) and also to further reduce errors.

3.4 SUBJECTS All the pupils in each of the schools participated in the study except those in the exclusion criteria.

1. INCLUSION CRITERIA

Only the subjects that fulfill the following criteria were included in the study.

(a) Being a primary school pupil.

(b) Age between 6 and 15 years.

2. EXCLUSION CRITERIA

The following students were excluded.

(a) Children below the age of 6 years (they are less likely to be infected)

(b) Pupils in the final Year who may leave school before completion of the study.

(c) Children who have lived less than three months consecutively in the community (life cycle of schistosome is about 6-12 weeks) their inclusion could lead to a high number of false negatives

(d) Menstruating female pupils as at the time of sample collection.

3.5 ETHICAL CLEARANCE

Permission for the study was obtained from the Medical Ethical Committee of Ladoke Akintola Univesity of Technology Teaching Hospital, Osogbo, from the Olorunda and Odo

Otin Local Government Education Authorities and from headmasters/ headmistresses of the selected schools. An informed verbal consent of the parents/guardians was obtained through parents/ teachers association of the schools. The village heads and elder of the villages was also informed.

The objective of the study will be explained to the participants individually and the consent of each one of was obtained before commencing the interventions for each of them. Incentives, in form of sweets and biscuits were given to pupils. Praziquantel was administered on symptomatic participants in the control group after the completion of study.

3.6 COMMUNITY PENETRATION / ADVOCACY.

A letter of introduction was obtained from the Ministry of Education to the Headmasters of the schools, requesting for permission to conduct the study. Assurance was given concerning the safety of the drug. They were also informed of the purpose and benefits of the research. The Headmaster explained our mission at the Parents Teachers Association meeting (PTA) and obtained the consent of the parents. Advocacy visits were made to the traditional rulers and elders of the two communities.

3.7 RESEARCH INSTRUMENT AND METHODS OF DATA COLLECTION.

Five research assistants made up of two community health workers from the health facilities in each of the two communities who are fluent in English and Yoruba language, and a laboratory technologist were recruited and trained on voiding of urine and collection of urine samples, the use of chemical strips to determine the degree of haematuria, determination of egg count, drug dispensing in dosage, good and accurate record keeping, monitoring and management of side effects of Praziquantel, and filling of questionnaire.

A semi-structured questionnaire[117] was designed for the purpose of data collection and this was developed from information obtained from literatures and discussion with colleagues and senior colleagues. The questionnaire was pre-tested among primary school pupils in a primary school near Ede which also has a dam but far away about 50 km from the study area. This is to prevent filter of information and to minimize error of the instrument. The pre-tested questionnaire was analyzed. Necessary modification was made on the questionnaire. The questionnaire was administered on the pupils by the trained personnel with the help of the teachers in each of the schools.

The study was carried out in three stages

1. Pre-intervention stage
2. Intervention stage
3. Post intervention stage

1. **Pre-intervention stage**

A cross sectional survey was carried out among the primary school pupils in the study group (one randomly selected primary school in Ilie) and the control group (one randomly selected primary school in Ore) using pre-tested questionnaire[117]. This is to seek baseline information of demographic profile of the pupils, social data, and their knowledge of shistosomiasis, preventive practice, risk perception and risky behaviors.

Urine samples were collected between 10.00am and 2.00pm [118-120](period of maximum egg excretion) by the trained assistants. A terminal urine sample was collected from each participant in a labeled 25ml screw cap container, under the watchful eyes of the trained assistants. The pupils were instructed to void the urine into the plastic container when the stream of urine is slowing down until the last drop of urine is voided, the male research assistant supervised males and vice versa. The urine samples were collected in sessions: i.e

40-50 participants per session. The degree of haematuria was indicated by the color changes on the Uristrip (manufactured by Clinotec Diagnostics & Pharmaceuticals Inc.) was matched with standards and recorded in order of magnitude as follows: [121-122]

Uristick	Red blood cells	Egg count	WHO classification
(erythrocytes /ul)	(/hpf) O	Negative	0
±			Trace
+	10	1-10	Mild
++	11 – 50	11 – 50	Moderate
+++	50 – 250	50-200	Severe
++++	>250	> 200	heavy

There after, the samples have been preserved by 2 drops of 1% domestic bleach to prevent hatching of the eggs before microscopic examination.[88] The samples were be taken to the Comprehensive Health Center and examined microscopically under the power of x 40 after centrifuging at 3000rpm[62, 123-4] for three minutes by the laboratory technologist attached to the Comprehensive Health Center Ilie.

2. **Intervention stage:** The two interventions given to the pupils (i.e. the health education and treatment with praziquantel) were carried out in Ilie among the study group. Those who had eggs of schistosoma haematobium in their urine were weighed using a standing weighing scale and given a calculated single dose of Praziquantel (40mg/kg), [4, 41, 95, 98, 125-7] the drug was obtained from the Ministry of Health Osun State through the PHC Department of Olorunda Local Government Authority. The side effect of the drugs like abdominal discomfort, nausea and rashes were explained to each participant in Yoruba language. Also Health education sessions were conducted in Ilie among the study group in the school premises after the assembly, to ensure consistency in the contents of message all

the classes were put together. The researcher conducted the health education with the assistance of a health educator. Two health education sessions were conducted.

The health education sessions were conducted in form of interactive health talks. The topics focused on the basic knowledge of schistosomiasis, etiology, transmission, signs and symptoms, prevention, risky behaviors that can predispose to schistosomiasis infection, and the use of drugs.

Pamphlets designed to educate on schistosomiasis were distributed to each member of the study group to reinforce knowledge. Posters and other illustrative materials obtained from the ministry of Health were used to further educate the group.

3. **Post intervention stage**

The time interval between the intervention and the post intervention stage was three months to give room for assimilation of information and behavioral change. Same questionnaire used in the pre-intervention stage was used to re-assess the pupils in the two groups after three months. The analysis of the post-intervention questionnaire evaluated the impact of health education on pupils in the study group.

Also repeat urine test and egg count was conducted by the research team to determine the prevalence of haematuria among pupils in both groups after three months using chemical strips and microscopy. Absence of haematuria and eggs in urine as indicated by chemical strip and microscopy respectively indicate cure.

Health education sessions for the control group and praziquantel chemotherapy for pupils that had positive haematuria an egg count were carried out after the posts intervention stage.

3.8 DATA ANALYSIS

The questionnaire were validated manually and edited for errors and entered into the computer for analysis using statistical package for social scientists SPSS version 15.0 software package on the computer. Frequency distribution tables were generated while Cross tabulation was done where applicable. Appropriate statistical tests were used as applicable which include: Chi-square test, Filchers Exact test at 5% confidence interval. P value less than 0.05 was regarded as significant.

3.9 LIMITATION OF THE STUDY.

1. The health education was done for two sessions only. A continuous session of behavioral change communication with active involvement of the school teachers and pupils for a period of one year would make a significant change, especially if sufficient alternative source of potable water is provided.
2. Information obtained from school age children may not be very consistent and accurate. They easily forget details.

CHAPTER 4

RESULTS

Two hundred and fifty questionnaires were administered to each study and control group pre and post intervention. A total of 230 and 222 pupils in the study and control groups respectively finally took part in the study. This gave a response rate of 92% and 89% respectively.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS

Characteristics	Ilie (Study)	Ore (Control)	X^2	P value
Sex	No (%)	No (%)		
Male	98(42.8)	102(45.9)	0.51	0.4751
Female	132 (57.2)	120(54.1)		
Total	230 (100)	222(100)		
Male/female ratio	0.85: 1	0.85:1		
Religion				
Christian	54(24.1)	33(14.9)	5.43	0.0663
Muslim	171(77)	183(82.4)		
Traditional	5(2.3)	6(2.7)		
Total	230(100)	222(100)		
Tribe				
Yoruba	209 (93.2)	202(90.5)	3.86	0.1448
Ibo	17 (7.7)	16 (7.2)		
Hausa	6(2.7)	5(2.3)		
Total	230(100)	222(100)		
Age group (years)				
6-9	112(48.7)	140 (63.1)	17.05	0.00019
10-12	76(33)	36 (16.2)		
11-15	16 (7)	16(7.2)		
Age unknown	26(11.3)	30(113.5)		
Total	230(100)	222(100)		
Mean (sd)	10.4(1.33)	9.48(2.14)	*8.065	0.005
Mode	11.0	9.0		
Median	9.0	8		
Minimum	6	8		
Maximum	15	13		

** t-test

The total number of pupils in the study group is 230 with male: female ratio 0.73:1, while

there were 222 pupils in the control group with male: female ratio 0.85:1. They are predominantly Yorubas and the main religion is Islam. In the study group, the mean age 10.4(±1.33) ie 1.33 standard deviation, while in the control group mean age was 9.48(±2.14) ie 2.14 standard deviation.

TABLE 2: PRESENCE OF OVA IN URINE

Variable	Ilie (study)		Ore (control)	
	Pre-intervention	**Post**	**Initially**	**After three months**
Presence of Ova in urine				
(+)Positive	186 (80.9%)	18 (7.8%)	180(81.1%)	168 (75.7%)
(-)Negative	44 (19.1%)	212(92.2%)	42 (18.9%)	54 (24. 3%)
Total	**230**	**230**	**222**	**222**
Prevalence	80.9%	7.8%	81.1%	74.8%
Statistics	X^2=248.6 d_f=1	P=0.00000**	X^2 = 1.91 d_f =1	P=0.166

Majority of the pupils have positive egg count, 186(80.9%) in the study group and 180(81.1%) among the control group at pre- intervention . There was a statistically significant reduction in egg count from 186(80.9%) to 18(7.8%) after administration of praziquantel in the study group (p = 0.00000). While there was no statistically significant difference in egg count three months later among the control group (p = 0.166).

Cure rate is $\frac{186 - 18}{186} = 90.3\%$

TABLE 3: LEVEL OF EGG COUNT

Variable	**Ilie (study)**		**Ore (Control)**	
	Pre-intervention	**Post**	**Initially**	**After three months**
Level of egg count:				
Heavy (>200)	96(41.8%)	6 (2.6%)	62 (27.9%)	66(29.7%)
Severe (15- 200)	32(13.9%)	4(1.7%)	48 (21.6%)	34(15.3%)
Moderate (11.50)	52(22.6%)	8(3.5%)	60(27.1%)	48(21.6%)
Mild (1-10)	6 (2.6%)	____	10(4.5%)	20(9.0%)
Negative	44(19.1%)	212(92.2%)	42(18.9%)	54(24.3%)
Total	**230**	**230**	**222**	**222**
Statistics	$X^2 = 249.71$ $d_f = 4$ P=0.000001**		$X^2 = 7.63$ $d_f = 4$	P=0.106

Many of the pupils of both groups have severe/ heavy infection at pre-intervention. There is a statistically significant decrease in egg count among the pupils in the study group post intervention.

TABLE 4: PRESENCE OF HAEMATURIA

Variable	Ilie (study)		Ore (control)	
	Pre-intervention	**Post**	**Initially**	**Three months after**
Heamaturia:				
(+)Positive	186 (80.9%)	6(2.6%)	176 (79.3%)	216 (93.3%)
(-)Negative	44(19.1%)	224(97.4%)	46 (20.7%)	6 (2.7%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2 =289.65 d_f=1 P=0.000000 **		X^2 = 34.85 d_f =1 P=0.000000**	

Majority of pupils 186(80.9%), in the study group have positive haematuria, but there was a statistically significant reduction in the number of pupils with haematuria post intervention 6(2 6%), (p = 0.00). In Ore among the control majority of the pupils have positive haematuria 176(79.3%) at pre intervention, but this was even was even worse three months later with increase in the number of pupils with haematuria 216(93.3%). The post intervention increase in number of pupils in the control group be due to intra and inter observer error particularly when the eggs in urine are scanty, also there are other less common causes of haematuria.

TABLE 5. AWARENESS OF SCHISTOSOMIASIS, KNOWLEDGE OF SIGNS SYMPTOMS, AND MODE OF TRANSMISSION

Variable	Ilie(study)		Ore (control)	
	Pre-intervention	Post	Initially	After three months
Awareness of Schistosomiasis				
Yes	208(90.4%)	200(87.0%)	159 (71.6%)	182(82.0%)
No	22 (9.6%)	30(13.0 %)	60 (27.0%)	38(17.1%)
No response	____	_____	3(1.4%)	2(0.9%)
Total	**230**	**230**	**222**	**222**
Statistics	$X^2 = 1.39$ $d_f = 1$ $P = 0.2388$		$X^2 = 6.49$ $d_f = 1$ $P = 0.108$	
Signs & symptoms				
Blood in urine	200 (87.0%)	184(80.0%)	128 (57.7%)	78(35.1%)
Painful urination	8 (3.5%)	28(12.2%)	4 (1.8 %)	6 (2.7%)
Tiredness	4(1.7 %)	0(0.0%)	0(0.0%)	54 (24.3%)
No response	18(7.8%)	18(7.8%)	90(40.5%)	84(37.8%)
Total	**230**	**230**	**222**	**222**
Statistics	$X^2 = 15.78$ $d_f = 2$ $P = 0.000375$		$X^2 = 66.44$ $d_f = 2$ $P = 0.000000$	

Mode of transmission				
Through air	20(8.7%)	8(3.5%)	**8(3.7%)**	**14(6.3%)**
Through Water	194(84.4%)	198(86.1%)	**158 (71.1%)**	**186(83.8%)**
Body contact	4 (1.7%)	2 (0.8%)	**0(0.0%)**	**0(0.0%)**
No response	12(5.2%)	22(9.6%)	**56(25.2%)**	**22(9.9%)**
Total	230	230	222	222
Statistics	$X^2 = 5.62$ $d_f = 2$ P= 0.0602		$X^2 = 0.76$ $d_f = 1$ P=.03822	

Majority of the pupils are already aware of schistosomiasis, there are no statistically significant differences in level of awareness and knowledge of schistosomiasis in the study group post intervention, and in the control group three months after.

Majority of the pupils know that the disease is transmitted through water. In Ilie among the study group there is no statistically significant difference in response post intervention despite a slight increase in the number of respondents. However, in Ore among the control group there is a statistically significant increase in the number of pupils who claimed three months later that schistosomiasis is transmitted through water. This may be due to filter of information from peers.

Majority of the pupils already know that the major symptom of schistosomiasis is blood in urine. There is statistically significant difference in the level of knowledge of signs and symptoms among pupils in the study group in Ilie post intervention, more pupils mentioned painful urination which is usually due to super imposed infection. There is also a statistically significance difference in the level of knowledge of signs and symptoms among pupils in the control group in Ore three months after, appreciable number of respondents mentioned tiredness.

TABLE 6: KNOWLEDGE OF CAUSATIVE AGENT

Variables	**Ilie (study)**		**Ore (control)**	
	Pre	**Post**	**Initially**	**After three months**
Causative Agent:				
The river	210(91.3%)	202(87.8%)	112(50.5%)	196(88.3%)
Drinking unclean water	—	___	0(0.0%)	10(4.5%)
No response	20(8.7%)	28(12.2%)	110(49.5%)	16(7.2%)
Total	**230**	**230**	**122**	**222**
Statistics	Fisher's exact p P=0.222422		Fisher's exact p =0.016	

In llie among the study group, majority of respondents stated that schistosomiasis is caused by bathing in the river. Post intervention there is no statistically significant difference in the knowledge of causative agent. However, in Ore among the control group about half 112(50.5%) of the pupils initially responded that schistosomiasis is caused by the river. There is a statistically significant increase in the level of knowledge of the causative agent three months after 196(88.3%), (p = 0.016). An appreciable number of respondents latter 10(4.9%) mentioned drinking unclean water three months after.

TABLE 7: THINKING HAEMATURIA IS NORMAL, NOTICE OF BLOOD IN URINE, AND BLOODY PART OF URINATION

Variables	**Ilie (study)**		**Ore(control)**	
	Pre-intervention	**Post**	**Initially**	**Three months after**
Blood in urine is normal:				
Yes	12(5.3%)	12(5.2%)	8(3.6%)	___
No	214(93.0%)	204(88.7%)	200(90.1%)	220 (99.9%)
No response	4(1.7%)	14(6.1%)	14(6.3%)	2(0.9%)
Total	**230**	**230**	**222**	**222**
Statistics	$X^{2=}$ 0.01 d_f =1 p=0.909		Fisher's exact p = 0.0029	
Noticing Blood in urine:				
Yes	172(74.8%)	170(73.9%)	132(57.5%)	140(63.1%)
No	56(24.3%)	52(22.6%)	84(37.8%)	82(36.9%)
No response	2(0.9%)	8(3.5%)	6(2.7%)	__
Total	**230**	**230**	**222**	**222**
Statistics	X^2 = 0.08 d_f = 1 P= 0.777		X^2=0.18 d_f=1 P =0.673	
Bloody part of urine:				
Throughout urination	32(14.0%)	28(15.1%)	6(2.7%)	6(2.7%)
End of urine	144(62.6%)	144(77.4%)	112(50.5%)	134(60.4%)
Middle of urine	12(5.2%)	14(7.5%)	16(7.2%)	2(0.9%)
No response	42(18.2%)	44(19.1%)	88(39.6%)	80(36.0%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2 = 0.41d_f = 2 P= .814		X^2 = 12.64 d_f=2 P =0.0018**	

Majority of respondents from both groups think that passing blood in urine is abnormal. In Ore the control group there is a statistically significant increase in the correct answer three months after, almost all of them latter agreed that haematuria is abnormal.

Majority of respondents from both communities have noticed blood in their urine at one time or the other 172(74.8%) in the study group and 132(61.1%) in the control group. There is no statistically significant different in response from pupils in study group post intervention and the control group three months after.

Majority of respondents in the study and control group claimed that they notice blood at the end of urination. There was no statistically significant difference in response in the study group post intervention of. There is a statistically significant increase in correct response in the control group three months after.

TABLE 8: KNOWLEDGE OF OTHERS WITH HAEMATURIA

Variable	**Ilie(study)**		**Ore(control)**	
	Pre-intervention	**Post**	**Initially**	**Three months after**
Knowledge of others with haematuria:				
Yes	176(76.5%)	160(69.6 %)	154(69.4%)	176(79.3%)
No	50(21.8%)	58(25.2%)	68(30.6%)	46(20.7%)
No response	4(1.7%)	12(5.2%)		
Total	**230**	**230**	**222**	**222**
Statistics	$X^2 = 1.21$ $d_f = 1$ P=0.271		$X^2 = 5.71$ $d_f = 1$ P=0.016847	
Relationship:				
School mate	100(43.5%)	78(33.9%)	20(9.0%)	34(15.3%)
Family member	46(20.0%)	42(18.3%)	120(54.1%)	108(48.7%)
Friend	32(13.9%)	44(19.1%)	16(7.2%)	28(12.6%)
Towns'men	14(6.1%)	24(10.4%)	4(1.8%)	6(2.7%)
No response	38(16.5%)	42(18.3%)	62(27.9%)	46(20.7%)
Total \	**230**	**230**	**222**	**222**
Statistics	$X^2=7.39$ $d_f=3$ p=0.06		$X^2 =7.19$ $d_f=3$ p=0.066	

Majority of respondents from both group knew other people with haematuria, most of those they know are family members, some school mates, friends and town's men. There are no statistically significant differences in response in the study group post intervention but there is a significant increase in the number of pupils with positive response in the control group three months after.

TABLE 9: FEQUENCY OF WATER CONTACT.

Variables	**Ilie(study)**		**Ore(control)**	
	Pre-intervention	**Post**	**Initially**	**After three months**
Frequency:				
Daily	88(38.3%)	84(36.5%)	72(32.4%)	72(32.4%)
Weekly	96(41.7%)	86(37.4%)	80(36.1%)	56(25.3%)
Monthly	2(0.9 %)	10(4.3%)	6(2.7%)	___
Occasionally	32(13.9%)	40(17.4%)	56(25.2%)	92(41.4%)
Never	8(3.5%)	8(3.5%)	4(1.8%)	2(0.9%)
No response	4(1.7%)	2(0.9%)	4(1.8%)	____
Total	**230**	**230**	**222**	**222**
Statistics	X^2= 3.089 d_f =4 p=.543		X^2= 9.812 d_f =4 p=0.44	

Majority of respondents from both villages go to the stream either on daily or weekly basis 184(80.0%) in Ilie the study group and 152(68.5%) in Ore the control group. An appreciable number 32(13.9%) from Ilie and 56(25.2%) from Ore go there occasionally, only a few 8(3.5%) from Ilie and 4(1.8%) stay away from the stream. There is no significant different in response post intervention in the study group and three months after in the control group.

TABLE 10: WATER CONTACT ACTIVITIES.

Variable	**Ilie(study)**		**Ore(control)**	
	Pre	**Post**	**Pre**	**Post**
Entering the stream:				
Yes	192(83.5%)	178(77.4%)	180(81.1%)	200(90.1%)
No	30(13.0%)	36(15.6%)	24(10.8%)	18(8.1%)
No response	8(3.5%)	16(7.0%)	18(8.1)	4(1.8%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2 =0.723 d_f = 1 P=0.395		X^2=1.497 d_f=1 P =0.473	
Activity:				
Play	94(40.9%)	46(20.0%)	28 (12.6%)	12 (5.4%)
Fetch Water	102(44.4%)	152(66.1%)	136(61.3%)	192(86.5%)
Fishing	10(4.3%)	14 (6.1%)	4(1.8%)	8(3.6%)
Domestic work	4(1.7%)	___	34(15.3%)	8(3.6 %)
No response	20(8.7%)	18(7.8%)	20(9.0%)	2(0.9%)
Total	230	230	222	222
Statistics	X^2=30.96 d_f=3 P=0.000001		X^2 = 16.344 d_f =3 =0.000000	
Idol worship:				
Yes	36(15.7%)	28(12.2%)	0(0.0%)	0(0.0%)
No	164(71.3%)	196(85.2%)	158(71.2%)	198(89.2%)
No response	30(13.0%)	6(2.6%)	64(28.8)	24(10.8)
Total	230	230	222	222
Statistics	X^2 = 2.49 d_f =1 = P=0.11		-	

Majority of pupils from both groups do enter the stream when they go there. There was no significant different in response post intervention in the study group and three months later in the control group.

Majority of them enter the stream to fetch water, while some go there to play, to do domestic work and to fish. Post intervention in Ilie among the study group there was statistically significant decreases in the number of those who claim they enter the stream to do activities like playing, and domestic work and an increase in the number of those who enter the stream to fetch water and to fish. In Ore a similar trend was observed among the control group three months later.

In llie 36 (15.7%) of the study pupils claim that some cultural activities like the worship of the goddess of Erinle river take place by the river. It is an annual event. There was no statistically significant different in respondent post intervention.

TABLE 11: URINATING INTO THE RIVER

Variables	**Ilie(Study)**		**Ore(Control)**	
	Pre	**Post**	**Initially**	**After three months**
Ever urinated into the river				
Yes	138(60.0%)	108(47.0%)	74(33.3%)	86(38.7%)
No	86(37.4%)	114(49.5%)	148(66.7%)	136(61.3%)
No response	6(2.6%)	8(3.5%)	——	——
Total	**230**	**230**	**222**	**222**
Statistics	X^2=7.57 d_f =1 P=0.0059		X^2 =1.41 d_f=1 P=.2355	

At pre-intervention an appreciable number of respondents from both the control group 74(33.3%) in Ore and the study group 138 (60%) in llie claimed that they have urinated in the river at one time or the other. Some do so mistakenly and some just for fun. There was a statistically significant difference in response post intervention in the study group but not in the control group.

TABLE 12: WHERE THEY DEFEACATE.

Variable	Ilie(study) Pre	Post	Ore(control) Initially	Three months after
Defecation:				
Water (river)	6(2.6%)	2(0.9%)	4(1.8%)	4(1.8%)
Pit Latrine	34(14.8%)	24(10.4 %)	48(21.6%)	30(13.5%)
Bush	186(80.9%)	200(87.0%)	170(76.6%)	186(83.8%)
No response	4(1.7%)	4(1.7%)	_____	2(0.9%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2=4.23 d_f=2 P=0.12		X^2=4.86 d_f=2 P= 0.08	

Majority of the pupils disposed their human waste into the bush in both villages. 186(80.9%) in llie the study group and 170(76.6%) in Ore among the control group. only a minority 34(14.8%) in Ilie and 48 (21.6%) in Ore dispose their human waste in pit latrine. Few respondents dispose their human waste directly into the river 6(2.7%) in llie and 4 (1.8%) in Ore. Post intervention there is no statistically significant difference in response among the study group, there is a numerical decrease in the number of pupils who claim that they defecate regularly into the river. In Ore among the control group there is no statistically significant difference in response three months later. There is a numerical increase in the number of pupils how dispose of their human waste into the bush and a decrease in the number of pit latrine users.

TABLE 13: **SOURCE OF WATER SUPPLY**

Variables	**Ilie (Study)**		**Ore(Control)**	
	Pre	**Post**	**Initially**	**Three months after**
Tap in the house:				
Yes	64(27.8%)	52(23.0%)	82(36.9%)	76(34.5%)
No	158(68.7%)	174(77.0%)	128(57.7%)	144(65.5%)
No response	8(3.5%)	4(1.7%)	12(5.4%)	2(0.9%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2 = 1.98 d_f =1 P=0.159		X^2 =0.94 d_f=1 P=0.333	
Other source of water:				
Tap at a distance	12(5.2%)	2(0.9%)	18(8.1%)	18(8.1%)
Bore hole	14(6.1%)	10(4.3%)	22 (9.9 %)	24(10.8%)
Wells	64(27.8%)	68(29.6%)	56(25.2%)	58(26.1%)
River	100(43.5%)	122(53.0%)	118(53.2%)	46(20.7%)
No response	40(17.4%)	28(12.2%)	8(3.6%)	76(34.2%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2 =4.876 d_f =3 P= .181		X^2=10.123 d_f =3 P=.038	

Only 64(27.8%) of the pupils in the study group llie have tap in their house and 82(36.9%) of pupils in the control group in Ore. Pipe born water supply is irregular, though there are other sources of water like bore holes and wells they are not sufficient. Majority of pupils from both the study group 100 (43.5%) and the control group 118(53.2%) claimed that they often need to go to the river for water. There is no statistically significant difference in

response post intervention in the study group. Among pupils in the control group three is a statistically significant reduction in the number of pupils who claim they use the river as a source of water supply three months later.

TABLE 14: KNOWLEDGE THAT WADING IN THE RIVER CAN LEAD TO DISEASES.

Variables	**Ilie(study)**		**Ore (control)**	
	Pre	**Post**	**Initially**	**Three months after**
Knowledge:				
Yes	194(84.3%)	200(87.0%)	186(83.8%)	212(95.5%)
No	32(13.9%)	24(10.4%)	36(16.2%)	10(4.5%)
No response	4(1.7%)	6(2.6%)	___	___
Total	**230**	**230**	**222**	**222**
Statistics	$X^2 = 1.23$ $d_f = 1$ $P = 0.268$		$X^2 = 16.39$ $d_f = 1$ $P = 0.000051$	

Majority of pupils from both group already know that wadding into the river can lead to the disease. Post interventions in Ilie among the study group there is no statistically significant difference in response only a numerical increase in the number of those who claim that wading into the river can lead to disease. The interventions did not make a significant impact, as a large percentage of respondents are already knowledgeable. However in Ore among pupils in the control group there is a statistically significant increase in knowledge this may be due to filter of information from peers.

TABLE 15: **THE KNOWLEDGE THAT AND URINATING IN THE RIVER CAN TRANSMIT DISEASE TO OTHER USERS.**

Variables	**Ilie(study)**		**Ore(control)**	
	Pre	**Post**	**Initially**	**Three months after**
Knowledge:				
Yes	212(92.2%)	220(95.7%)	198(89.2%)	214(96.4%)
No	18(7.8%)	6(2.6%)	24(10.8%)	8(3.6%)
No response	____	4(1.7%)	___	___
Total	**230**	**230**	**222**	**222**
Statistics	X^2=6.11 d_f=1 P=0.0134		X^2= 8.62 d_f =1 P=0.0033	

Majority of pupils from the study group in llie 212 (92.2%) and control group in Ore 198 (89.2%) already know that urinating and defecating in the river can transmit disease to other river users. There is a statistically significant increase in knowledge among the pupils in the study population from Ilie post intervention. In Ore among the control group there is also a statistically significant increase in knowledge three months later this may be due to filter of information from peers.

TABLE 16: TYPE OF DISEASE THAT CUOLD BE CONTACTED BY URINATING AND WADING INTO RIVER.

Variables	**Ilie(study)**		**Ore(Control)**	
	Pre	**Post**	**Pre**	**Post**
Type of disease:				
Water Borne diseases	84(36.5%)	102(44.3%)	66(29.7%)	80(35.0%)
Schistosomiasis	132(57.4%)	96(41.8%)	64(28.8%)	22(9.9%)
No response	14(6.1%)	32(13.9%)	92(41.5%)	120(54.1%)
Total	**230**	**230**	**222**	**222**
Statistics	X^2 =6.66 d_f =1 P=0.00988		X^2 =18.75 d_f =2 P=.000015	

In llie about half 132(57.4%) of pupils in the study group mentioned schistosomiasis as a type of disease that could be contacted by urinating and wading into river. There is a statistically significant decrease in the number of those that mentioned schistosomiasis post intervention, more pupils mentioned water borne diseases. In Ore an appreciable number of respondents mentioned schistosomiasis 64(28.8%) as disease that could be contacted through urinating and wading into river. Three months later there is a statistically significant reduction in the number of pupils that mentioned schistosomiasis as more of them latter mentioned water borne disease 80(35.0%),

TABLE 17: METHOD OF PROTECTION

Variable	**Ilie (study)**		**Ore(control)**	
	Pre	**Post**	**Initially**	**Three months later**
Method of protection:				
Avoid contact with river	174(75.7%)	76(33.0%)	198(89.2%)	124(55.9%)
Drink treated water	18(7.8%)	106(46.1%)	10(4.5%)	54(24.3%)
No response	38(16.5%)	48(20.9%)	14(6.3%)	44(19 8%)
Total	**230**	**2 30**	**222**	**222**
Statistics	X^2=50.33	$=d_f$ P=0.000	X^2=19.831	d_f=1 s p=0.000

Majority of respondents mentioned avoidance of contact with river from both groups 174(75.7%) in llie the study group and 198(89.2%) in Ore the control. Post intervention in Ilie among the study group and three months later in Ore, there is a statistically significant decrease among those that mentioned the correct answer to 76(33.0%) and 124(55.9%) respectively. More respondents later mentioned drinking treated water in both group but this was more in the study than the control group.

CHAPTER 5

DISCUSSION

The control of schistosomiasis in developing countries by presently available and affordable strategies can be approached most effectively by a combination of (1) human behavioral change through health education, communication participation (2) mass-chemotherapy and (3) clean water supply and sanitation facilities in the primary health care system.[2] This study was conducted to assess the effect of health education and chemotherapy intervention on knowledge, risk perception and prevalence of schistosomiasis among school children in two rural communities of Osun State.

The age range of 6-15 years of subjects infected by schistosoma in this study is within the school age children. In schistosomiasis endemic communities, this segment of the population are actively excreting schistosome eggs. The range is within the range of school children of other studies from Nigeria[32,43-5,53-4,59,67,77,128-9,130-1] and elsewhere in Africa.[5,24,125-6,46,60,117,132-3]

With a prevalence of 80.9% among the study pupils in Ilie and a prevalence of 81.1% in Ore among the control group based on egg count, both communities are endemic for S. haematobium. Haematuria rate was 80.9% among the study group in Ilie, and 79.3% among the control group Ore. The data on prevalence of schistosomiasis using the uristick method and egg count method are similar. Both methods are therefore useful in determining the prevalence of schistosomiasis. Uristick is a faster method of diagnosing haematuria and is very useful in the field but haematuria may be due to other less common causes. Microscopic method, the egg count method is more specific and is usually used to confirm schistosomiasis.

There is a statistically significant decrease in prevalence of schistosomiasis among the study pupils in Ilie from 80.9% to 7.8% post intervention ($p = 0.00$) as indicated by egg

count, Similarly there is a statistically significant decrease in haematuria from 80.9% to 2.6% (p = 0.00). However there is no statistically significant reduction in egg count among the control pupils in Ore three months after 81.1% to (75.7%) (p = 0.106). But there is a statistically significant increase in haematuria from 79.3% to 93.3% (p = 0.00). This indicates that more pupils developed haematuria during the interval among the control group. This may be because they had not received health education during the three months interval. The study was conducted in the dry season when the wells dry up and visits to the stream are more frequent.

The presence of haematuria and positive egg count were expected findings. The egg S. mansoni was observed in the urine of one of the heavily infected female pupils. S. mansoni egg are normally found in feaces. This is an indication that S.mansoni is also prevalent in the environment. The correlation between positive egg count and haematuria was described by Lucas & Gallies.[1] In this study the prevalence of Schistosomiasis was based on positive egg count.

In a World Bank project that enabled China to make a significant progress in schistosomiasis control from 1992 to 2001, chemotherapy was complemented with health education. Evaluation in the year 2002 showed that infection rate in humans and life stock decreased by 55% and 50% respectively.[134] Majority of researchers who conducted studies in specific endemic areas of Brazil consistently reported significant decrease in prevalence and incidence of schistosomiasis when control measures (chemotherapy and/ or molluscicide) are repeatedly used for a number of years.[135]

Similar observation as found in this the study group was reported by King et al[135] where a school age–targeted annual chemotherapy control of schistosomiasis was implemented among children 5-21years old in an endemic area in Kenya. In the first year the prevalence reduced from 66% to 22%, P< 0.001, with a corresponding reduction of

haematuria from 52% to 19% p< 0.001. There was no significant difference in urinary tract abnormalities within the first year but in subsequent second and third year significant regression of hydronephrosis and bladder abnormalities was observed 41% to 6% p< 0.01. The intensity of schistosomiasis infection and ultrasound abnormalities remained suppressed for two years after discontinuation of therapy but haematuria prevalence began to increase to 33% in1989. Reinstitution of annual therapy in 1989 and 1990 reversed this trend. Another study conducted in the Msambweni area of Coast Province, Kenya among school aged children revealed significant reduction in prevalence of schistosomiasis from 75% to 17% in the first 12 months and long–term suppression of S. haematobium infection in the targeted school aged children which lasted for two years after cessation of treatment. [136]

High prevalence in school age population had been observed by other authors.[41, 43-8] The high prevalence is related to considerable water population with schistosoma eggs, intense water contact pattern and dependence on the stream for water needs.

Regular contact with water are very high within the two communities, 94.8% among the study group in Ilie and 96.4% among the control group in Ore. This occur mostly on daily or weekly basis. Only a minority 3.5% of the study group in Ilie and 1.8% of the control group in Ore and stay away from the stream. No statistically significant difference in response was observed in both groups (p = 0.543) and (p= 0.44) respectively. Some of the activities include playing in the river, fishing, fetching water, and some domestic work.

There was a statistically significant decrease among those who go to the stream to play and to do domestic work post intervention in Ilie among the study pupils and three months after in Ore among the control pupils, p= 0.00 and p= 0.00 respectively. In both groups there are corresponding increases in other activities, like either to fetching water, and fishing. This might be as a result of the fact that the stream is the only constant source of water.

Also 15.7% of those that respondents in Ilie, the study group claimed that some people go to the stream annually to worship the goddess of the river.

This finding is similar to the finding of Hu[112] which reported that after instituting an intensive behavioural communication and health education programme to the study pupils in China for a period of one year noted that the frequency of infested water exposure due to entertainment like swimming dropped off greatly among the pupils.

Schistosoma infection is associated with water related activities where contact with snail infected water bodies was reported to have encouraged the transmission of the disease.[21-5, 42] The two villages are located along Erinle river and people go there to wash clothes, play, bath, fish, and collect water for domestic needs. This high prevalence was greatly accounted for by those whose occupation exposes them to frequent contact with water and those who depend on the dam for their water needs. On Saturdays and Sundays a large number of people can be seen by the river doing different activities including those who come to wash their motorbikes. This clearly shows that contact with water bodies dictated by necessities of life is a major factor in acquisition of infection in these communities.

Availability and use of sanitary facilities were poor in both communities. There was a high level of pollution of the streams by human wastes due to inadequate sanitary measures, about two third of the respondents in the study group claim to have urinated in the stream at one time or the other. Majority dispose their human wastes in the bush 80.9% around houses and these are washed into the stream during rainy seasons or are carried on the feet of animals into the stream. Some 2.6% pupils defecate and urinate directly in the stream on regular basis, only a minority less than one-fifth have pit latrine in their homes. Similar conditions were observed in Ore the control group. This accounts for the high pollution of the river with human wastes.

Other contributory factors include inadequate supply of potable water. Only about a quarter of pupils in the study group in Ilie and about one third in the control group in Ore have tap in their house? As pipe born water supply is irregular members of the community resort to other sources of water like well, bore hole; some of the wells and bore holes sometimes dry up in the dry season and majority (over half) of the respondents need to go to the river for water in Ilie, simila'rly in Ore. There is no statistically significant decrease in the number of people that go to the river for water post intervention in both groups. This is because water is one of the basic necessities of life and the river is the only constant source of water.

Similar observation was made by in Abeokuta, [46] where despite the fact that Abeokuta is highly urbanized, and supplied with pipe born water, pollution of water with human wastes and water contact activities likely to enhance the transmission of schistosoma infection occurred along the Sokori stream. Similar observation was also reported in Kenya by Clenon et al,[42] and King et al.[136] Bello et al[25] in their study around Gurongo dam in Sokoto reported similar insanitary condition, high water contact activities and subsequent pollution of river with human waste and the overall prevalence among scschool pupils in the study community was 52%.

Onuigbo et al[54] had earlier reported a high prevalence of 53.4% in Agulu Anambra State with similar environmental conditions. Studies later conducted by Ekejindu et al[129]in the same area revealed a prevalence of 11.8%, the improvement was due to better enlightenment and provision of good waste disposal system among the people in Agulu.

In China in a study conducted by Long-De Wang et al[137] in two villages along Poyang lake where similar insanitary environmental conditions prevailed, famers defecate in the bush and these are carried on the feet of animals like buffalos and cattle into streams. Intervention included chemotherapy, removal of cattle and buffalos from snail infested grassland,

providing famers with mechanized farm equipment, improving sanitation by supplying tap water and building lavatories and latrines. Focus was on the avoidance of snail infested areas and associated lake water. After three transmission seasons the rate of infection in humans in the intervention villages decreased from 11.3% to 0.7% and 4.0% to 0.0% in the other ($p< 0.001$ for both comparisons). The rate of infection in mice after exposure to the lake water decreased from 79% to zero ($p< 0.001$).

Majority of pupils in both communities are already highly aware of schistosomiasis 90.4% among the study group in Ilie and 71.6% among the control group in Ore. This is because schistosomiasis has emerged as a major health burden in the villages located along Erinle river after the construction of the dam across the river at Igbokiti more than two decades ago. There were no statistically significant differences in level of awareness post intervention in the study group and three months later in the control group. The health education intervention has no impact here because most of them are already know legible.

Majority of respondents in the study group 87.0% and also above half 57% of the control group have knowledge of the signs, symptoms of schistosomiasis. There is a statistically significant difference in response in both groups post intervention and three months later among the study group more pupils 12.2% mentioned painful urination, which usually occur due super imposed infection and inflammation of the bladder. While among the pupils in control group 24.3% mentioned tiredness.

Painful urination is significantly associated with schistosoma haematobium infection. It is not an unexpected finding as the symptom is known to be associated with schistosome infection and have similarly been described by Ernest et al [61]and Edington in their books[60]. It is worth nothing that dysuria could also be a symptom of bacteria urinary tract infection coexistence with S. haematobium infection. Such coexistences are not unusual as the raw

surface pressured by the chronic inflammation around the worms and eggs produces a fertile ground for bacterial colonization.

Majority of respondents in the study group claim that the disease is transmitted through water 84%, and many 71.1% among the control group. There was no statistically significant diference in response among the study group post intervention; this is because most of them are already knowlegibe. However among the control group there is a statistically significant increase in level of knowledge of correct mode of transmission, this may be due to filter of information from their peers.

In Ilie among the study group majority of respondents pre and post intervention mention the river as the causative agent. However in Ore among the control group about half 50.5% of the pupils initially responded that schistosomiasis is caused by the river. There is a statistically significant increase in the level of knowledge of the causative agent three months after to 88.3 %, the increase is likely to be due to filter of information. Some 4.9% mentioned drinking unclean water. This finding shows that the pupils are only aware that the disease come from the river, they do not grasp the fact that the disease is caused by a micro organism or snail vector.

Moji et al[2] in their study noted that in most schistosomiasis endemic communities people are already aware of the disease and the signs and symptoms. Health education may not bring about expected behavioral change. There is need to provide alternate source of potable water. This is the basic infrastructure that will enhance behavioral change. And most importantly there is need to have a deep insight into knowledge gaps, risk perception and risky behavior though research work. This will enable the researcher to work out the best method and where to lay emphasis during health education and behavioral change communication. Behavioral change communication is a long term and continuous process.

The number of health education sessions was not enough, and behavioral change communication was not put in place to achieve a high level of desired result due to time and financial constrains. More so the respondents are children. They easily forget details.

Majority of respondents from both communities know that it is abnormal to pass blood in urine 93.0% among the study group in Ilie and 90.1% among the control group in Ore. There is a statistically significant increase in response from pupils in the control group three months later.

Majority of pupils in both groups 172 (74.8%) among the study group in Ilie and 132 (61.1%) among the control group in Ore have noticed blood in their urine at one time or the other in their life time. Most of them noticed the blood at the end of urination. Majority of respondents both in Ilie and Ore know that other people within the community also pass blood in their urine. These people are mostly schoolmates, family members and a few town's men.

There is a statistically significant increase in the number of those who claim they notice blood at the end of urination in the control group three months after this might be due to passage of information from their knowledgible peers or they might just start to notice after the first questionnaire.

Similarly, majority of respondents from both groups 84.3% of pupils in the study group in Ilie and 83.2% of pupils in the control group in Ore know that wading unto the stream can lead to disease There is a statistically significant increase in positive response among the control group three months after. Majority also responded in both groups that urinating and defecating into the stream can lead to transfer of disease to other water users. There is a statistically increase in knowledge among the study group in Ilie post intervention ($p=0.0134$). This is due to health education. There is also a statistically significant increase in knowledge among pupils in the control group in Ore three months after ($p=0.0033$). The

increase observed in Ilie indicated that the health education intervention made an impact. The increase in Ore may be due to knowledge acquired from their peers after the administration of the first questionnaire as majority of them are already knowledgeable also.

About half of respondents from both villages 57.4% from the study group in Ilie, and 84(49.2%) from the control group in Ore mentioned schistosomiasis a disease that could be contacted by defecating, urinating and wading into steams. They also mentioned some other water borne diseases: typhoid and cholera. Post intervention there is a statistically significant decrease in the number of pupils that responded correctly in both groups 41.8% in Ilie and 9.9% in Ore.

Majority of the sampled pupils from both villages responded that to protect against Shistosomiasis one must avoid contact with water, 75.7% from the study group in Ilie and 89.2% from the control group in Ore. There is a statistically significant decrease in correct response post intervention among the study group where a larger number of respondents mentioned drinking treated water. As indicated by the findings it is obvious that majority of respondents from have not grasped the route of entry of schistosoma cercariae into the human body. Health education made no impact here. Similar trend was observed in Ore.

This is similar to a study was conducted by Chimbari[107]in Zimbabwe which reported that the studied community was aware of schistosomiasis, but their knowledge on transmission and control of the disease was limited. About 80% of people in another endemic community studied by Ndamba et al,[108] thought that schistosomiasis was a dangerous disease with blood in urine but only 12% knew that snail was involved in transmission.

After a continuous and intensive health education and behavioral change communication for a period of one year, Hu[112] increased schistosomiasis knowledge and risk perception among primary school pupils in the study group by 89.5% compared with that of control in China.

Praziquantel was a very effective drug in the treatment of schistosomiasis with minimal side effect. A single oral dose of 40mg/kg is generally sufficient to give cure rate of between 60-90%, and a reduction of 90-95% in the average number of excreted eggs.[16] Also at the international workshop conducted by WHO at Niamey Niger[93] and WHO report [16] praziquantel was recommended as the best drug for the treatment of all forms of schistosomiasis infection, and retreatment was also recommended for some special group. In this study some 18(7. 8%) of affected pupils with positive egg count post intervention were given repeat treatment.

In this study reagent strip is a highly sensitive test, given a sensitivity of 96.2% and a specificity of 73.7%. It is a useful diagnostic tool for rapid field assessment of S. haematobium.

5.2 CONCLUSION.

- This study found that the prevalence of S. haematobium infection is very high among primary school pupils in Ilie and Ore and this compares favorably with findings in endemic areas with similar environmental condition. There was a high level of pollution and water contact activities thereby encouraging transmission and acquisition of infection.
- Both Communities have high level of awareness of signs and symptoms, but knowledge on mode of transmission, snail vector and risk perception of Schistosomiasis is limited.. Majority of the school children think that the disease is contacted by drinking untreated water even despite health education intervention given to the Ilie group.
- There was a statistically significant decrease in prevalence of haematuria among the primary school pupils after intervention.
- There was no significant difference in knowledge, risk perception and practice of preventive measure for Schistosomiasis infection among pupils in the study group pre and post intervention.
- Health education had little impact on behavioral change because an alternative potable water supply was not available, and it seems that the duration and intensity of health education intervention was inadequate due to time and financial constraints. .

5.3 RECOMMENDATION.

1. The government should conduct a comprehensive survey covering the two Local Governments to establish the magnitude and public health implication of the infection in the two communities.

2. Urgent need for regular supply of potable water supply and provision of good sanitary disposal of human wastes to the two communities to reduce water contamination, water contact activities and transmission of Schistosoma infection. This can be achieved through communial efforts. The people could contribute to repair shallow wells in the month of March at the height of dry season. The Local Government authority should assist in training some members of the community on how to repair the bore hole handles when they brake down.

3. There is need for continuous health education intervention and behavioral change communication programme with the support of the school teachers, formulating the school discipline and class rule, to limit pupils' unhygienic behavior. Mobilization and active involvement of the pupils in form of role play, formulation of stories, posters and locally made cardboards

4. Since praziquantel has been found to be very effective in this study it is advised that the Local Government Authority should conduct annual screening and mass chemoterapy in all the villages along Erinle dam with praziquantel (40mg/kg) as done in Egypt and elsewhere.

5. Local and State government should strengthen the already existing Schstosomiasis control programm , it should be integrated into primary health care system and the school health programme. The programme should concentrate on children and adolescents. As the control program advances the interval between treatments may be lengthened on basis of evaluation.

5.4 Further Research.

1. The government should carry out further research in the two Local Government areas and possibly the whole Osun State to be able to define the populations most susceptible to schistosomiasis, this will be used for planning intervention.

2. Further study to assess the re-infection rate after treating with prazyquantel.

4. Further study to assess the status of the genito-urinary systems.

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QUESTIONNAIRE

Effect of interventions on knowledge, risk perception and prevalence of schistosomiasis infection among school pupils of two rural communities in Osun State.

Sir,

This questionnaire was designed to obtain information on the above-mentioned topic. The information will be used for academic purpose. The anonymity and confidentiality of the respondents is guaranteed.

Thanks for your cooperation.

Dr. Mrs. Y. A. OYEKENU-AGORO.

Please tick the right answer (x)

Section A: Socio demographic DATA

1. Name----------

2. Age----------

3 Sex Male ( ) Female ( )

4. Tribe: Yoruba( ) Ibo ( ) Hausa ( )

Others Specify----------

5. Religion: Christianity ( ) Islam ( ) Traditional ( )

Others (Specify) ----------

Section B: Knowledge and attitude towards Schistosomiasis.

6. Are you aware of a disease called schistosomiasis (Atosi Aja)

Yes ( ) No ( )

7. What are the signs and symptoms?

---

8. What is the causative agent?

---

9. How is the diseases transmitted to man?

a. Through air

b. Through Water

c. Body Contact

d. Through food

10. Have you ever noticed blood in your urine?

Yes ( ) No ( )

11. If yes, is it?

i throughout urination

ii At the end of urination

iii Middle of urination

iv beginning of urination

12. Since when have you been passing blood in urine?

specify----------

13. Do you know anybody that passes blood in urine? YES ( ) NO ( )

14. If yes how is he/she to you?

a. Schoolmate

b. A family member

c. A friend

d A town's man

e Others specify ----------

15. Do you think that passage of blood in urine is normal?

Yes ( ) No ( )

Section C : High Rick behavior

16. How frequently do you go to the stream?

    a Daily

    b Weekly

    c Monthly

    d Occasionally

    e Never

17. When you get to the stream do you usually enter the stream?

    Yes ( ) No ( )

18. What do you do when you enter the stream? (you can tick more than one)

    i To swim in the river

    ii To fetch water

    iii To fish

    iv For domestic shores

    v Others specify ……

19. Any cultural or recreational activities in the community that is done at the river

    Yes No

20. If Yes, State----------

    ----

21. How do you dispose your human waste?

    a Water Closet

    b Pit Latrine

    c In the bush

    d In the river

    e Others Specify----------

22. Have you ever urinated or defecated in the river?

Yes ( ) No ( )

23. If yes why? ----------

Section D: Preventive practice

24. Do you have tap in your house?

Yes ( ) No ( )

25. If is No, do you have tap at a convenient distance from your home?

Yes ( ) No ( )

26. If No, Where else do you go for water ?

i. Tap (at inconvenient distance)

iiBore Hole

iii Well

iv River

v Others (specify)----------

Section E: Risk Perception

27. Do you know that wading into the river it can lead to disease?

Yes ( ) No ( )

28. Do you know that urinating and defecation into the river is can lead to transmission diseases to other water users?

Yes ( ) No ( )

29. If 28 & 29 are yes, what diseases? (Specify)----------

30. How can you protect yourself? ----------