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WATER CONTACT AND ITS RELATIONSHIP TO SCHISTOSOMIASIS
MANSONI IN LOWER NDUU, NORTHERN DIVISION OF MACHAKOS
DISTRICT //

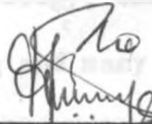
JOHNSON MUNYAO MUSAU

"A Thesis submitted in fulfilment of the requirements
for the Degree of Master of Arts in the University of
Nairobi"

1977



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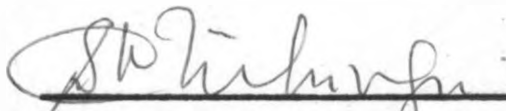


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To Dr. Warren and the Clark Foundation for their financial support through the Ministry of Health which made the field work for this study possible plus the necessary information and data collected in the study area and the comparative results of St. Lucia.

A B S T R A C T.

The aim of this study is to establish the role of Socio-economic factors in relation to the infection with Schistosomiasis Mansonii.

Many medical doctors have been explaining the high intensity of infection shown by children as compared with adults by the immune status developed by adults which lacks among children. But recently, other doctors have tried to explain the differences in intensity of infection with this disease by using Sociological factors which persist between these age categories. They feel that behavioural patterns of the adults is different from that of the young children as regards water contact. They advocate that children spend more time in water and water related activities than adults and due to this greater exposure to infected water, the children are infected and re-infected more intensively than adults and as a result of this, children show a higher rate of infection with Schistosomiasis than adults.

It is this difference in behaviour between children and adults that this study tries to show. The findings in this study clearly show that children's life-style and behaviour as regards water contact is different from that of adults. Children spent more time in the infected water of Lower Nduu than adults and this explains why children in this area show a high rate of infection with Schistosomiasis Mansonii than adults. The need for health education among adults and children in the area and other areas where the disease is rampant.

INTRODUCTION

The study on water contact and its relationship to infection with Schistosomiasis Mansoni was made possible by the Clark Foundation (U.S.A.) in conjunction with Dr. Warren, by providing funds for the research programme.

The Medical Research Team of the Royal Institute of Amsterdam had earlier on been involved in Medical Research in the area. Their research covered childhood diseases like measles, diarrhoea, and whooping cough, infant mortality and nutrition. This detailed knowledge of the health of the people in the area and the outbreak of Schistosomiasis in the area made possible an additional study on the following fields in the area:-

- (a) Human Water Contact behaviour.
- (b) Clinical Study on the infection rate of the population with Schistosomiasis Mansoni.
- (c) Vector studies on the snails as carried by Schistosomiasis Mansoni.

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CHAPTER I

SECTION (i)

STATEMENT OF THE PROBLEMS

The Central problem of this study is to establish the social, economic and cultural factors which bring people into contact with water, a factor which influences the rate of infection with Schistosomiasis Mansoni within the population under study.

The anticipated social and cultural factors which influence people's constant contact with river water are religious rituals, like christian baptisms, circumscision rituals; like bathing in the river in preparation for traditional circumcison, bathing and washing clothes. The economic factors which might bring people into contact with river water are small and large scale irrigation schemes especially the large scale coffee farms in Matungulu, the constant contact with water at the coffee ginnery which comes from the river, the daily activity of watering livestock, drawing river water for domestic use, washing foodstuffs like arrow roots and sweet potatoes, fording and making bricks for house constructions.

Schistosomiasis Mansoni (the name which will be used throughout this study instead of bilharzia) is a disease which infects human beings the moment they go into contact with

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Schistosomiasis Mansoni (the name which will be used throughout this study instead of bilharzia) is a disease which infects human beings the moment they go into contact with

infected water. The life cycle of this disease is simply illustrated in the next chart with the six important stages in the life cycle.

In stage 1 of the chart, Schistosomiasis Mansoni can only be transmitted through human faeces, and this is the most common type of bilharzia found in the study area. The majority of the households in the study area lack latrines and as a result of this most people defaecate in the bushes around the river and streams. The faeces are either washed by rain water during wet seasons, into the river water (stage 2 of the chart) or eaten by dogs which when drinking river water deposit some faeces into the water and the Schistosome eggs are passed into the water. The eggs hatch in the water into Larvae which enter snails in the water. After some weeks the fish-like organisms leave the snails and re-enter the water. At this stage if they find any part of the human body exposed to the water they penetrate the skin and the person is infected with Schistosomiasis.

The present study concentrates mainly on sections 1 and 5 of the chart. These are the sections concentrating mainly on human behaviour in regard to water contact.

A cross sectional and Longitudinal clinical study which was done by medical doctors from the National Laboratory for Public Health revealed that 80% of the population in the study area was suffering from Schistosomiasis Mansoni.

HOW BILHARZIA IS SPREAD

1. A person suffering from bilharzia has bilharzia eggs in his/her urine or faeces. In Kenya, the urinary type of bilharzia is by far the commonest and the eggs are therefore found in infected urine.
2. When infected people urinate in or near stagnant water pond, lake or stream etc, which contain snails, eggs are passed into the water with urine.
3. The eggs hatch in water, and small larvae (miracidium) emerge. These enter certain kind of snails to grow.
4. After some weeks, small fish-like organisms (cercariae) leave the snail and re-enter water.
5. Then if a man wades or swims in this water, this fish like organisms, will pierce his skin and enter his body, giving him bilharzia disease.
6. Inside the human body, the organism travel to the liver, grow to adult bilharzia worms which pass eggs into the urine bladder to be passed out and again infect more people.

Source: Farooq et al (1966)

The people in this study area depend wholly on water supply from sources outside their households (a typical characteristic of the majority of Kenya's rural households) most of which are healthy carriers of *Schistosomiasis cercariae*. Due to the vital role played by water in human life, and the lack of safe water supplies in rural areas, people are forced to go into contact with infected water and because of their conditioned behaviour, *Schistosomiasis* becomes more a behavioural disease.

Advocates of public health are always of the opinion that if people stopped coming into contact with infected water or took health precautionary measures like boiling all domestic and recreational water supplies, *Schistosomiasis* and other hazardous water borne diseases like cholera could be terminated. But experience has shown that this is at the present period in rural Kenya a theoretical academic wishful thinking. The rural people claim that they have with their ancestors been using the same water sources without employing such health measures since time immemorial not to mention the burden of boiling water on the rural household work force. A case in point is the continuous rampant outbreak of cholera in Western Kenya where the Government has gone to the extent of prosecuting the people who fail to observe the laid out health precautions like digging latrines. Rural communities are tied up with myriads of different traditional ceremonies and lifestyles which unless they are fully taken into account the continuous outbreaks of water borne diseases will not be

eliminated.

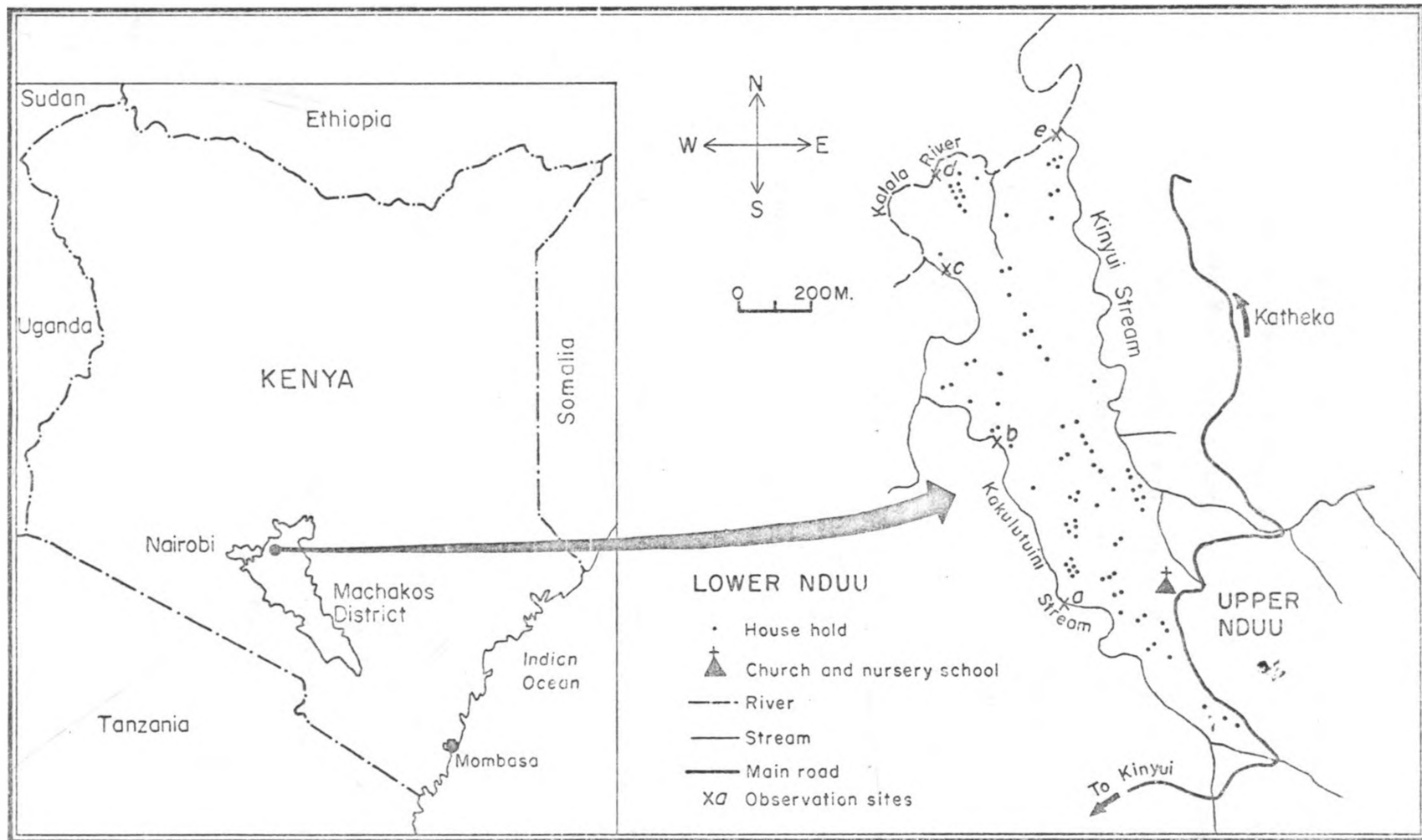
SECTION (ii)

SITE AND AREA DESCRIPTION

The area of study is in the Northern Division of Machakos District in Matungulu Location. Because the nature of the study required everybody to be studied in a pre-selected village, only Lower Nduu Village (see map page 6) of Matheini Sub-Location was studied.

This village is bordered by two streams and a major river. The Kinyui stream lies to the eastern side of the village, the Kakulutuini stream to the western side and the Kalala river to the northern side of the village. Both streams which are tributaries of Kalala river dry up in dry seasons but pools of stagnant water are left permanently. It is from these pools and ponds where snails are collected for Laboratory experiments. During the present study some sites (see map with sites marked a,b,c,d,e) were used as observation sites recording the people's activities during water contact.

The majority of the people from Lower Nduu and the neighbouring villages depend wholly on these streams and the major river for their domestic and recreational water supply



STUDY AREA FOR JOINT PROJECT MACHAKOS

in all seasons. All the water wells, springs and sand dug-out water holes are found along the streams and the river and these provide the population of the area with drinking water.

From the demographic survey carried out by the Medical Research Center of the Royal Tropical Institute of Amsterdam in Nairobi, Lower Nduu was recorded as having 90 households with a population of 505 people in 1973. During the time this study was carried out in November 1975, the population of the village recorded was 416 people. The decrease in number was due to migration of some families, other people were working away from home while some of the children were in schools far away from home.

Lower Nduu is comparatively poor in cash crops compared with Upper Nduu and the villages lying to the western side of Kakulutuini stream. As a result of this low potential in cash crops and poor soil, most of the residents of this village are employed as casual labourers at the neighbouring Matungulu Large Scale Coffee Estates and a Co-operative Coffee Factory in Upper Nduu. To arrive at the Coffee Estates or any other place outside the village, except Upper Nduu, or Matheini Market following the main road (see map), the residents of this village must cross either the streams or Kalala river at least twice a day.

In terms of water development, nothing has been done so far in Lower Nduu except in Matheini where piped water has been provided to the Harambee Secondary School near the market.

During colonial times, there had been piped water at the Matheini market but this is no longer operational because the pipes were stolen by people from the area.

This means that, the school provides the only safe piped water in the area.

The study was carried out in the months of August to November 1975. This is usually a dry season when water supply is relatively scarce in the whole district. Fortunately enough for the study area, the Kalala river provides sure and permanent water source for the entire population.

The Medical Research Center has set up a clinic in Matheini Market which is a few yards from the study area. That is where the majority of the people especially children are referred to for treatment and routine medical check up.

In addition to this clinic there is a government run health Centre (Matungulu) which caters for the other patients. Patients who cannot get treatment in any of these clinics go to private doctors in Kangundo, Tala or the Government hospital in Kangundo which is the Divisional Headquarters.

The distance from the study area to the main hospital of Kangundo or Machakos General Hospital is relatively far if considered hand in hand with the unavailability of road transport in the area. This is a major problem facing patients in the area and more often they wait for the Medical Research field vehicle to take them to hospital. If they fail to get transport many patients remain at home and are treated with traditional herbs.

SECTION (iii)

BACKGROUND AND MOTIVATION OF PROBLEM JUSTIFICATION

The study was carried out in an area where the "Joint Project Machakos" a department of the Royal Institute of Amsterdam has been gathering data on mortality and morbidity patterns with respect to childhood diseases like measles, whooping cough, acute diarrhoea and nutrition studies. In addition to this, the Division of Vector Borne Diseases of the National Public Health Laboratories, Nairobi is carrying out clinical and snail research studies on Schistosomiasis Mansoni in the same area sponsored by the "Clark Foundation" under Dr. Warren of the U.S.A.

It has been established that in Kenya about one million people suffer from Schistosomiasis Mansoni. In the area of study, it was established and demonstrated by Dr. Warren

(August 1974 unpublished) that 80% of the population of 505 people studied were infected with Schistosomiasis Mansoni. This is one of the highest prevalences in world perspectives.

It has not been established, to quote Dr. Warren, Dr. Muller and Dr. Weijers why the prevalence of Schistosomiasis Mansoni is more prevalent among the young people of ages 1-20 years than adults. Some doctors believe that the difference in prevalence between the ages is due to immunity while others believe it is due to differences in water contact behaviour of the different age groups within a population. It was the realization that the bio-chemical approach alone cannot bring full understanding of the disease which motivated this sociological study on water contact behaviour.

The sociological study will fit in the clinical, snail and epidemiological studies on Schistosomiasis being carried out in the same study area by the Medical Research Center and the Division of Vector Borne Diseases of the Ministry of Health.

It is anticipated that the study of the disease from these four aspects will present a near complete picture on the difficulties, ways and means of attacking the disease. Hence the study relates to a particular problem. The study will also fill the gap of theoretical frame work on theories about Schistosomiasis Mansoni since water contact studies in relation to Schistosomiasis Mansoni have tended to be neglected. It will give an insight on whether the differences in water contact among the different age groups or the immune status of the host

also plays a role in determining the prevalence rate of Schistosomiasis infection within a population.

The relevance and significance of this study is that it relates to a real situation and a practical problem in an area in Kenya where the disease has been demonstrated to be very high hence it is timely.

Results from the study could be compared with results from a similar study which has been in progress in St. Lucia West Indies, because the Machakos study area is an entirely different situation when one considers the geographical, cultural, life styles and socio-economic aspects of the people in the two regions. In the case of St. Lucia, Dr. Dalton, an Anthropologist dealing with the water contact studies established that, the major activity which brings people into contact with water was swimming and fording when taking bananas to the market. Swimming is hardly found in the Machakos area because the rivers are shallow and the area has no cash crops to be marketed on large scale, not to mention the cultural differences of the two areas.

Since Schistosomiasis is more of a behavioural disease, results from the study will permit generalization on the broader principles of social interaction especially in the other areas where the prevalence of the disease is known to exist.

In Kenya, there is a great campaign to provide water irrigation schemes in the rural areas to boost agricultural production and provide human beings with water in draught stricken areas. These schemes could, as an unforeseen bi-product, provide healthy breeding grounds for snails and due to human contamination of the water, they could become spreading grounds for Schistosomiasis though not intended. The theme for 1976 Freedom From Hunger Campaign was "Walk For Water". This study will provide the planners with the practical, social and physical implications for such developmental programmes be they in rural or urban areas. Only then, can they take strict measures to prevent the breeding of snails and the spreading of the disease through human contamination of the water

SECTION (iv)

OBJECTIVES AND AIMS

In connection with the high prevalence rate of infection with Schistosomiasis *Mansoni*, the aims and objectives of this study will mainly focus on factors which bring people into contact with water and the activities they perform during water contact.

- (a) To find out the frequency and type of contact with infected water and why people make such

water contact.

- (b) To find out the peoples perception and knowledge about the relationship between health, water and diseases.
- (c) To determine how and why people differentiate sources of drinking water from sources for other purposes like bathing, washing clothes, etc. What criteria do they use to define safe drinking water? What are the people's life styles and how are these related to water contact and Schistosomiasis infection?

The infection with Schistosomiasis within a population depends to a great extent on the degree of body exposure to infected water. This study aims to show the different patterns of body exposure to water among the population under study. These differences in patterns of exposure to water are related to the people's life styles and their occupational activities. The study also aims at identifying the different life styles and occupational activities of the people which bring them into continuous contact with the infected water in the area of study.

In establishing the degree of water contact in relation to Schistosomiasis, the frequency, duration and location of water contact will be taken into account because it is assumed that people who come into contact with infected

water less frequently or draw water from safer water sites would have a lower probability of infection with Schistosomiasis Mansoni.

In establishing the people's perception on the association in general between water and health, the study aims at asking questions like "Do the people know about Schistosomiasis?" and if they know about it "which are their sources of knowledge?" How far has this knowledge influenced their behaviour as regards water contact and water use? Which water borne diseases do they know? It is with the assumption that knowledge influences people's behaviour that the question of knowledge is dealt with in depth.

Another aim of the study is to find out:-

- (d) Which household tasks concerning water are performed by the family members according to age, sex, education and income.
- (e) Of the household tasks which bring people into **constant** contact with water, what is the rate of infection with Schistosomiasis Mansoni?

CHAPTER IILITERATURE REVIEW AND THEORETICAL FRAMEWORK
OF THE STUDY

The population studied is part and parcel of a social system. The degree of water contact is thus determined by their culture, role differentiation and status within the family life. Culture functions as the social frame of reference. It determines and shapes the social system of each society. Parsons (1951), Merton (1967), see a social system as the arrangement according to roles, status and norms which define the expected behaviour of an individual in a society. All these govern and co-ordinate individuals and ensure the smooth running of a society.

In societies, status refers to the position an individual holds in the society as seen by other members of the society. Role refers to the socially expected behaviour of an individual holding a certain position. It is this differentiation which determines in a family who performs what duties concerning water. This differentiation of roles exposes some members with infected water more than others and their frequency of contact with water makes them more prone to be infected with Schistosomiasis Mansoni.

In any population, where Schistosomiasis Mansoni is rampant, the people who are not heavily infected may have more knowledge about the relationship between health, water and diseases. This knowledge may have forced them to adopt better health practices as regards water use. Their adoption involves a mental confrontation with the structure of the new idea, and the severity of the expected consequences from unhealthy water sources. If the severity of the expected consequences are great, the people tend to change their existing cognition about the old ideas on water use. The people who adopt better health practise as regards water have no infection with Schistosomiasis or show a low stool egg count are what Rogers (1962) called innovators. They have perceived the adoption of better health practices as advantageous.

The knowledge about the relationship between water and health should influence innovations like boiling water for all purposes or seeking treatment when people know that they are suffering from Schistosomiasis Mansoni.

If such knowledge exists, it is assumed in this study that it should change people's behaviour towards water use. But as Rogers (1962) said, not all the people in an area will adopt new ideas and methods.

The complexity of an innovation will determine the rate at which it is adopted and the duration of practising the adoption. Boiling water is a labourious activity in the rural areas where people must first acquire charcoal or firewood. Their

availability will determine whether a family which perceives water as a health hazard, adopts the idea of boiling water for all purposes. Also the act of boiling water must be evaluated by the people in terms of its contributions and benefits and how far it enables or hinders the achievement of other family or individual goals. As stated earlier, boiling water is an additional burden to the rural labour force. This study takes a lot of interest to establish which families boil water in the study area, the frequency, their characteristics and reasons which motivated them into adopting this method. If they boil water as a preventive mechanism to water borne diseases, which diseases do they have in mind?

The behaviour and actions of an individual do not occur in a vacuum. He makes the decisions but his process of decision making and the action he takes are guided by his cognition Krech (1962). This cognition helps man to define which sources of water are safe from the ones that are not.

In the study area, people differentiate drinking water sources from water sources for other purposes. Depending on the availability of water, drinking water is drawn from a spring while water for washing clothes, watering cattle, sheep, and goats, bathing and irrigation come from other sources. Probably the people's cognitive reality about water has led them to define water as a health hazard only when one drinks it and not when one bathes in it. Thus, under these circumstances, drinking water is seen as dangerous because it goes into the

body while bathing water does not. The study aspires to establish how much people know about transmission of diseases from bathing water as well as drinking water. Are there some particular diseases known to them which are transmitted through drinking water and not through bathing?

In the rural areas water for domestic use, recreation and occupational requirements mostly comes from outside the households. As a result people cannot avoid coming into contact with water. To ensure a smooth supply of water for domestic use, each family has a defined division of household tasks between the family members. The status of each member of the family and cultural definition on the importance placed on these duties enable the division of labour in a rural family. It establishes which members of the family are responsible for domestic water supply. A father, as head of household cannot in the Kamba community draw water if he has a wife and children. Similarly a teenage male cannot draw domestic water if he has young sisters and brothers at home.

The availability of water within a given area also shapes the definition of water supply in terms of purpose. In areas where water is scarce, each member of the household will have a role to play on particular water activities. Under such conditions, washing clothes and bathing are performed by each individual at their own convenience and these duties tend to be performed at the water source rather than at home, where one has to labour first drawing water. Walji (1976 unpublished)

found that in Ukambani, "children make significant contributions as regards activities like cultivating in the shamba, herding, fetching firewood and drawing water for domestic use...".

Webbe (1962) says that, "...if domestic water supply is far from home, first contact with water is delayed until the children are older to walk further from home. The earlier the age at which children become infected with Schistosomiasis gives some indication of the proximity of the house to the infected water and thus the prevalence pattern in the earlier years will vary from an area to the other". Generalizations from his findings will be tested in this study to establish the influence of proximity of the household to the water sources and the frequency and degree of water contact by the individuals from these households.

In St. Lucia, Jordan, Lees (unpublished) found "considerable differences in the prevalence of infection in children under five years even in communities within few hundred yards from each other. Thus by the age of 4, children living on the valley floor showed a prevalence of 65% with Schistosomiasis while those living on the side of the valley away from main transmission sites showed a prevalence of less than 5% at this age". These findings indicate that among the children of 4 years of age, there was difference in water contact though living in one area. The major factor contributing to this difference in water contact and differences in the prevalence rate of Schistosomiasis can be assumed to

be the differences in distance from the various households, to the major transmission sites. Children from households farther away from these sites have lower frequency of contact with water than those living near the water transmission sites.

The family is the unit of organization and it is within the family where the status and roles of each individual are defined. Some status carry with them roles which bring some people more into contact with water, thus showing differences in the degree of infection with *Schistosomiasis Mansoni*. Farooq (et.al 1966) found in Egypt that "Muslims, show a greater prevalence than Christians and children not attending school". These findings indicate a difference in water contact by the population studied in terms of occupations and a deep rooted cultural difference within the community. Muslims are more involved in the fishing industry than Christians hence Muslims get into contact with water more than Christians.

As Van der Schalie (1960) shows in the Life Cycle, "Humans who bathe, fish, wash clothes or tend livestock in infected waters or who drink polluted water contract *Schistosomiasis* when the worm larvae burrow through the skin and then migrate to the lungs, liver, bladder and other organs. The females lay eggs in the intestines; in human wastes they find their way back to water."

As stated in the motivation of this study, Jordan (et. al unpublished St. Lucia) show that, "prevalence of *Schistosomiasis Mansoni* increases throughout childhood

to reach a peak in the second decade of life after which a gradual decline occurs". This decline in prevalence is not known whether it is due to immunity or a change in behaviour by the people as regards water". This study will establish the degree of water contact according to age, sex, education and occupation, which will make it possible to relate the frequency of water contact and the prevalence of infection with Schistosomiasis.

Van der Scharlie states in (1975) that "An inexpensive, safe drug treatment...a sure-fire vaccine or immunizing agent...a cheap and effective method of controlling the snail population - all those still remain elusive".

In order to study and understand the behaviour of the people as regards their understanding of the relationship between water and health, (Schistosomiasis in particular), the present study will focus on the actions taken by the people when they realise they are suffering from Schistosomiasis Mansoni. The seriousness of the disease and its symptoms determine the actions taken by the patients. Kloetzel (1967) indicates that "...the symptoms in infected children, vary from area to area, as does the number seeking treatment but while symptoms necessitating medical action indicate to the physician and the patient that the infection is troublesome, authorities in endemic areas are rarely convinced that the illness is sufficiently severe enough to warrant control programmes." This leaves the patient to evaluate the

seriousness of the disease which is a mental confrontation and then decides on the action either to see a physician or seek help from traditional healers to cure it. Treatment of a disease depends on the time the patient decides the disease is severe enough to warrant treatment. Some will seek treatment of the disease at its early stages while others will seek treatment later or never.

Poor sanitation leads to pollution of water sources in both rural and urban areas. An effective implementation of an innovation depends on how acceptable the idea is to the people. Scott, Barlow (1938), Weir, Wasif, Faraq, Allan, Abdel Kadem, (1952) show that "Sanitation when accepted by a community should lead to a reduced prevalence of Schistosomiasis Mansoni and other intestinal helminths". In the study area many people indicated that they do not use latrines. This study aspires at evaluating how people in the area understand and perceive the relationship between latrines and health. Latrines are a new phenomena and according to the peoples culture, the old defaecating habits are still acceptable to the majority of the people. Farooq et.al (1966) expressed the feeling that "...latrine facilities are poorly developed in areas of poor socio-economic conditions". He found that "in Egypt 49-Project, infection rates are higher for persons without access to a latrine." In the same area he also found out that, "in the low socio-economic groups, personal habits tend to be more

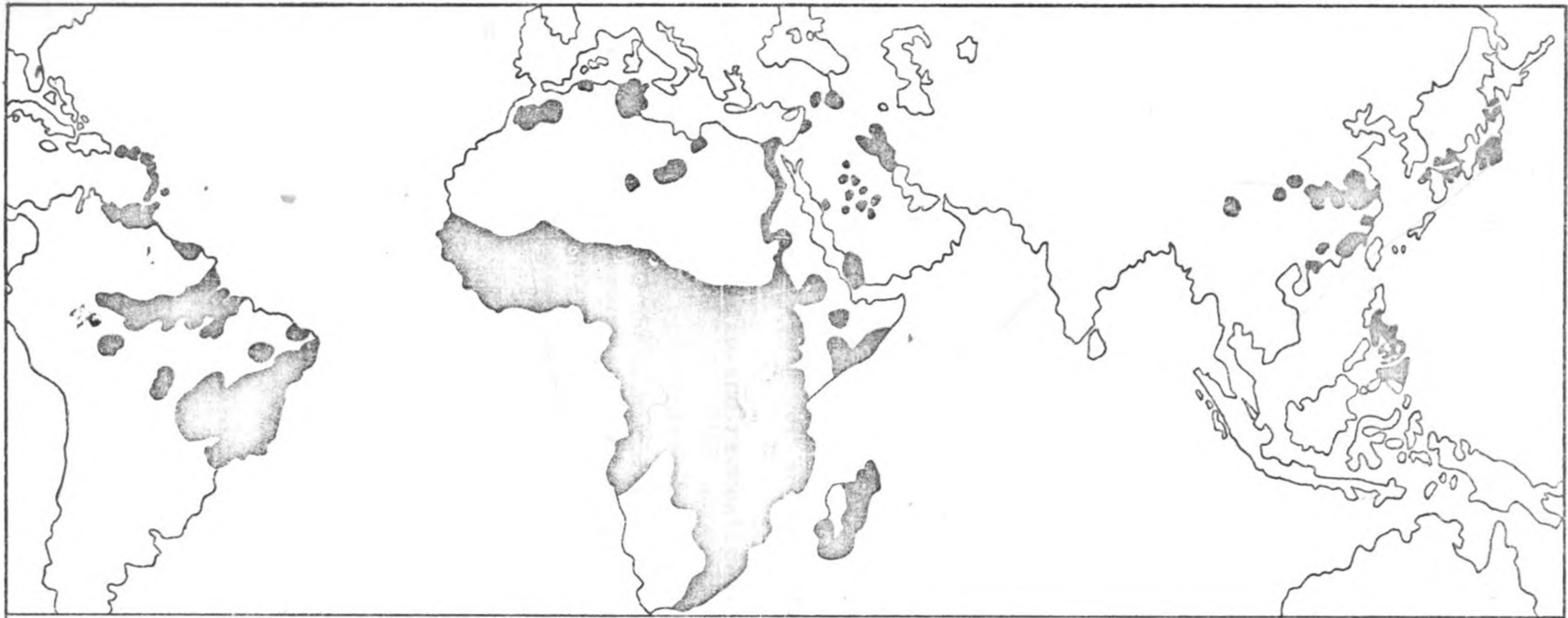
insanitary than in the higher socio-economic groups and these persons have more contact with infested bodies of water. Does this situation hold true in a typical rural Kenya?

Weirs et.al (1973 unpublished) found from a study carried out at Mathare Valley that the majority of the people infected with Schistosomiasis Mansoni were children. From his observations, he found that "children will always play along the Nairobi River regardless of the pollution in the river." He attributed this factor to explain the high infection rate among the children in Mathare Valley.

Dams certainly are dramatic symbols of economic progress. Dams provide irrigation to make arid lands bloom. They become reservoirs of valuable protein because of the fish in them. They provide electricity to light homes. Yet in Africa and other tropical lands dams often bring with them a terrible scourge, the debilitating parasitic disease, Schistosomiasis.

Africa, with development, is infact confronted with what amounts to, according to Bush (1976) "bilharzia explosion" (see map).

Van der Schalie (Head of the University of Michigan's parasitology center) predicted the explosive effect the Aswan Dam would have on the spread of Schistosomiasis along the banks of the Nile in Egypt and Southwards to Sudan. He said "The debilitating nature of this disease and its



Shaded areas show worldwide distribution of bilharzia

occupational hazards place it at the heart of many economic and social problems in countries where it is prevalent". He further says that "A man seriously affected with Schistosomiasis is not able to contribute much to the economic development of a country". He believes that "... with the increase in modern irrigation, the outbreak of bilharzia has grown by astronomical proportions".

In Lower Nduu, although modern irrigation is not being practised except at the Mutungulu Coffee Estates, infection with Schistosomiasis Mansoni is still very high. The river and streams in the area harbour snails which are Schistosomiasis Mansoni carriers. The river and streams provide a greater percentage of domestic and recreational water supply. This high dependence on river/stream water supply in Lower Nduu for domestic and recreational needs might explain the high prevalence of infection with Schistosomiasis Mansoni in the area.

CHAPTER IIIHYPOTHESES AND METHODS OF DATA COLLECTIONSECTION (i) HYPOTHESES:-

The following hypotheses were tested in this study:-

- (a) The degree of perception and understanding of the relationship between water and diseases (health) will influence water contact behaviour among individuals.
- (b) Knowledge of the diseases associated with water influences people's behaviour towards water contact.
- (c) Children have a higher frequency of water contact than adults hence should show a higher intensity of infection with Schistosomiasis Mansoni than adults.
- (d) Occupational categories like housewives and farm labourers show a high frequency of water contact than others and people performing these tasks should have a higher prevalence of infection with Schistosomiasis Mansoni.

- (e) Division of household tasks within a family assigns duties to some members which bring them more into contact with water than others and these people should show a higher prevalence infection rate than others.
- (f) Individuals from families which are far from water sources have less frequency of water contact than those from families near water sources.

SECTION (ii)

DEFINITION OF VARIABLES AND CONCEPTS FOR MEASUREMENTS

The following definition of variables, and concepts used in the study is necessary to enable the reader to understand the level of measurements defined and used in the text. These variables and concepts are defined operationally. In addition to this and where necessary the theoretical definition of the variables and concepts is also given.

- (a) Water contact: - operationally this will be taken to mean body exposure to water. It includes categories like bathing hands, feet, face or whole body. The last category will be considered as total body exposure to water while the others will be measured as partial body exposure to water.

(b) Perception and knowledge about the relationship between health (diseases) and water:-

The acquisition of these two variables is determined by many factors like age, education and openness to the outer world by individuals. Both will be treated as influential variables determined the degree of change in human behaviour on water contact among the people in the study area. Perception means how the people see inwardly health and disease.

(c) Age:-

This is defined as the age in years since birth for all the people interviewed in the study area. For the older people who could not remember when they were born, a list with important events like World Wars or famines was used to estimate their age. Later these ages were cross checked with the age list used by the J.P.M. in the same area.

For analytical purposes the variable age has been divided into two categories of young and adults.

(d) Sex:-

This takes into account the sex of the respondents categorized into male or female for analytical purposes.

(e) Education:-

This variable stands for the highest grade attained by the respondents during the interview in this study. For analysis the category of those who have attained nursery education has been combined with the category of no school, because it is felt that nursery education is not enough to give people knowledge about health and diseases which is one of the main objective of this study to measure its influence on water contact.

(f) Occupation:-

Operationally this stands for the major job each individual performs for a living. For analysis because the answers given by respondents to this question resulted with many occupational categories, a logical combination of the categories was carried out combining the similar jobs into one category. The final categories used in analysis are as follows:-

- i) None - this stands for the very young children and old people who said they had no occupation at all. Thus the dependants on other family members.
- ii) Schooling - this stands for the respondents who during the time of interview were in in school, meaning that they spend most of the days of the year in school.
- iii) Blue color jobs - this combined the categories of labourers at the Matungulu Coffee estate, household servants, and all those who indicated they depended on cultivating their shambas. Hence farmers.
- iv) White color jobs - All the people who indicated that they were either plumbers, machine operators, tailors, shopkeeper and hoteliers, clerks and teachers. This combination was logical and vital in the present study because some jobs had very few respondents.

(g) Family economic status:-

This is defined in the present study in terms of the type of house and the materials used in constructing the house, like the walls and the roofs.

(h) (i) Wells:-

These are defined as those water sources, which provide drinking water, which have carefully been dug either on communal basis or individually and provide water to the community throughout the year.

(ii) Sand dug holes:-

These are defined as water holes whereby sand is scooped at the river or stream bed and is allowed to accumulate water for any purpose. Unlike wells these are temporary water sources which tend to be common in dry seasons or are dug by children playing along the river bed.

SECTION (iii)

METHODS OF DATA COLLECTION

The unit of study was all the individuals living in Lower Nduu Village because the nature of the study required the water contact behaviour of all the residents in the village.

For data collection, three methodological procedures were applied:-

- i) Scheduled Questionnaire Interview.
- ii) Participant Observation.
- iii) Case studies - oral interview.

The need for utilising these three methodological procedures was the differences in water use within the households and outside the households. The scheduled questionnaire interview focused on domestic water use while the observation focused on water use at the chosen water sights along the river for observation.

(a) Scheduled Questionnaire Interview

The questionnaire interview was carried out by the author with the help of two research assistants from the study area. Both of them had been thoroughly trained on how to collect accurate data before the actual interview began. The pretesting of the questionnaire was carried out during their training, a method which made them be acquainted with the interview procedure.

Data collection by the scheduled questionnaire interview was done through visits to each household in the study area and all members of the household were interviewed. In the case of the young children who could not answer questions, their mothers, elder brothers and sisters were asked to answer on their behalf. For the people who happened to be away during interviews, revisits to the same households were made until they were

interviewed.

Because all members of the household were being interviewed, no sampling procedure was required for the questionnaire interview schedule. The questions in the questionnaire focused on domestic water use and supply like who in the family draws water for different purposes, where the residents draw water for different uses and what actions if any they take on the water brought home.

Questions on the respondents frequency of bathing in a week and their perception about the relationship between water, health and diseases were asked at home.

The questionnaire interview schedule was divided into two parts, a and b. Part a asked questions on the materials used in the construction of the house, distance from water sources to the household, places where water is stored in the household and general actions taken on the water brought home. Section b, asked individual questions on where people bathe and frequency of bathing and their knowledge on water borne diseases. All in all, the questionnaire interview schedule contained 37 questions, 21 for individual respondents and 16 for general household information.

(b) Observation

The observations were carried out at five randomly selected water sites along the streams and the river Kalala

(see earlier map pp 6). This focused mainly on outdoor water use and contact. These randomly selected sites included those where snails were collected for vector studies and a well where people go to draw water for drinking. This diversification provided water sources for the different water needs and activities in the area. Each site was given a number i.e. (a-f) and observed for seven days of the week from 6 a.m. in the morning to 6 p.m. in the evening. This ensured that the greatest percentage of the people having any water contact between these times were included. Also it is between these two periods of the day when the highest frequency of water contact takes place either occupational or recreational water contact in the rural areas.

Observing each site for seven days of the week provided a weekly variation on water contact between the sites. All the people observed at each of the chosen water sites were recorded down giving the site number, activities performed during water contact, the date of observation, day of the week when observation was done, duration i.e. time taken by people during water contact, approximate age of the people seen during contact with water, sex and the degree of water contact which means the parts of the body exposed to water during contact. All these categories provided information on the different utilities rural people put on water and which ones are most popular.

Before the observations were carried out a test survey was used to test the influence of the sex of the observers on the population being observed. It became apparent that the sex of the observer had little influence on the people because the residents of Lower Nduu are used to bathing in the river and streams. But as a precautionary measure, the observers were stationed in areas where the people could not notice they were being observed.

The population observed at these sites was unfortunately from both Lower Nduu and the surrounding areas. Even though the research assistants knew all the people from the study area, those seen visiting these water sites were treated as one population. After all it is felt that the water use by residents of Lower Nduu, the study area is not by and large very different from that of its neighbours.

(c) Oral Interview - Case Study

This was a case study on general knowledge and traditional name for Schistosomiasis Mansoni. It was necessary because only the older people seemed to have an idea on a traditional name for this disease. The oral interview also focused on questions like how people differentiate drinking water from water for other purposes a task which was not possible to accomplish by using questionnaire interview.

SECTION (iv)

SAMPLE SIZE

For the questionnaire interview all the people in a total number of 90 households were interviewed. These households had a recorded population of 506 people. Out of this number 90 potential respondents had either migrated to other areas like Yatta, married away or died. This left 416 residents as the people interviewed in Lower Nduu.

For the observations, the sample size could not be pre-determined but after observations the number of cases observed turned out to be 699. This high number can be explained by recorded people from neighbouring villages and people who might make more than one visit a day to a particular site. In this case the χ^2 test will not be applied for observations.

SECTION (v)

DATA PROCESSING AND ANALYSIS

For data processing and analysis, a code manual was prepared and then the raw data was transferred into code sheets and sent for punching. After this a computer programme of SO4B was used which gave results in tables with means and

percentages. For further illustrations graphs have been used and the chi-square tests calculated and given after each table, to test the significance of the association between the variables.

SECTION (vi)

PROBLEMS ENCOUNTERED

One serious problem faced in this study which might have increased the people's awareness and knowledge about the relationship between water and diseases (health) is the daily activity of collecting snails from the river and streams for vector studies. If this action has really had any influence on the population, it is doubtful whether it greatly changed the people's water behaviour because so far they have not been provided with any other water source alternative.

In order to measure and control the influence of this activity plus stool collection from the study area, respondents were asked in addition to their knowledge, to name the source from which they learned about Schistosomiasis Mansoni or the relationship between water and health.

Another problem faced was having too many interviews in the study area for different studies currently being carried out by the medical team of the J.P.M.

It was however assumed that the co-operation given by the respondents in the study area to J.P.M. research team would be retained. In fact the respondents turned out to be very co-operative and not suspicious in answering the questions. This eliminated the problem of long and labourious introductions before interview. On the whole all the respondents answered the questions except in households where some members had migrated away, died or had been married to a different household.

CHAPTER IV

FINDINGS AND INTERPRETATION OF RESULTS

First and foremost in this chapter, the over-all demographic characteristics of the sample population is given.

After data analysis, it became apparent that the majority of the respondents were between the age category of 1-20 years. Demographically the age variable distribution in the population under study is clearly illustrated in the histogram no. 1. This represents the questionnaire sample of N=416 and not the observation sample of N=699. Originally the age variable was categorized into 13 groups. For analytical purposes, these categories were grouped into two major categories which have been used throughout this chapter. These are: Young and Adults.

Young refers to all those respondents between the ages of 1-20 years.

Adults refers to all the respondents whose age is over 20 years.

This age categorization was deemed fit for this study because in the rural context, someone of 18-20 years is still considered young and many of them are still in primary schools.

By age, the breakdown in numbers was as follows:-

(a) Young - n = 243

(b) Adults - n = 173

According to sex the breakdown was as follows:-

(a) Males - n = 174

(b) Females - n = 242

This shows that the majority of the people interviewed were young and females.

In this chapter the χ^2 test has been applied to the questionnaire sample alone $N=416$, because in the observation sample $N=699$, some people (cases) had been counted more than once.

The formula for χ^2 (used) is:-

$$\chi^2 = \frac{(fo-fe)^2}{fe}$$

To compute the degrees of freedom (d.f) in each table, the formula used was:-

$$df = (r-1)(c-1)$$

The χ^2 test has been applied in all tables at the probability level of $p = .001$.

By age, the breakdown in numbers was as follows:-

(a) Young - n = 243

(b) Adults - n = 173

According to sex the breakdown was as follows:-

(a) Males - n = 174

(b) Females - n = 242

This shows that the majority of the people interviewed were young and females.

In this chapter the X^2 test has been applied to the questionnaire sample alone $N=416$, because in the observation sample $N=699$, some people (cases) had been counted more than once.

The formula for X^2 (used) is:-

$$X^2 = \frac{(f_o - f_e)^2}{f_e}$$

To compute the degrees of freedom (d.f) in each table, the formula used was:-

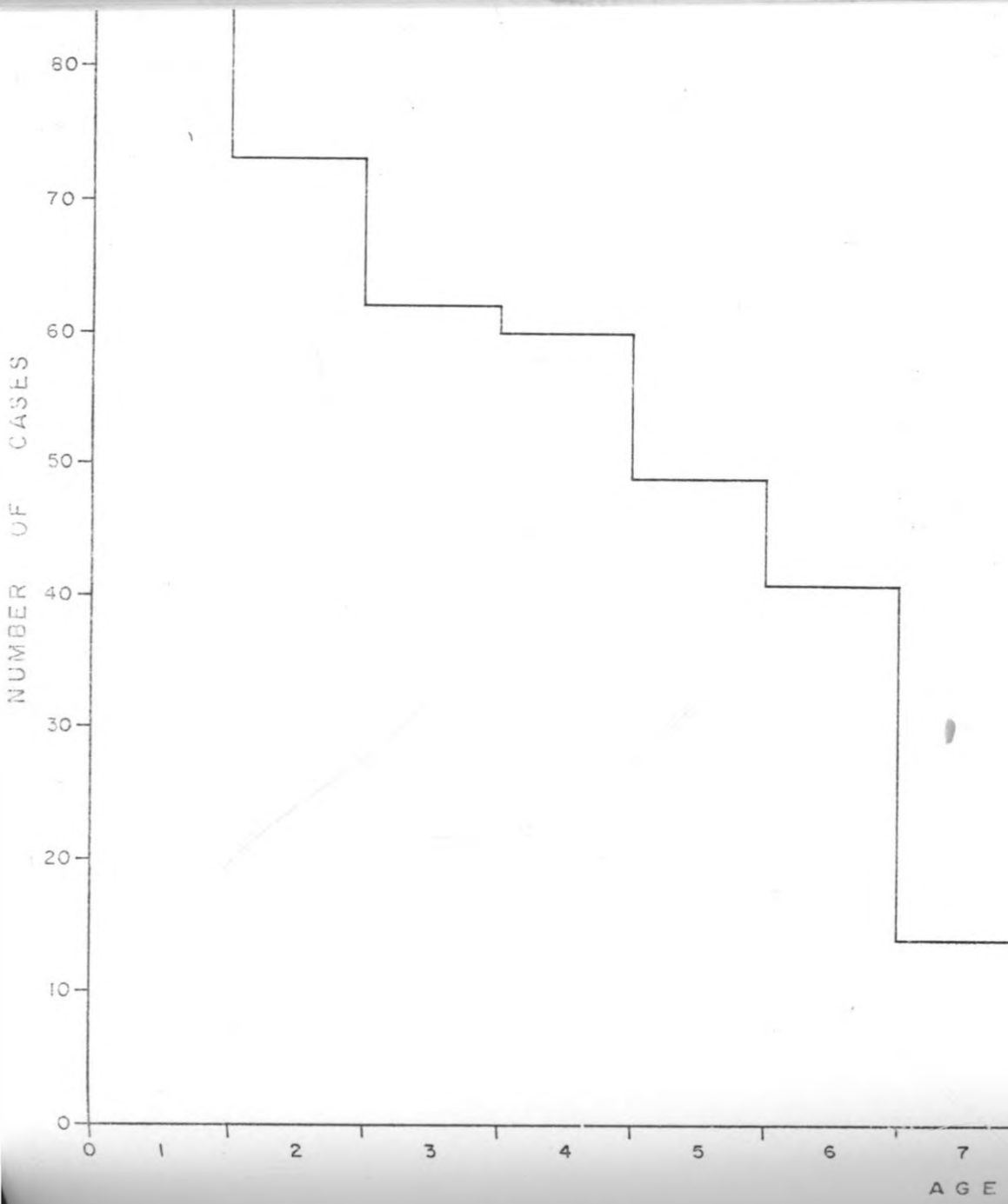
$$df = (r-1)(c-1)$$

The X^2 test has been applied in all tables at the probability level of $p = .001$.

After presenting the demographic distribution of the questionnaire, the rest of the chapter concentrates on presenting and comparing the results from the questionnaire and the observations which as stated earlier is a methodological objective of this study. The initiative of comparing the two is a methodological innovation even though expensive in both time and resources, as a search for validity of the research findings.

The findings of Warren (1974) show that, the intensity of infection with *Schistosomiasis Mansoni* is highest among the young people. In this study, this was translated to mean that the young people prefer to bathe in the river and stream more than the adults a factor which should contribute to the high rate of infection with *Schistosomiasis Mansoni* among the young people.

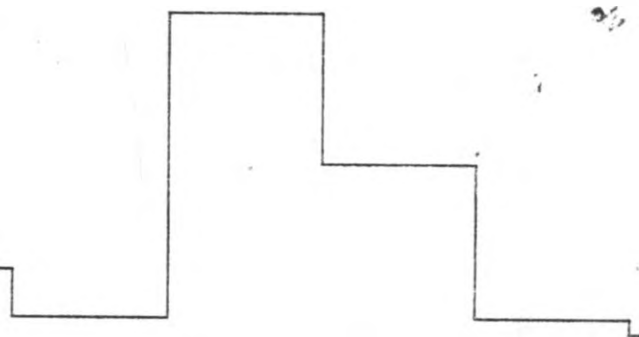
Table No. 1 from the questionnaire findings, N=416, compares the preferential areas for bathing with the variable of age (see page 43).



KEY

AGE

- 1 = 1 - 5 yrs
- 2 = 6 - 10 "
- 3 = 11 - 16 "
- 4 = 16 - 20 "
- 5 = 21 - 25 "
- 6 = 26 - 30 "
- 7 = 31 - 35 "
- 8 = 36 - 40 "
- 9 = 41 - 45 "
- 10 = 46 - 50 "
- 11 = 51 - 55 "
- 12 = 56 - 60 "
- 13 = 61 - 65 "



8

9

10

11

Table No. 1Preferential Areas for Bathing

Age	River/Stream	Home	Total
Young	179 (193) 54.9	64 (50) 71.1	243
Adults	147 (133) 45.1	26 (40) 28.9	173
Total	n=326 100%	n=90 100%	N=416

$$\chi^2 = 11.31 \quad P .001 = 10.827 \quad 1df.$$

Results from table no. 1 show that the greatest percentage of the population from Lower Nduu have a greater liking for river/stream as bathing areas than home. The table also shows that the greater percentage of young people prefer bathing at the river/stream as well as adults who prefer the river/stream than home as their bathing areas.

The χ^2 test shows that, the chances that this event will occur by chance alone are 0.1%.

Numerically, because more young people prefer river/stream water sources than adults, we would expect more young people to be infected with *Schistosomiasis Mansoni* than the adults. Also, the high preference of river/stream as bathing sources

indicates that Lower Nduu should generally show a higher rate of infection with *Schistosomiasis* *Mansoni* than other areas where the people prefer bathing at home.

The possible cultural explanation for the preference of the young to bathing in the river and stream are

- (a) Adults require more privacy than children. Rivers are not private sites for adult bathing.
- (b) Children get more dirt than adults and therefore need frequent bathing. But with the scarcity of water, they have to go to the river and streams needless to speak about the labour involved in drawing water for bathing.

According to the people's life styles it is socially acceptable for a person to bathe in the river/stream as long as one does not use the sites where the population draws water for drinking. Such water sources are guarded by the community and any body seen bathing nearby is sanctioned by his family and the community at large. These sanctions can sometimes result to beatings for the young children, or ridicule for the adults and force to clean the spring. The community allows the residents to utilize the river water as they prefer because water among the Kamba people is a communal property.

In Table No. 1 the higher percentage of the young people preferring to bathe at home than adults represents by and large the very young children who rarely go to the

river and are always bathed at home by their mothers unlike the rest of the population.

From the vector studies which have been carried out by the Division of Vector Borne Diseases in the same area, it has been demonstrated that snails shed caecariae according to the period of the day. As Dr. Blankespoor (Ann Arbor News) says "The snails shed huge number of infectious larvae, at ten when the warmest weather starts". This means that in the mornings, the caecariae output is lower than that of noon and afternoon periods because these periods are relatively warmer than the morning. This means that the people bathing or coming into contact with water more often in these periods of the day should show a higher prevalence of infection with Schistosomiasis than those bathing or coming into contact with the river water in the morning period.

The family and individual daily activities which shapes people's life styles sets up a time schedule on the periods of the day when an individual should take a bath. Adults tend to be busy during daytime than the young people because they must work for their living and their families than the young people. Young people tend to be afraid of cold water in the mornings than adults. Thus young people should tend to bathe when it is warm, the period when the caecariae output is highest. This means that young people should show a higher rate of infection with Schistosomiasis Mansoni than adults. Due to the daily time pressure on adults, they tend to spend lesser

time at the river than the young people and hence should show a lower prevalence of infection than the young people.

Table No. 2

Time of day a bath is taken

Age	Morning	Afternoon	Evening	Total
Young	19 ⁽²³⁾ 48.7	165 ^{a(152)} 63.5	59 ⁽⁶⁸⁾ 50.8	243
Adults	20 ⁽¹⁶⁾ 51.3	95 ⁽¹⁰⁸⁾ 36.5	57 ⁽⁴⁸⁾ 49.2	172
Total	n=39 100%	n=260 100%	n=116 100%	n=415

$$\chi^2 = 8.25 \quad p \quad .001 \quad df2$$

$$p \quad .001 = 13.815$$

N = 415 because one case was rejected by the computer.

Morning refers to 6 a.m. - 12 noon.

Afternoon refers to 12 noon - 4 p.m.

Evening refers to 4 p.m. - 6 p.m. +

Table No. 2 shows that, in Lower Nduu the majority of the people prefer to take a bath in the afternoons and in the evenings than in the mornings. This means that the greatest percentage of the people in the study area take

a bath at the periods when the Schistosomiasis caecarie output is highest, a factor which helps to explain why the rate of infection with Schistosomiasis Mansoni in Lower Nduu is one of the highest in world perspectives.

The possible explanations why the majority of the people bathe in the high risk periods of the day could be the rural activities and duties performed by rural people. Due to these activities rural people do not have to be clean before going to cultivate in a shamba. As such most rural activities are manual duties and unlike urban areas personal appearance is secondary. But in the afternoons and evenings when the majority of the people return home from their respective labourious duties, most of them end up taking baths on their way home. They are sweaty, dirty and dusty. Also many of them end up going to the market to spend their daily earnings, (especially the people working at the large scale coffee farms) and for most people, personal appearance and cleanliness is vital at this juncture because there they meet friends.

Table No. 2 also shows that, in the afternoons a greater percentage of the young people take baths than adults. This is the period when children in primary school are released from school. ; With free warm afternoons, they go to the river to bathe. The fact that the young people show a higher rate of water contact during the periods of high risk than adults explains why a greater percentage of the young people show a higher intensity rate of infection with

Schistosomiasis Mansoni than adults.

χ^2 indicates that the chances that this event will occur by chance alone are 0.1%.

It has been established that snails, which are hosts of Schistosomiasis Mansoni, tend to prefer areas with slow flowing and stagnant water as their breeding areas and natural habitats. Also snails prefer dams and streams with weeds and other vegetation on which they feed. People who bathe in the streams, dams and rivers have differential preferences for the type of water they bathe in because of their cognitive behaviour. Young people who cannot swim or fear bathing in fast flowing river water tend to prefer the stagnant and slow flowing water, which is the most favourable for snails than adults. Thus children (young people) should show a higher prevalence of infection to Schistosomiasis Mansoni than adults. To establish this relationship, respondents were asked to name the type of water they preferred to bathe in.

Table No. 3Type of water preferred for Bathing

Age	Stagnant	Slow flowing	Fast flowing	Total
Young	117 ^(84.5) 81.3	57 ^(62.2) 53	63 ^(90.3) 40.9	237
Adults	27 ^(59.5) 23.7	49 ^(43.8) 46.3	91 ^(63.7) 59.1	167
Total	n=144 100%	n=106 100%	n=154 100%	N=404

$$\chi^2 = 51.3 \quad p = .001 \quad df=2$$

$$\chi^2 = 51.3 \quad p = .001 = 13.815$$

NB N=404, 1 case was rejected by the computer

D.K=11

Table No. 3 shows that the greatest percentage of the people who prefer stagnant water are the young ones. They prefer the type of water which tends to harbour snails and as a result must show a higher prevalence of infection with *Schistosomiasis Mansoni* than adults.

The stagnant water is more attractive to children because it is less risky and they can safely bathe and play in it.

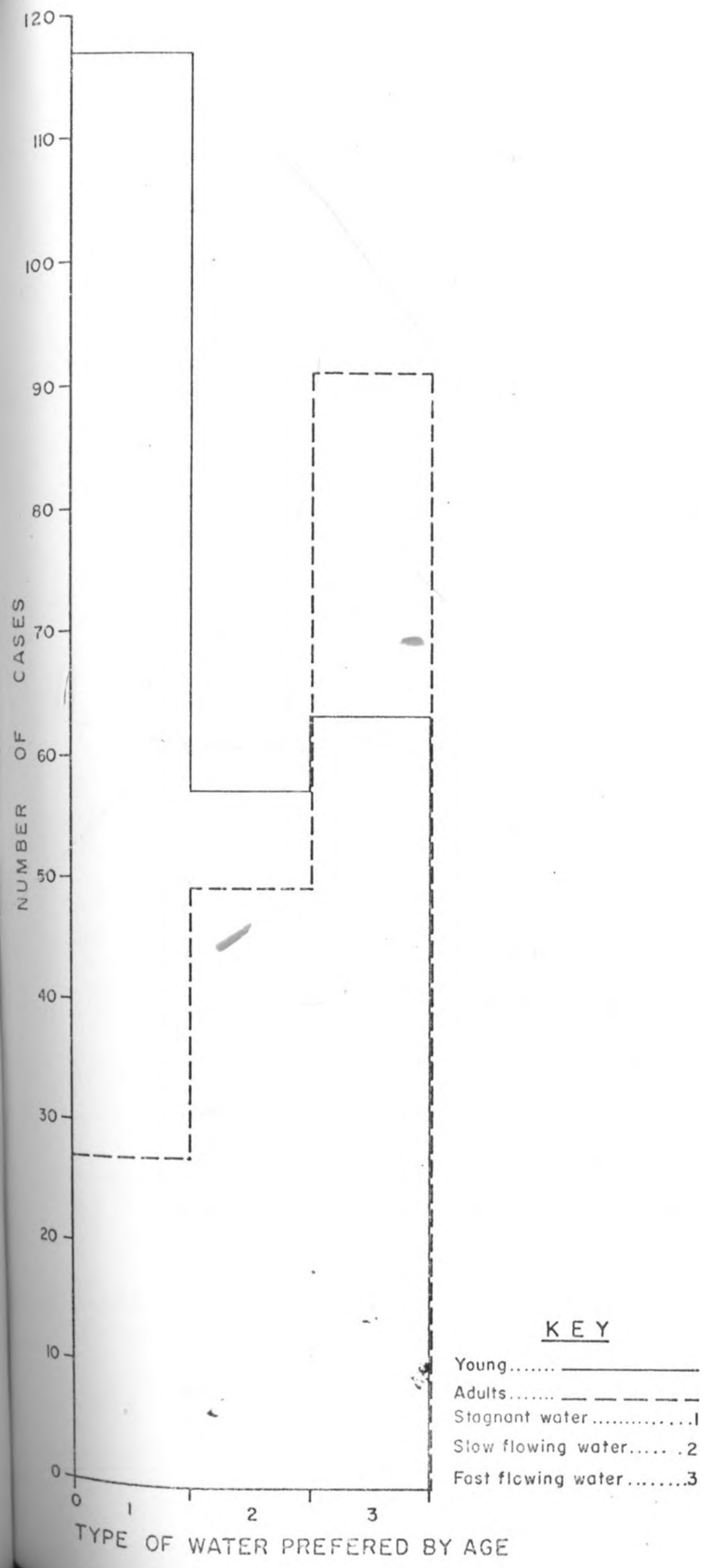
The χ^2 shows that, this event is expected to occur by chance .1% of the times or 1 out of 1000.

A graphical presentation of this relationship between age and the type of water preferred for bathing is shown in histogram No. 2. This shows (in the next page) that the majority of the young people prefer stagnant water while the majority of adults prefer fast flowing water. This is a clear distinction of the perception and cognition as regards water between the two age categories. It helps the adults to avoid the highly contaminated and polluted water with Schistosome Caecarie.

The findings so far show that there is significant relationship between age and the frequency of water contact, where young people show a higher rate of contact than adults.

One of the hypotheses being tested in this study is that "knowledge of the diseases associated with water influences people's behaviour towards water contact". This means that people with this knowledge should have less contact with river water.

A case study carried out in the study area, with an attempt to try and get the "Kamba" name for Schistosomiasis Mansoni, became apparent that the majority of the adult population did not know any local name for the disease. However some adults gave "MULUO" as the name while others



mentioned "MUTHYOI". When asked further to explain how the disease they knew about was transmitted some of them, referred to water, when one bathes in it with snails present. Some of these people are suspected to have been influenced by the Medical Team and the continuous snail collection from the river and stream.

Other respondents said that the disease was transmitted when a person steps on fresh human urine or stool (excreta) of a person suffering from the disease. Other respondents attributed transmission of the disease to sexual intercourse. On further investigations these people turned out to be referring to venereal diseases.

In the questionnaire, respondents were asked if they knew of any diseases associated with water.

Table No. 4 shows that the majority of the people in Lower Nduu have no knowledge about diseases associated with water. With this limited or no knowledge about diseases associated with water most people of Lower Nduu go into contact with water indiscriminately, a factor which explains the high prevalence rate of infection with Schistosomiasis in the area.

The same table shows that more adults have knowledge of the disease associated with water than the young people.

Table No. 4Knowledge of Diseases Associated with Water

Age	Know	Don't Know	Total
Young	22 (38.6) 33.2	221 (204.5) 63.1	243
Adults	44 (27.5) 66.7	129 (145.6) 36.9	173
Total	n=66 100%	n=350 100%	N=416

$$\chi^2 = 20.2 \quad p = .001 \quad 1df$$

$$\chi^2 = 20.2 \quad p.001 = 10.827$$

It is not yet known how knowledge could influence people's behaviour if they were provided with alternative water sources in Lower Nduu. People in this area have for a long time been relying on the river water as their major water sources. But Dalton (St. Lucia West Indies) reports that, people still use the old water sources even after being provided with new alternatives. The possible explanations he gives to this, is that people tend to prefer more space for drying clothes and are less crowded, thus giving them, especially females some ground for gossips. In the study area, there are lots of bushes which provide enough cover for adults to bathe in the river especially the shy females.

In the study area, the people who have knowledge about diseases associated with water might be forced to rely on the same water supplies as the rest of the population especially in dry seasons when the distance to the nearest safe water sites is far and the labour involved in carrying water home makes these alternative sites too unattractive to them.

During the case study interview when people were asked why they used the river water, some old men and women claimed that they had been using these water sites since birth without any complaints. They saw no reasons for discontinuing using it and blamed the established nearby coffee factory for the outbreak of the disease.

It was the objective of this study to "determine how and why people differentiate sources of drinking water from sources for other purposes in rural areas like bathing water and water for washing clothes. What criteria do they use to determine safe drinking water?"

It became apparent from the case study that people use concepts of colour, smell and taste mainly to determine safe drinking water. They also evaluate the general cleanliness of the area around the water source. Some respondents indicated that they preferred the milky water because it tasted better and had no foul smell. It seemed that irrespective of the presence of bacteria in the water most

people would define safe drinking water as that without smell, clear or milky, but not salty.

Some females indicated that they filter drinking water. Their reasons for filtering the water was to remove any visible residues and the green algae which they believed make them lose their voice. After checking this with medical authorities it was confirmed that the green algae found in water, if drank can cause losing ones voice (hoarse).

One conclusion is drawn from the findings of the case study on why people differentiate sources of water for different purpose. Most people from Lower Nduu believe the water which can affect one's health is actually when somebody drinks unsafe water. To them water which does not go through the digestive system is not harzardous. This perception, cognition and lifestyle of the people explains why they indiscriminately bathe in the river. The result of this is the reported high rate of infection with Schistosomiasis Mansoni.

Due to lack of data on the people infected with Schistosomiasis Mansoni in Lower Nduu, people were asked whether they had been treated for Schistosomiasis. The treated were those whose stool examination indicated they were severely infected.

The next table No. 5, compares age of the people with the incidence of treatment for Schistosomiasis Mansoni.

The age group which shows a higher percentage rate of treatment means that, the age group had more severe cases of Schistosomiasis infection.

Table No. 5

Treatment for Schistosomiasis

Age	Treated	Not Treated	Total
Young	74 ⁽⁵⁵⁾ 77.9	169 ⁽¹⁸⁸⁾ 52.6	243
Adults	21 ⁽⁴⁰⁾ 22.1	152 ⁽¹³³⁾ 47.4	173
Total	n=95 100%	n=321 100%	N=416

$$\chi^2 = 20.22 \quad p = .001 \quad 1d.f.$$

$$\chi^2 = 20.22 \quad p.001 = 10.827$$

NB. Treatment in the area was given by the Ministry of Health, the Medical Research Centre and Dr. Warren at Kinyui, Kangundo and Kenyatta National Hospital.

Table No. 5 clearly shows that among the people treated for Schistosomiasis the highest percentage treated was the young people. It has been established that, to be infected with Schistosomiasis Mansonii, a person must come into contact with infected water. Also severe infection with

Schistosomiasis means that the people concerned must have made repeated contacts with infected water because during each contact, the cercariae of Schistosomiasis Mansoni penetrate human skin and the person is infected.

This higher percentage of treated cases among the young people means that they make more contact with infected water than the adults.

As Walji (unpublished) had found in Machakos, the young people are the major suppliers of household water and this exposes them more to infected water in the study area than the adults.

The X^2 means that the chances that this event will occur by chance alone are 1 in 1,000.

The transmission of Schistosomiasis is a complex process for the rural Kerwa population to understand. Lack of knowledge on how it is transmitted explains why Lower Nduu shows a high rate of infection. A close examination of the village revealed that the majority of the households did not have latrines. Lack of latrines means that the majority of the people defecate in the bushes along the streams and far from the households. Many people in the study area see nothing wrong with such a practice, after all, soon after defecation, the rural starving dogs and hens feed on the stool. After the stool is eaten, the matter is closed as far as the rural people are concerned. They fail to connect the fact that these animals drink water at the river, and by so doing drop some

stool particles hanging on their whiskers into the water. By any chance, if this stool had Schistosome eggs, they will immediately begin the life cycle again in the water and re-infect man once again.

This factor shows the urgency of health education required by the rural population to reduce the incidence of this disease and other water borne diseases in the area.

Jordan and Lees (unpublished St. Lucia) shows that "the prevalence of Schistosomiasis increases throughout childhood to reach a peak in the second decade of life after which a gradual decline occurs". This decline in prevalence is not known whether it is due to behavioural change on water contact, due to age, there should be a clear difference on patterns of water contact between the adults and the young people.

To establish whether any behavioural water contact differences does exist in Lower Nduu, observations were carried out from five chosen sites, and in each, observations were carried out for one week. The rationale of recording water contact for the seven days of the week was in order to establish whether during some particular days of the week the two age categories had different water contact patterns. Are there some days of the week when the rate of water contact is higher and if so, how can this be explained?

Table No. 6Rate of Water contact per day of the Week

Age	Mon.	Tue.	Wed.	Thur.	Fri.	Sat.	Sun.	Total
Young	46 57.8	53 57.5	58 55.8	46 56.3	56 52.9	94 60.9	61 64.4	414
Adults	34 42.2	45 42.5	45 42.2	41 43.7	36 47.1	52 39.1	35 35.6	285
Total	n=80 100%	n=98 100%	n=103 100%	n=87 100%	n=92 100%	n=146 100%	n=96 100%	N=699

Results from this table show that there is a difference in the rate of water contact between adults and the young people in Lower Nduu. In all seven days of the week, a greater percentage of the young people made water contact than adults. On Monday - Friday over half of the people observed having water contact were the young ones. On Saturdays and Sundays the number of the young people observed having water contact was almost double that of the adults.

This means that the young people make more water contact with infected water than adults. Therefore the prevalence of infection with *Schistosomiasis Mansoni* should be higher among the young people than adults.

These observation findings support the hypotheses that "children in Lower Nduu have a higher frequency of water contact than adults hence should show a higher prevalence rate of infection with Schistosomiasis Mansoni.

Among the young people, the days of the week when the highest frequency of water contact takes place is on Saturdays and Sundays. These are the days when most young people are free from school and must clean their clothes and school uniform.

For the adults the highest frequency of water contact was recorded on Saturdays. Being a market day, the majority of the adults bathe in the river on their way to the market place (Tala or Kinyui).

Table No. 2 of the questionnaire findings revealed that the majority of the people preferred to take a bath in the afternoon and evening periods of the day. As stated earlier in the objectives, the observation results are being used to validate the questionnaire findings.

In order to make this comparison during the observations, records were kept on the approximate time of the day when people were observed having water contact.

Table No. 7Time of day when water contact occurred

Age	Morning	Afternoon	Total
Young	177 56.0	237 61.9	414
Adults	139 44.0	146 38.1	285
Total	n=316 100%	n=383 100%	N=699

Table No. 7 shows that the frequency of water contact is higher in the afternoon than in the morning periods. The percentage of the young people observed having water contact is higher than that of the adults, but predominantly higher in the afternoon than in the morning period. The high frequency of water contact by the young people in the afternoon coincides with the risk period when snails cercariae output is highest. It can be concluded that due to this high frequency of water contact in the afternoons the young people should show a higher prevalence rate of infection than adults.

The observation findings do support the questionnaire findings.

In rural Kenya, household tasks and the division of labour is mainly based on sex and age of the people. Some of the activities bringing people into constant contact with infected water being household tasks like drawing water and washing clothes expose some people to infected water than others.

During the observations, the sex of the people was recorded down to establish whether there exists any difference between water contact and the sex of the people.

Table No. 8

Age	<u>Sex</u>		Total
	Male	Female	
Young	99 52.7	315 61.6	414
Adults	89 47.3	196 38.4	285
Total	n=188 100%	n=511 100%	N=699

Table No. 8 of the observation results show that the highest percentage of the people seen at the observation infected water sites were the young people.

The young females had a higher frequency of contact with water than the adult females while the young males also had a higher rate of contact with water than the adults males.

In the group of the young people, the females frequency observed was higher than that of the young males. For the adults, more adult females were seen making water contact than the adult males. From these findings, it is concluded that the young males and females should have a higher prevalence rate of infection with *Schistosomiasis Mansoni* than the adults. Also, young females should have a higher prevalence rate of infection than young males because more young females make frequent water contact than the males. Adult females should show a higher prevalence rate of infection than adult males because more females go into contact with infected water more frequently than the adult males.

This persistent high rate of contact with water by the females can be attributed to the fact that in the Kamba community most of the duties associated with water are performed by the females.

When people come into contact with river/stream waters, there must be some family, personal or social activities which force them to go into contact with the water. In order to establish

the activities which bring people into contact with water a record was kept during the observations noting down the activities people performed in the water at the observation sites.

Table No. 9

Activity During Water Contact

Age	Bathing	Washing parts of body	Washing clothes	Fording	Playing	Drawing water	Total
Young	66 51.6	150 54.3	30 65.2	27 75	4 100	137 65.9	414
Adults	62 44.4	126 45.6	16 34.8	9 25	0 0	71 24.1	
Total	n=128 100%	n=276 100%	n=46 100%	n=36 100%	n=4 100%	n=208 100%	N=698

NB

1 case was rejected by the computer N=698

Table No. 9 shows that, of all the six activities recorded at the observation sites, a higher percentage of children was recorded per activity than adults.

Hypotheses (e) states that "Division of household tasks within a family assigns duties to some members, this brings them more into contact with infected water than the others. People performing these activities show a higher prevalence rate of infection than others."

Table No. 9 shows that washing clothes and drawing water are performed mainly by the young people. These expose them to infected water than adults. Therefore young people should show a higher prevalence rate of infection than the adults in Lower Nduu.

The young people seen playing were shooting lizards with catapults on the stone boulders as a measure for marksmanship.

Schistosomiasis cercariae will keep on penetrating the human body as long as the person remains in contact with the water. The greater the body surface exposed to the infected water the greater the chances of severe infection.

During the observations, the parts of the human body exposed to water were recorded down.

Table No. 10

<u>Degree of Water Contact</u>			
Age	Parts of the body	Whole body	Total
Young	359 61.1	55 50	414
Adults	229 38.9	55 50	284
Total	n=588 100%	n=110 100%	N=698

NB

1 case was rejected in the computer.

Table No. 10 shows that washing parts of the body is the most common in body exposure to water. Not surprising, the percentage of the young people exposed to water is higher than the adults in this category. This difference in patterns of body exposure to water can be attributed to the different types of activities performed by the people. Surprising enough, an equal number of adults and the young ones was recorded bathing whole body at the sites. This exposes them to infection than the other people.

Chart No. 3, illustrates the degree of water contact for the people observed at the sites. The frequency is highest in washing hands, hands, feet, and face and face followed by bathing whole body in that order.

Some activities like washing clothes and bathing whole body take longer durations in water than other activities. The longer the duration in infected water the higher the intensity of infection with Schistosomiasis Mansoni.

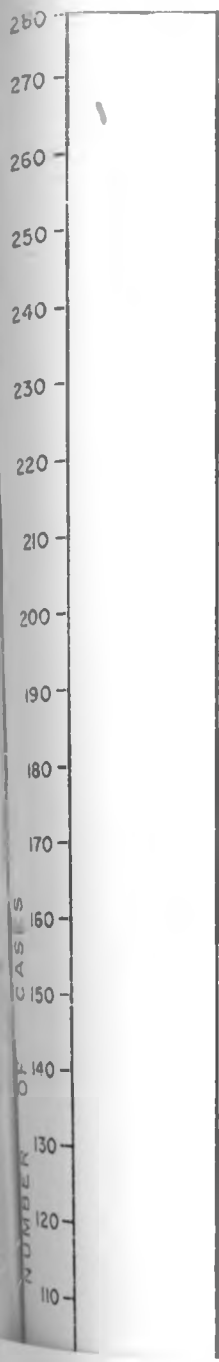
As part of the observations, the duration in minutes, the people took during water contact was recorded down.

Table No. 11

Duration of Water Contact

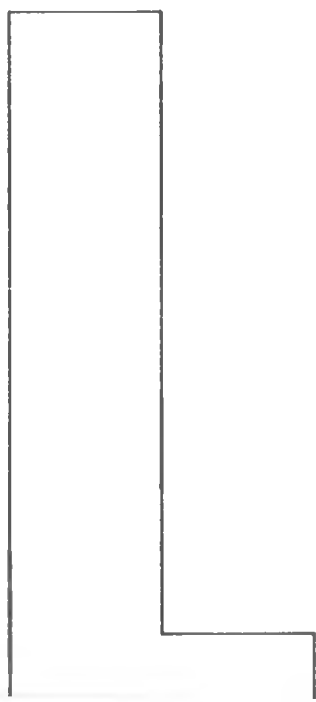
Age	1-10 min.	10-20 min.	20 min.	Total
Young	370 61.7	32 48.5	12 52.1	414
Adults	230 38.3	34 51.5	11 47.9	264
Total	n=600 100%	n=66 100%	n=23 100%	N=678

NB. 21 cases were not recorded on duration because there were too many people to time them.



KEY

- 1. ___ Hands
- 2. ___ Feet
- 3. ___ Face
- 4. ___ Hands, Feet
- 5. ___ Hands, Face
- 6. ___ Hands, Feet, Face
- 7. ___ Whole body



This table shows that the majority of the people observed spend less than 10 minutes during their water contact. The percentage of the young people observed was higher in this category than that of adults. For the next two categories of time, the percentage of adults observed and that of the young people is almost equal. It is clear from these findings that people spend quite some substantial amount of time in water contact.

Farooq, established in Egypt that people from houses constructed with mud and bricks had a higher prevalence of Schistosomiasis infection. His level of measurement was the building materials.

In the study area, the building material was used as the measure of economic status of the entire household. Comparison of the economic status with preferential areas for bathing among the residents is shown in Table No. 12, of the questionnaire results N=416.

Table No. 12

Preferential Areas for bathing

Roof material of house	River/Stream	Home	Total
Grass thatched	227 (253.9) 84.9	47 (70.17) 52.2	324
Iron sheets	49 (72.1) 15.1	43 (19.9) 47.7	92
Total	n=326 100%	n=90 100%	N=416

$$\chi^2 = 43.9 \quad P \quad .001 \quad df.1$$

$$\chi^2 = 43.9 \quad p.001 = 10.827$$

Results from this table show that the majority of the houses in Lower Nduu are grass thatched. The greatest percentage of the people preferring the river/stream water for bathing come from these households. An explanation for this could be because unlike people in houses with iron roofing they cannot catch rain water and as a result must depend wholly on water supply from the river.

After comparing the roofing material of the houses and the people treated for Schistosomiasis, it became apparent that 82.1% of the people treated came from houses with grass thatching.

Table No. 13

Wall materials	<u>Treatment for Schistosomiasis</u>		Total
	Treated	Not Reated	
Cement	1 (4.1) 1.1	17 (13.9) 1.1	18
Bricks	82 (79.0) 86.3	264 (266.9) 82.2	346
Mud	12 (11.8) 12.6	40 (40.1) 12.5	52
Total	n=95 100%	n=321 100%	N=416

$$\chi^2 = 3.1332 \quad p \quad .001 \quad 2d.f.$$

$$\chi^2 = 3.1332 \quad p.001 = 13.815$$

From table No. 13, the greatest percentage of the people treated for Schistosomiasis Mansoni in Lower Nduu come from houses with walls constructed with mud and unburned bricks.

This finding supports Farooq's findings in Egypt that materials used in building houses have some association with the infection of Schistosomiasis in areas where the disease is common.

An explanation to this possible association is that bricks and mud for building houses are made with the help of river water in Lower Nduu. This forces the people involved in building to spend more time in infested water and are thus infected with Schistosomiasis.

Gerald Webbe (1962) said that the distance from the household to the nearest (river/stream) water source should influence water contact among people. He also said that water contact is delayed among children by this distance. If this is true, the distance from the households in Lower Nduu to the nearest river/stream should influence the preferential areas for bathing.

Table No. 14Preferential areas for bathing

Distance to water source from Household	River/stream	Home	Total
200 metres	265 (257) 81.3	63 (70.9) 70	328
500 metres	47 (47.8) 14.4	14 (13.2) 15.6	61
1000 metres	14 (15.7) 4.3	6 (4.3) 6.7	20
1000 metres	0 (5.5) 0	7 (1.5) 7.7	7
Total	n=326 100%	n=90 100%	N=416

$$\chi^2 = 6.46 \quad p = .001 \quad 3d.f.$$

$$\chi^2 = 6.46 \quad p = .001 = 16.268$$

From Table No. 14 the highest percentage of the people in Lower Nduu prefer the river/stream for bathing. These are the people from households within a distance of 200 metres from the river. The liking for the river as bathing areas decreases with every increase in distance from the river to the household.

The majority of the people come from households which are within a distance of less than 200 metres from the river.

This means that people from these households are within short distances from the river water supply and utilize it very often, than people from households further away.

If this holds true, it means that people from households near the river should show a higher rate of infection than the people from households further away.

This relationship is demonstrated in Table No. 15 comparing treatment for Schistosomiasis with the distance from household to the river.

Table No. 15 shows that the greatest percentage of the people treated in Lower Nduu come from households within 200 metres from the water sources. They have water available and at their disposal. This is why 80% of the population of the village of 410 people was in 1974 infected with Schistosomiasis.

It is assumed that education gives people knowledge about the health hazards connected with the continuous use of infested water. People with formal education should have less contact with infested water and should prefer bathing at home than the people without education.

Table No. 15

Treatment for Schistosomiasis

Distance from household to water source in metres	Treated	Not Treated	Total
200	67 ⁽⁷⁵⁾ 70.5	261 ⁽²⁵³⁾ 81.3	328
500	19 ⁽¹⁴⁾ 20	42 ⁽⁴⁷⁾ 13.1	61
1000	8 ⁽⁵⁾ 8.4	12 ⁽¹⁵⁾ 3.7	20
1000	1 ⁽¹⁾ 1.1	6 ⁽⁶⁾ 1.9	7
Total	n=95 100%	n=321 100%	N=416

$$\chi^2 = 5.82 \quad p = 0.001 \quad 3df$$

$$\chi^2 = 5.82 \quad p = .001 = 16.268$$

Table No. 16Preferential Areas for bathing

Education	River/stream	Home	Total
No school	104 (129.1) 33.5	56 (35.7) 62.2	165
Primary	201 (176.9) 61.8	25 (49.1) 27.8	226
Secondary	14 (18) 5.7	9 (5) 11	25
Total	n=324 100%	n=90 100%	N=414

$$\chi^2 = 35.6 \quad p \quad .001 \text{ at } 2d.f.$$

$$\chi^2 = 35.6 \quad p.001 = 13.815$$

NB.

2 cases were rejected by the computer N=414

Table No. 16 shows that the majority of the people preferring river/steem are either in primary school or have no education at all.

During analysis it became apparent that among the people treated, the greatest percentage was among the people with primary education.

In order to test hypotheses (d) which states "Occupational Categories like housewives and farm labourers should show a high frequency of water contact than other occupational categories and should show a higher intensity of infection with Schistosomiasis Mansoni", comparison between occupation and preferential areas for bathing was done.

Table No. 17

Occupation	<u>Preferential areas for bathing</u>		
	River/stream	Home	Total
Schooling	117 40.9	27 25.2	144
Manual job	110 38.5	13 12.1	123
None	36 12.6	48 44.9	84
Non-Manual Jobs	23 8	19 17.8	42
Total	n=286 100%	n=107 100%	N=393

$$\chi^2 = 67.4 \quad p = .001 \text{ at } 3d.f.$$

$$\chi^2 = 67.4 \quad p.001 = 16.268$$

NB. N=393, 23 respondents refused to give their occupations.

Table No. 17 shows the greatest percentage of the people would prefer river water. They are those in the occupational category of schooling. This is followed by the blue color jobs which encompasses occupations like labourers, and those who cultivate at home. A great number of the blue color jobs are people employed at the Matungulu Estate and result to bathing in the river on their way home.

After comparing treatment with occupational categories, it became apparent that the highest percentage treated was among the school children (56.8%). Once again this shows that the young people have more contact with infested water frequently than adults in Lower Nduu.

The reasons why more children are treated for Schistosomiasis Mansoni than other occupational categories are:-

- (i) Children have more free time than adults and in lower Nduu children spend most of their time in the river. Hence children are more exposed to infested water than adults and will therefore show a higher intensity of infection with Schistosomiasis Mansoni than adults.
- (ii) Treatment in Lower Nduu was given to people who showed a high rate of egg count in their stool. Childrens egg count in stool was higher than that of adults hence more children were given treatment than adults.

CHAPTER VCONCLUSIONS AND RECOMMENDATIONS(i) CONCLUSIONS

The results of this study show clearly that:-

- (a) In Lower Nduu, very few people have any knowledge on the relationship between health and water. Due to this lack of knowledge more people are being infected with Schistosomiasis Mansoni because they are still using the infested river and stream which are the major sources of domestic and recreational water supply.
- (b) The majority of the people in the study area have no knowledge on the transmission of Schistosomiasis and this explains why the prevalence of the disease is so high.
- (c) Children (young people) have a higher rate of contact with infested water than adults in Lower Nduu. It can be concluded that due to this high rate of contact with infested water children will always show a higher prevalence rate of infection, than adults until a lasting solution is found.

- (d) Some activities assigned to people through household division of labour bring some people into continuous contact with infested water and as a result these people will suffer from Schistosomiasis Mansoni and other water borne diseases more than the rest of the population which makes less water contact. Like children who are more engaged in washing clothes and drawing water for the family are in more contact with the river infested water than adults.
- (e) Infection with Schistosomiasis Mansoni, and other waterborne diseases is governed by people's behaviour regarding water. Because of the vital role played by water in human life, people cannot avoid water contact. Some people feel that they have been using the same river water for many years and cannot see any justification for ceasing to utilize the same water sources.
- (f) The existing water sites provide Lower Nduu residents (especially children) with convenient and attractive playing grounds (recreational) and as such children will continue to use these sites thus enhancing infection with Schistosomiasis Mansoni.
- (g) Results from the study confirm the findings of Farooq that people from houses constructed with bricks and mud in Schistosomiasis areas show

higher prevalence rates of infection than those from buildings constructed with stones.

Also distance from the households to the river influences the rate of infection with Schistosomiasis Mansoni.

(ii) RECOMMENDATIONS

(a) Health Education

This is defined as the process by which people as individuals or groups are equipped with awareness and are taught how to prevent themselves from contracting or spreading a disease. It is a precious investment if the people could be made to solve their single health problems by their actions and efforts before these problems turn into epidemics. The definition of health education here presupposes that health education begins with a human need, perceived and recognised by all parties concerned. After identifying the human needs and problems, it is essential to initiate and stimulate their interests in trying to solve their problem. Generate their participation and stimulate their sense of personal responsibility in the problem at hand instead of imposing one's will on the people. These are the factors very essential for the success of any health programme in the rural areas.

The next chart provides six methods on how to avoid infection with Schistosomiasis.

In addition to these six methods, it is recommended that, the people can be provided with safe water sites and then teach them not to utilize the river water.

In cases where dams are being constructed to provide the population with water, it is suggested that, care must be taken to make sure that these dams do not become breeding grounds for snails, hosts of the Schistosomiasis disease.

In the case of Lower Nduu, it is suggested that the snails in the river be killed and eliminated. But the most important recommendations of all these is health education.

Any health education programme must be integrated fully with other social and economic efforts and needs of the people in the area. Health educators must work in consultation with the people because it is the local participation of the people which will inspire the understanding, acceptance and active support for the programme.

It is recommended that after the health education programme is initiated a further sociological study should be carried out to measure and evaluate the behavioural changes in regard to water contact by the people in the area. Unless a change in behaviour of the rural people is achieved through health education, people will still continue going into

How to avoid Bilharzia.

1. Always use a latrine for urinating or defaecating.
2. If you want to urinate, and there is no latrine nearby, do so a long way from water.
3. Do not swim, bath, drink or wash clothes in water unless you are sure it is safe and free from infection.
4. Dams, streams and other watering places should be kept clean of weeds and other vegetations on which the bilharzia snail feed.
5. When not sure of safety, always boil water before using it.
6. In case you notice blood in your urine or faeces, or if you should feel irritations after urinating or defaecating, go to the nearest Health Clinic for Medical Examination.

Source: Farooq et al (1966)

contact with infected water and infection with Schistosomiasis Mansoni and other related water borne diseases will continue to be a threat to human life and health.

In the absence of a reliable cure, instituting modern sanitation practices, purifying the drinking water and providing rubber wading boots for those who must work in water would go along way toward halting the spread of Schistosomiasis Mansoni. But these measures are both expensive and impractical in many isolated regions of the world and they sometimes run counter to age-old customs of the different people.

Dr. Van der Schalie concludes that "The fullest hope for alleviating suffering and improving the economy will only be achieved when the control of Schistosomiasis receives total commitment. Few diseases demand as much coordination and cooperation among such groups as sanitary engineers, clinical specialists, sociologists, health educators and biologists as does Schistosomiasis.

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SCHISTOSOMIASIS QUESTIONNAIRE

"Good morning/afternoon/evening. I am a student from the Department of Sociology, University of Nairobi. I am doing a study on water use in this area and I would appreciate if you can answer the following questions".

PART A

(To be answered by head of household. Mainly wife)

Name:..... H.H. No.....

1. Family type

0	Nucleas	
1	Extended	

2. How many people live in this house?.....

3. What are their names. Start with Father and Mother.

0	(a)	5	(f)
1	(b)	6	(g)
2	(c)	7	(h)
3	(d)	8	(i)
4	(e)	9	(j)

4. What duties does each member do for the family?

0	(a) Father
1	(b) Mother
2	(c) Child
3	(d)
4	(e)
5	(f)

- 6 (g)
- 7 (h)
- 8 (i)
- 9 (j)

5. In this house who performs the following duties? Fill in the following table:

	Names	How often in a day	Amount	What part of body is exposed to water
0 (a) Drawing water				
1 (b) Washing clothes				
2 (c) Washing utensils				

6. Roof of house is:

0 grass thatched

1 iron, tins, plastic

7. Walls of houses are:

8. 0 Stone

1 Bricks not burned

2 Piles with mud

8. Floor of house is:

0 Cemented

1 Mud

9. In dry season, where do people in this household get water for:

- 0 (a) Bathing.....
- 1 (b) Washing clothes.....
- 2 (c) Drinking.....

10. In wet season, where do people in this household get water for:

- 0 (a) Bathing.....
- 1 (b) Washing clothes.....
- 2 (c) Drinking.....

11. How far is your drinking water source from your house?

- 0 Less than 200 metres
- 1 Less than 500 metres
- 2 About 1,000 metres
- 3 More than 1,000 metres

12. How far is the nearest river or stream to your house?

- 0 Less than 200 metres
- 1 Less than 500 metres
- 2 About 1,000 metres
- 3 More than 1,000 metres

13. When you draw water and bring it home, what do you do to it?

- 0 (a) Drinking water?
- 1 (b) Bathing water:.....
- 2 (c) Water for washing clothes?.....

14. Do you store water in this household?

- 0 YES
- 1 NO

15. If YES, where do you store water?

- 0 Stone tanks
- 1 Drums
- 2 Tins
- 3 Pots
- 4 Gourds
- 5 Elsewhere. Explain

16. If you store water, how long do you store it for?

- 0 Half a day
- 1 One day
- 2 Two days
- 3 More than three days

PART B

(To be answered by every member of the household. For each member, fill a new form and information about very young children should be given by the mothers)

1. Name.....
2. Age.....
3. Sex.....
4. How far have you gone in education?.....
(Grade attained in school)
5. What is your present occupation?.....
6. What specific jobs do you do for the family?
.....
.....
7. When you want to bathe where do you go?
 - 0 (a)
 - 1 (b)
 - 2 (c)
8. Have you taken a bath this week?
 - 0 YES
 - 1 NO
9. Did you take a bath since yesterday?
 - 0 YES
 - 1 NO

10. If YES, where did you have your bath?
11. How long do you take having a bath?
12. Generally what time of the day do you normally take a bath?
.....
13. If you were to bathe in the river, which type of water would
you prefer to bathe in?

- 0 Stagnant water
- 1 Slow flowing water
- 2 Fast flowing water

14. In your family, who accompanies you when you go to do the
following duties?

- 0 (a) Drawing water.....
- 1 (b) Washing clothes.....
- 2 (c) Bathing away from home.....

15. Do you know any diseases associated with water?

- 0 YES
- 1 NO

16. If YES, can you tell me which ones?

- 0 (a)
- 1 (b)
- 2 (c)
- 3 (d)

17. Have you heard about bilharzia?

- 0 YES
- 1 NO

18. If YES, from whom did you hear?

0 (a)

1 (b)

2 (c)

19. Have you been treated for bilharzia?

0 YES

1 NO

20. If YES, when were you treated?

Year..... Month.....

21. Where were you treated?

0 Place.....

18. If YES, from whom did you hear?

0 (a)

1 (b)

2 (c)

19. Have you been treated for bilharzia?

0 YES

1 NO

20. If YES, when were you treated?

Year..... Month.....

21. Where were you treated?

0 Place.....

