

**A STUDY OF SCHISTOSOMIASIS AMONG SCHOOL  
CHILDREN BETWEEN THE AGES OF 6 - 17 YEARS IN  
THE OUTAPI HEALTH DISTRICT IN NAMIBIA.**

**A THESIS SUBMITTED IN PARTIAL  
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**Abstract**

Schistosomiasis is a parasitic disease caused by flukes. This infection creates a reaction in the human tissue that manifests as scarring of the bladder, urethra, or colon. Schistosomiasis is closely associated with water, as snails carry the parasite.

The purpose of this study was to describe and explore any factors (variables) that could be associated with the persistence of the high infection rate of schistosomiasis

in school children between the ages 6 – 17 years in the Outapi health district, in order to implement appropriate prevention strategies.

In this study, two specific objectives have been formulated. They are firstly, to describe the incidence and magnitude of schistosomiasis in school children in the Outapi health district and secondly, to identify the possible factors that may be associated with the high persistence rate of schistosomiasis in that district.

Two study groups were used in this study. The first was a case population (from which a case group was selected), which consisted of all the school children infected with schistosomiasis for the period 2006/2007 in the Outapi district. The second population (from which a control group was selected) was the control group and comprised of all the school children in the Outapi district not infected with schistosomiasis for the same period.

In this study, 31% of the schoolchildren tested positive for schistosomiasis. Significant correlations were found with regard to four independent variables namely, age, water contact, lack of toilets at household and health education as a subject at school. It was found that water contacts, lack of latrines and lack of health education and promotion in schools are factors that contribute to the transmission and persistence of this disease. In this study the researcher also found that the schistosomiasis peak between 9 and 13 years of age in the district.

**TABLE OF CONTENTS**

<b>Title page</b>	<b>i</b>
<b>Abstract</b>	<b>ii</b>
<b>Table of contents</b>	<b>iv</b>
<b>Acknowledgements</b>	<b>xi</b>
<b>Dedications</b>	<b>xii</b>

<b>Declarations</b>	<b>xiii</b>
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## **Chapter 1**

### **Problem Statement and Research Design**

1.1 Introduction to the study	1
1.2 Problem statement	5
1.3 Purpose of the study	5
1.4 Specific objectives	5
1.5 Study setting	6
1.6 Terminology	6
1.7 Significance of the study	6
1.8 Outline of the study	7
1.9 Summary	7

## **Chapter 2**

### **Literature review**

2.1 Introduction	8
2.1.1 The epidemiological focus of the framework	8
2.1.2 A health promotion focus	9
2.2 The causative organism	11
2.3 The Person	18
2.3.1 The Person with specific biological characteristics	18

2.3.2 The Person with a perceived health status	19
2.3.3 The Person with a perceived control over health	19
2.3.4 The Person and perceived self-efficacy	19
2.3.5 The Person and perceived barriers to health promoting behaviour	20
2.3.6 The Person and the importance to health	20
2.4 The environment and the persistence of schistosomiasis	20
2.5 The time and situational factors	30
2.6 Socio-economic status	31
2.7 Empowerment through health education	32
2.8 Summary	33

### **Chapter 3**

#### **Research design and research methodology**

3.1 Introduction	34
3.2 Research design	34
3.3 The study population	36
3.4 Sampling procedure and sampling size	37
3.5 Research instruments	39
3.5.1 The reagent strip	39
3.5.2 The questionnaires	40
3.6 Compilation of the instruments	41
3.7 Testing of the instruments	44
3.8 Data collection	46
3.9 Permission to conduct the research	47

3.10 Ethical considerations	47
3.11 Data analysis	48
3.12 The hypotheses	49
3.13 Summary	51

## **Chapter 4**

### **Analysing of the findings**

4.1 Introduction	52
4.2 Findings of infection with schistosomiasis haematobium	53
4.3 Results obtained by means of the questionnaires	53
4.3.1 Caregiver	54
4.3.2 Eating anything before going to school	54
4.3.3 Taking something to eat at school	55
4.3.4 Working caretaker	55
4.3.5 Knowledge on preventative and control measures	56
4.3.6 Infections according to ages	57
4.3.7 Infections according to gender	58
4.3.8 Infections caused by passing through water on way to schools	59
4.3.9 Boiling water for drinking	60
4.3.10 Infections caused by using drinking water from the canal	60
4.3.11 Lack of toilets at households	61
4.3.12 Health education as a school subject	62
4.3.13 Infection caused by playing in water	64
4.3.14 Using tap water for domestic purposes	64

4.3.15 Using tap water for bathing	65
4.3.16 Using canal water for bathing	66
4.3.17 Signs and symptoms	67
4.3.18 Source of schistosomiasis information	68
4.3.19 Schistosomiasis a health problem in the area	68
4.3.20 Family members affected by schistosomiasis	69
4.3.21 Affected family members received schistosomiasis treatment	69
4.3.22 Knowledge on mode of transmission	70
4.3.23 Family member that contracted the disease	70
4.3.24 Schistosomiasis preventative measures	71
4.3.25 Availability of toilets and water at schools	71
4.3.26 Using the bush as toilets at household	72
4.4 Summary	72

## **Chapter 5**

### **Conclusions, recommendations and limitations**

5.1 Introduction	73
5.2 Purpose of the study	73
5.3 Conclusion and recommendations regarding to the stated objectives	73
5.3.1 Conclusions and recommendations regarding Objective 1	73
5.3.2 Conclusions regarding Objective 2	74
5.3.3 Recommendations regarding Objective 2	79



5.4 Stated conclusions and the framework of the study	81
5.5 Limitation of the study	81
5.6 Final conclusion	82
5.7 Further research	82
5.8 Summary	83
6. References	84
<b>7. Tables</b>	
Table 1.1: Infection rate of schistosomiasis in children in Namibia	4
Table 3.1: The correlation of the questionnaire with the framework of the study	42
Table 3.2: The null hypotheses	49
Table 3.3: Alternative hypothesis	50
Table 5.1: The factors identified as being associated with the persistence of a high Schistosomiasis infection rate	75
Table 5.2: The null hypotheses that were rejected	77
<b>8. Figures</b>	
Figure 1.1: A map of Namibia to illustrate rivers and canals	3
Figure 2.1: An epidemiological health promotion focused approach	10
Figure 2.2: The schistosomiasis life cycle	17
Figure 3.1: Sampling technique: stratified random sampling	38
Figure 4.1: Knowledge on preventative and control measures	56
Figure 4.2: Age distribution of learners	57
Figure 4.3: Infection caused by passing through water on the way to school	59

Figure 4.4: Collecting of drinking water at canal	61
Figure 4.5: Access to home toilets	62
Figure 4.6: Exposure health education as a school subject	63
Figure 4.7: Using tap water for bathing	65
Figure 4.8: Using canal water for bathing	66

## **9. Annexures**

Annex 1: Permission letter to conduct research from post graduate committee – UNAM

Annex 2: Application letter to the Omusati region education Director requesting permission to conduct research in schools

Annex 3: Permission letter to conduct research in school from the Omusati region education Director

Annex 4: Application letter to school principals requesting permission to conduct research in their schools

Annex 5: List of identified schools for data collection

Annex 6: One of the tools used in data collection

Annex 7: Questionnaire used for data collection

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The journey though this life has not always been made easier by the path I have walked. But all along the journey you have filled life with the most amazing and unconditional love.

I hope that I have made you proud.

### **Declaration**

I, Leonard Amutenya Uusiku, hereby declare that this research is true a reflection of my own research, and that this work, or any part thereof has not been submitted for a degree to any other institution of high education.

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Leonard-Amutenya Uusiku

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Date

## **CHAPTER 1**

### **1.1 Introduction to the study**

Health is a topic of concern to all citizens of Namibia. It is inextricably linked within all aspects of daily living and is a prerequisite for a productive and satisfying life. A major goal of any health care delivery system today is to reserve and maximize human capital by offering health preserving and social practices that result in the avoidance of disease and by offering diagnosis, treatment and rehabilitation services for existing diseases (Chitsulo, Engels and Savioli, 2000, p.41)

In spite of major changes and approaches to the health care delivery system, there are many diseases and health problems that still exists and cause problems to society. These many diseases and health problems are being attributed primarily to personal behaviour and environmental factors. One of these diseases is schistosomiasis (also known as bilharzias) which is still prominent in some countries including Namibia and particularly prevalent in the Outapi health district.

Schistosomiasis is a disease caused by a parasitic worm or fluke, a trematode, which completes its life cycle partly in humans and partly in snails. The pathophysiology results from the reaction of human tissue to the eggs and the fibrotic scarring of the bladder, urethra, ureter and/or the descending colon, depending on the type of organism (Bruijning, 2003, p.12).

Schistosomiasis is caused by several different *Schistosoma species*, each requiring a different approach to treatment and control. The species are *Schistosoma haematobium* and *Schistosoma mansoni* (Gilles & Lucas, 2003, p.20).

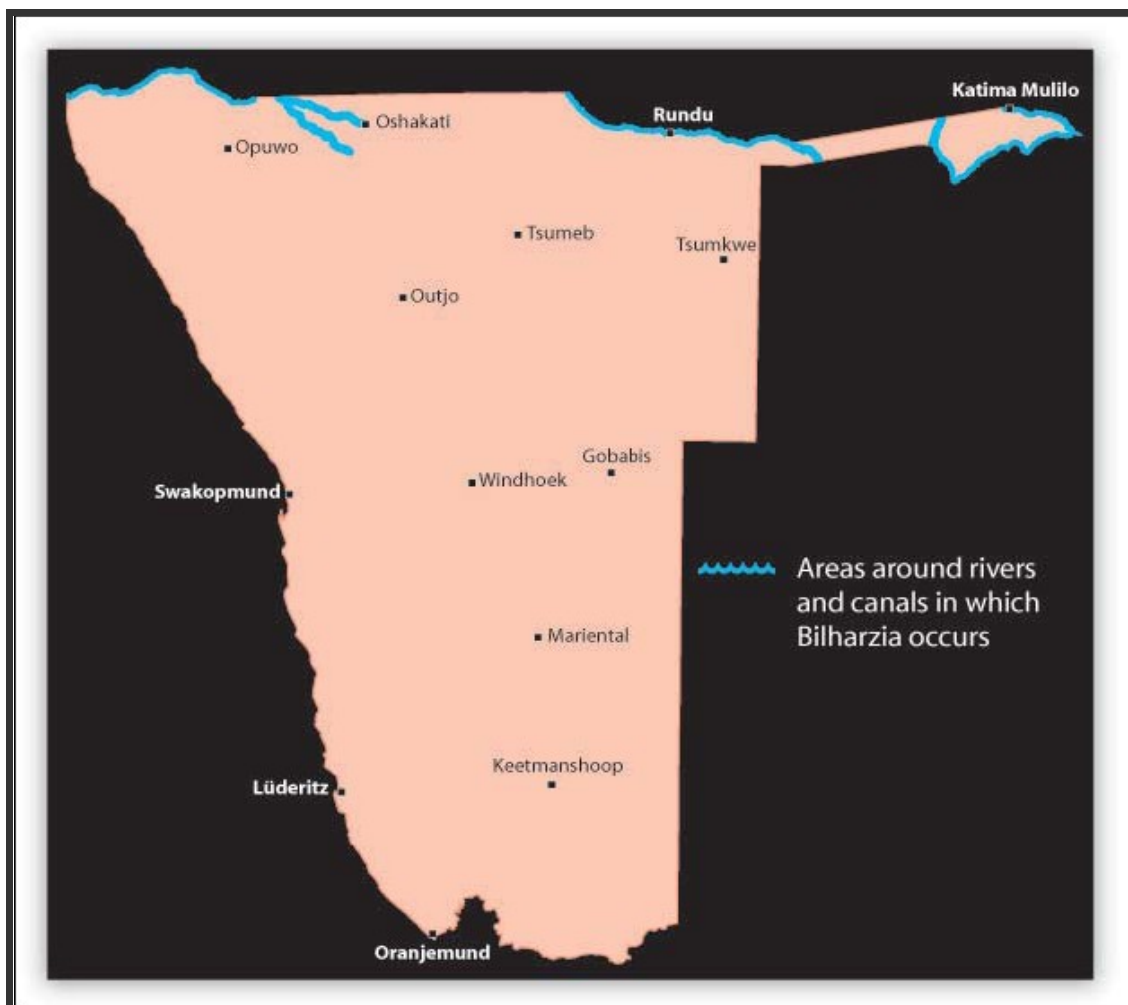
The *Schistosoma haematobium* species cause urinary schistosomiasis and its intermediate host species are *Bulinus* and *Physopsis Africanus* snails, while *Schistosoma mansoni* causes intestinal schistosomiasis and its intermediate host species are the *Biomphalaria Pfeifferi* snails. The incubation period of these organisms is about 4-6 weeks after contamination and the reservoir is man (Chin, 2000, p.20).

Schistosomiasis is closely associated with water, as snails carry the parasite. Thus all infected humans have been in close contact with water. Unfortunately water forms the basic requirement for daily living, forcing humans to maintain close contact with available water resources.

Although Namibia is an arid country, areas of the country do experience seasonal “overflows” of water. There are also “man-made” contributing factors. In the case

of the Outapi health district, this “man-made” factor is the Calueque-Oshakati water canal which was completed in the 1980’s. This water canal, construction of which began in 1974, is an open concrete canal bringing water from the Kunene River to Oshakati, over a distance of about 180 kilometres. The Olushandja dam, a reservoir for the water canal created in a dry riverbed, is the main water source for most of the community in the surrounding areas (Ministry of Health and Social Services (MoHSS), 2000, p.41). Here humans tend to erect houses. This water source has been known to be infected with schistosomiasis (see Figure 1.1). The geographical distribution and pathophysiology of schistosomiasis reflect the unique life cycle of these parasites. Schistosomes infect particular species of susceptible freshwater snails in endemic areas (Elliot, 2001, p.599).

The current literature, namely the studies conducted by the Ministry of Health and





Areas where there is a high risk of being infected with schistosomiasis are zones that are within 5 kilometres of perennial rivers and open water canals in northern Namibia (Hinalulu, 2000, p.6).

**Table 1.1: Infection rate of *Schistosomiasis* in children (5 – 13 years) in Namibia (1996 – 2000)**

<b>Year</b>	<b>Sample size</b>	<b>Infected</b>	<b>Percentage infection rate</b>
1996	1697	1397	82%
1997	50	44	88%
1998	1752	1462	83%
2000	3248	1692	52%

(MoHSS, 2000p12)

Although the statistics show that there has been a decline in the number of children infected with schistosomiasis, over the 4 year period between 1996 and 2000 the rate of 52% is still high considering that it is a preventable condition and campaigns have been conducted by the Ministry of Health and Social Services.

Schistosomiasis, being a parasitic infection, incorporates variables like socio-economic status, behaviour aspects as well as environmental and immunity-related

aspects. Information on these variables is needed for proper health education. This information will assist the stakeholders (community, local authorities and schools) and encourage them to provide proper control measures, especially at schools.

### **1.2 Problem statement**

Schistosomiasis is one of the most important public health problems in Namibia in especially the Outapi health district. Although numerous health education campaigns have been conducted and money has been invested by the Ministry of Health and Social Services to eradicate this disease, there is still a persistent high infection rate (see table 1.1).

It is therefore against this background that all possible data on epidemiological nature of schistosomiasis and the current health education strategies are required for adequate assessment and intervention to address the persistence of schistosomiasis infection. The problem and concern is that data are not available, therefore the correct planning and preventative strategies cannot be implemented.

### **1.3 The purpose of the study**

The purpose of this study was to describe and explore factors (variables) that could be associated with the persistence of the high infection rate of schistosomiasis infection in school children between the ages 6 –17 years in the Outapi health district, in order to implement appropriate prevention strategies.

### **1.4 Specific objectives**

To achieve the stated purpose of the study, two specific objectives have been developed. They are as follows:

- To describe the incidence and magnitude of schistosomiasis in school children in the Outapi health district.
- To identify the possible factors that may be associated with the high persistence rate of schistosomiasis in the Outapi district.

### **1.5 Study setting**

The study was conducted at Outapi health district among school children of the age between 6 and 17 years of age.

### **1.6 Terminology**

School age children – in this study refers to learners between the age of 6 and 17 years old.

Prevalence – In this study it is the number of cases of schistosomiasis during the period of 2006/2007 in the Outapi health district.

Persistence – the continuing existence of schistosomiasis (Taylor and Makura, 2000, p. 287).

Factor – a condition that causes, predisposes, or influences the spread or transmission of a disease. In this study the word is also synonymous with the term “variable” (Chitsulo et al , 2000, p. 42).

Schistosomiasis - is a disease caused by parasitic worms or flukes, a trematode, which completes its life cycle partly in human and partly in snails (WHO, 2001, p.161).

### **1.7. Significance of the study**

The significance of the study is to provide data that will contribute to a more multi-prolonged approach to health service provision, prevention and control of schistosomiasis. The findings of this study will significantly contribute to improving the health of learners in the Outapi health district. Thus after implementation of the recommendation of the study, it is expected that schistosomiasis cases will be minimised, if not eradicated.

### **1.8 Outline of the study**

This study is presented in the following chapters:

Chapter1: Problem Statement and Research Design

Chapter 2: Literature Review

Chapter 3: Research Design and Research Methodology

Chapter 4: Analysis of the Findings

Chapter 5: Conclusions, Recommendations and Limitations

### **1.9 Summary**

The introduction and background to the problem concerning schistosomiasis were discussed, which lead to the formulation of the purpose, objectives and significance of the study.

The next chapter will be the literature review.

## **CHAPTER 2**

### **Literature review**

#### **2.1. Introduction**

Since schistosomiasis still persists in the Outapi district, it is important to identify factors associated with the persistence. These factors could be related to the interaction between man, environment, water and time. The framework that would address this complex relationship the best would be an epidemiological focused one. Also, it might be that health promotion principles are not correctly implemented or followed, thus necessitating the inclusion of a health promotion focus related framework.

These two frameworks have been combined as one single framework and this is used in the review of the literature. The combined framework will first be broken down into its two components. These are:

- An epidemiological focus
- A health promotion focus

##### **2.1.1 The epidemiological focus of the framework**

According to the Abdool-Karim, Joubert and Katzenellenbogen (2000, p. 71) epidemiology is the study of the distribution and determinants of health – related

states or events in specified populations. The focus in epidemiology is on the interrelationship between “man”, environment and time. For the purpose of this study “man” will be equated with person.

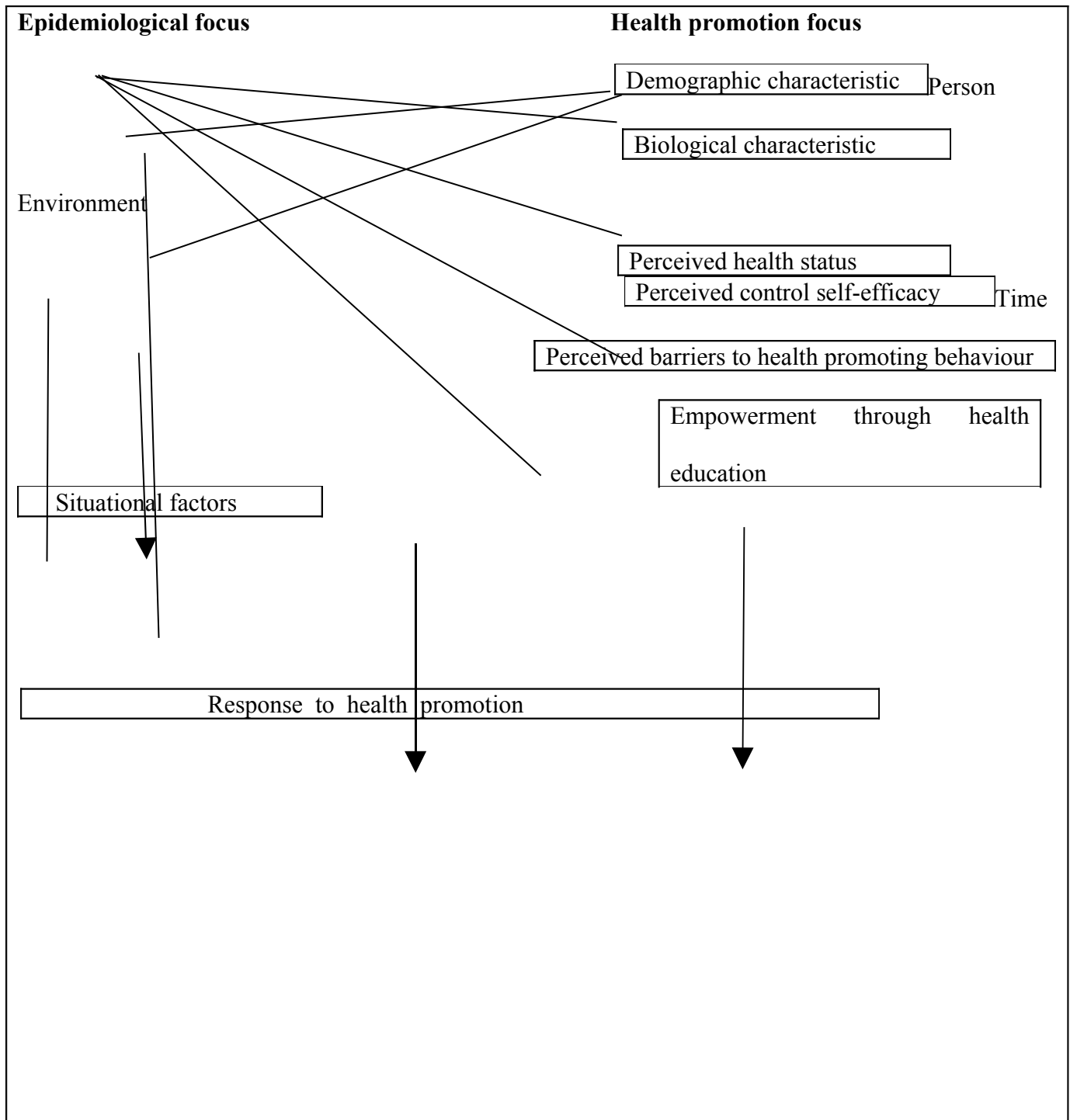
### **2.1.2 A health promotion focus**

The health promotion framework utilised in this study is based in part on the “Health Promotion Model” as described by Polit and Beck, (2006, p.156). This model consists of three main factors, namely:

- Cognitive perceptual factors
- Modifying factors
- Participation in health promotion behaviours factor

These three factors with a selective (eclectic) utilisation of its subcomponents were used. The two combined frameworks are called an “Epidemiological health promotion focused approach”. In figure 2.1 an outline is provided of this “Epidemiological Health promotion focused approach.

**Figure 2.1 An Epidemiological health promotion focussed approach**



Adapted from the Health Promotion Model of Pender, Walker and Sechrist as described in Polit and Beck et al (2006, p.156)

The discussion of the literature will follow a discussion of the three components of the epidemiological focus, namely person, environment and time. The integration



with the health promotion focus are conducted simultaneously. It is, however, necessary to first describe the morphology and physiology of the causative organism.

## **2.2 The Causative Organism (parasite)**

In chapter one, as part of the introduction, the causative organism for schistosomiasis has already been identified, namely *Schistosoma haematobium*. Yet it is necessary to describe in more detail its morphology, physiology and effects on the human body, as these details have implications on the continuous persistence of schistosomiasis infection in Namibia as well as the health promotion guidelines which are envisaged.

- **Morphology and Physiology**

Adult human schistosomes are devious (male and female worms are separate organisms), and the sexes have different morphologies. The adult worms are bilaterally symmetrical and have both a digestive system and oral and ventral suckers for attachment and stabilization. Male worms are 0.6-2.2 centimeters in length and rather thick. They possess a structure known as a gynecophoral canal running the length of the body in which the 1.2-2.6 centimeter-long female remains during much of the life cycle (Chandiwana and Christensen, 2003, p.188).

The thinner female separates from her mate to migrate to the venules bordering the intestine or bladder of humans in order to deposit eggs. These eggs are responsible for the clinical manifestations of schistosomiasis, and the eggs of each species are easily-distinguishable (Cetron, Chitsulo and Sullivan, 2001, pp.1274-1278).

Schistosomes have a typical [trematode](#) vertebrate-invertebrate lifecycle, with humans being the definitive host (Hochberg and Ryan, 2004, p.215). The life cycles of human schistosomes are broadly similar: parasite eggs are released into the environment from infected individuals, hatching on contact with fresh water to release the free-swimming [miracidium](#). Miracidia infect fresh-water [snails](#) by penetrating the snail's foot. After infection, close to the site of penetration, the miracidium transforms into a primary (mother) sporocyst (Doumenge, Mott and Cheung, 2002, p.55).

Germ cells within the primary sporocyst will then begin dividing to produce secondary (daughter) sporocysts, which migrate to the snail's [hepatopancreas](#). Once at the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of new parasites, known as [cercariae](#), which are the larvae capable of infecting mammals (Feldmeier, 2000, p.13).

Cercariae emerge daily from the snail host in a [circadian](#) rhythm, dependent on ambient temperature and light. Young cercariae are highly mobile, alternating between vigorous upward movements and sinking to maintain their position in the water. Cercarial activity is particularly stimulated by water turbulence, by shadows and by chemicals found on human skin (Ganem and Marroum, 2001, p.581).

Penetration of the human skin occurs after the cercaria have attached to and explored the skin. The parasite secretes enzymes that break down the skin's protein to enable penetration of the cercarial head through the skin. As the cercaria

penetrates the skin it transforms into a migrating [schistosomulum](#) stage (WHO, 2006, p.146).

The newly transformed schistosomulum may remain in the skin for two days before locating a post-capillary [venule](#); from here the schistosomulum travels to the lungs where it undergoes further developmental changes necessary for subsequent migration to the liver. Eight to ten days after penetration of the skin, the parasite migrates to the [liver sinusoids](#) (Cetron et al, 2001, pp.1274-1278).

*S. japonicum* migrates more quickly than *S. mansoni*, and usually reaches the liver within eight days of penetration. Juvenile *S. mansoni* and *S. japonicum* worms develop an oral sucker after arriving at the liver, and it is during this period that the parasite begins to feed on red blood cells (Carabin, Guyatt and Engels, 2002, p.210).

The nearly-mature worms pair, with the longer female worm residing in the [gynaecophoric channel](#) of the shorter male. Adult worms are about 10 mm long. Worm pairs of *S. mansoni* and *S. japonicum* relocate to the [mesenteric](#) or rectal veins. *S. haematobium* schistosomula ultimately migrate from the liver to the perivesical venous plexus of the bladder, ureters, and kidneys through the hemorrhoidal plexus (German Agency for Technical Cooperation (GTZ)/World Health Organisation(WHO), 2000, p.122)

Parasites reach maturity in six to eight weeks, at which time they begin to produce eggs. Adult *S. mansoni* pairs residing in the mesenteric vessels may produce up to 300 eggs per day during their reproductive lives. *S. japonicum* may produce up to 3000 eggs per day. Many of the eggs pass through the walls of the blood vessels, and

through the intestinal wall, to be passed out of the body in faeces. *S. haematobium* eggs pass through the ureteral or bladder wall and into the urine (Guyatt, Evans and Tanner, 2002, p.386).

Only mature eggs are capable of crossing into the digestive tract, possibly through the release of **proteolytic** enzymes, but also as a function of host immune response, which fosters local tissue ulceration. Up to half the eggs released by the worm pairs become trapped in the mesenteric veins, or will be washed back into the liver, where they will become lodged. Worm pairs can live in the body for an average of four and a half years, but may persist up to 20 years (Ishii, Tsuji and Tada, 2003, pp.313-319).

Trapped eggs mature normally, secreting **antigens** that elicit a vigorous **immune** response. The eggs themselves do not damage the body. Rather it is the cellular infiltration resultant from the immune response that causes the pathology classically associated with schistosomiasis (Hatz , Vernnervald and Nkulila, 2001, p.776).

- **Effects on the human body**

An estimated 170 million people in sub-Saharan Africa, and a further 30 million in North Africa, Asia and South America, suffer from schistosomiasis, which is generally associated with rural poverty (Naris, 2000, p.212). The global burden of death and chronic disability is high – perhaps 20 million with severe disease and an estimated 200 000 deaths in 2003 – and may well be underestimated, since

schistosomiasis related conditions such as anaemia and low growth rate may not be recognized as resulting from the disease (Kumaresan ,2003, p.33).

Humans are infected when they enter or come in contact with schistosome-infested water. Schistosomiasis is primarily a disease caused by extreme poverty, people become infected because they do not have access to safe water supplies and proper sanitation (Meltzer, Artom and Marva, 2006, p.1696).

The disease is maintained under these conditions because infected people release schistosome eggs in their excreta. After reaching water, the eggs hatch into larvae that infect aquatic snails, where they develop further until they are released as free-swimming immature parasites (cercariae) that can penetrate the skin of human hosts and develop into adult worms (Richens, 2004, p.13).

People acquire the infection during the course of routine domestic, agricultural or occupational duties (Montresor et al, 2000, p.102). The adult worms lodge in blood vessels of the intestinal or urinary (for *S. haematobium*) systems. After mating, female worms produce eggs that are deposited in the liver, bladder or other tissues, depending on the infecting species, and are released in excreta to complete the cycle. The manifestations of disease are due to chronic inflammatory reactions induced by the eggs (Poggensee and Feldmeier, 2001, p.194).

Initial contact with cercariae can cause an itchy, papular rash, known as “swimmers itch.” Once infection has been established, clinical manifestations can occur within

2-3 weeks of exposure, but many infections are asymptomatic (Ross, Bartley and Sleight, 2002, p.1214).

The symptomatic, acute phase of illness is known as Katayama fever and presents with fever, malaise, urticaria and eosinophilia. Other symptoms can include cough, diarrhoea, weight loss, haematuria, headaches, joint and muscle pain, and enlargement of the liver and spleen (Naris et al, 2000, p.120).

Chronic infection with *S. mansoni* and *S. japonicum* causes periportal liver fibrosis and portal hypertension with ascites and oesophageal varices. Long term infection with *S. haematobium* is associated with bladder scarring, renal obstruction, chronic urinary infection, and possibly bladder carcinoma (Schutte, 2004, p.366).

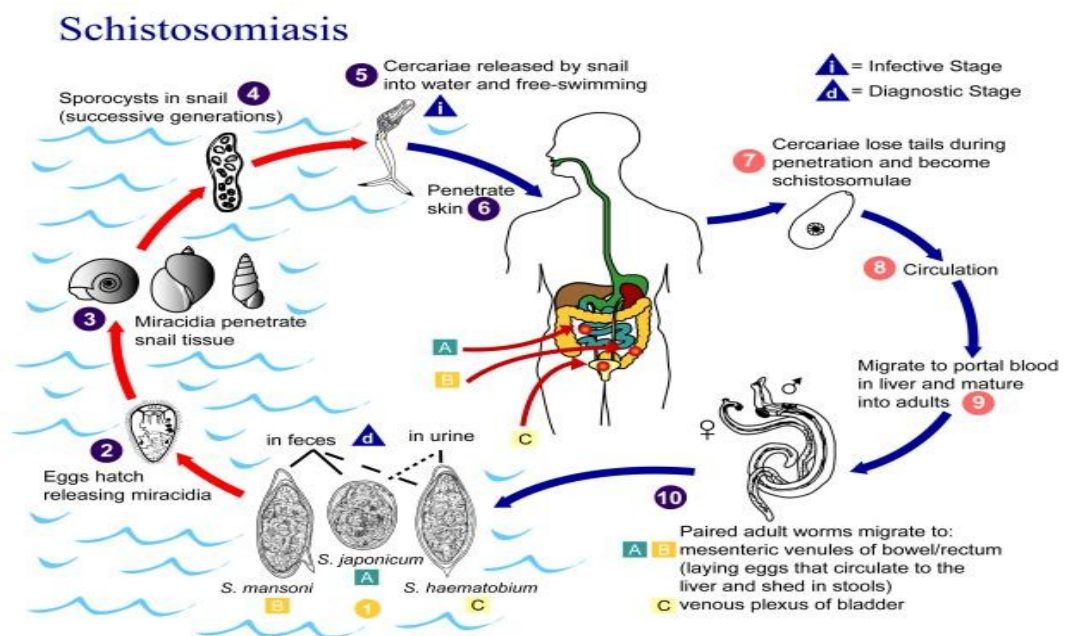
Diagnosis can be made by finding schistosome eggs on microscopic examination of stool or urine, by finding eggs on rectal biopsy, or with serology detecting antibodies to schistosomal antigens or the antigens themselves (WHO, 2007, p.115). Schistosomiasis seriously threatens the health and productive life of rural families, and (together with malaria) is held responsible for impeding the development of whole nations (Thomas, Bassett and Sigola, 2001, p.85).

The severity of the disease is related to inflammatory and fibrotic response in the host to the eggs in the liver, lungs, intestine and urinary bladder. In urinary schistosomiasis (due to *S. haematobium*), damage to the urinary tract is revealed by blood in the urine. Urination becomes painful and there is progressive damage to the

bladder and ureters and then to the kidneys. Bladder cancer is quite common in advanced cases. Intestinal schistosomiasis (due to *S. mansoni*) is slower to develop (Vizcaino, Parkin and Boffetta, 2000, p.518).

There is progressive enlargement of the liver and spleen as well as damage to the intestine, due to fibrotic lesions around the schistosome eggs lodged in these tissues and hypertension of the abdominal blood vessels. Repeated bleeding from these vessels leads to blood in the stools (WHO/UNICEF, 2004, p.10). See figure 2.2 for outline of the life cycle of the parasite(s).

**Figure 2.2 The Schistosomiasis life cycle: source: WHO, 2006, p.56**



### 2.3 The person

The condition especially affects children between the ages of 6 and 17 years old as they are most often in contact with water, because they swim and fish, collect water, and walk through infected water to and from school (Chitsulo, et al, 2000, p.44).

This connection with children is an important focus point. The next discussion point will thus be “the person”, affected by this condition. The heading “the person” refers in this situation to the host and the subjection of the host to the persistence and spread of schistosomiasis. The hosts in this study are children, between the ages of 6-17 years.

### **2.3.1 The person with specific biological characteristics**

Two development stages are involved in the age group from 6 to 17 years, namely middle childhood and adolescence (Swartz, de la Rey and Duncan, 2006, p.64). Middle childhood refers to the period from 6 to 12 years. This is the period when cognitive development rapidly develops. Adolescence is usually regarded as following the middle childhood period. This is also the period of risk - taking behaviour, like swimming in infected water (Swartz, de la Rey and Duncan, 2006, p.80). The age group from 6 to 17 years included school children in different development stages. Children at the age of 6 to 8 years have a tendency to try new things. You will find them playing outside in the rain, swimming or playing in stagnant water.

### **2.3.2 The person with a perceived health status**



How people perceived their current health status will influence to what length they will go to obtain and maintain optimum health. Optimum health in this study is being “parasite” free (Cetron, et al, 2001, pp. 1274-1278).

The person in this study has already been identified as being in different developmental stages. He/she will therefore have different perceptions about health and disease. A six year old child will definitely have a totally different perception than a 17 year old. These are factors that may influence the person’s reaction to health promotion being given or the obtaining of health education independently.

### **2.3.3 The person with a perceived control over health**

Perceived control over health is to a certain extent also a cognitive factor, as well as a modifying factor. Children might be intellectually (cognitively) ready to take control over their own health. Their care – giver like parents, family and teachers indirectly influence their health (Chitsulo, et al, 2000, p. 45). This dependence on significant others (parents and family), introduce the consideration of strategies to get them involved in the health of their children.

### **2.3.4 The person and perceived self-efficacy**

With regard to self – efficacy the children might find themselves in different developmental stages that vary from total dependency, to minimal independence, in order to improve their health to make independent decisions. This aspect thus influences their self-efficacy (Chitsulo, et al, 2000, p. 46).

### **2.3.5 The person and perceived barriers to health promoting behaviour**

Because of age differences, not all children have a perception of what might be a barrier to health promotion. Some of these barriers are deduced from other factors like immaturity, no supportive environment, ignorance from the care giver, in the middle childhood period it might be that required cognitive development has not yet occurred (Chitsulo, et al, 2000, p. 47).

### **2.3.6 The person and the importance to health**

Children, to a varying degree, have a limited understanding of what it means to be healthy. Their understanding is developed through their socialisation with their parents, peers and teachers. Unfortunately it is possible that incorrect information may be obtained from their peers (Chitsulo, et al, 2000, p. 48).

### **2.4 The environment and the persistence of schistosomiasis**

The literature has also explained that the introduction or spread of schistosomiasis all over the world is related to the development of “man-made” water resources. A large part of this development took place on the African continent (WHO, 2001, p.18). To concomitantly demonstrate this point, it has been found that populations of both *Bulinus* and *Biomphalaria* snails increased considerably two years after completion of two dams in Cote d’Ivoire (WHO, 2001, p.20).

The relationship between water and schistosomiasis is also highlighted by De Haan, (2004, p.133). He stated that schistosomiasis as a disease is associated with water and mostly occurs in dams where children swim, defaecate and urinates and also where adults use this water for washing and drinking purposes.

The major factors affecting the distribution and prevalence of schistosomiasis are surface water availability and permanence, human water contact behaviour, and environmental and climatic conditions (Taylor and Makura , 2000, p.287). Water contact is therefore the most critical variable in the transmission of schistosomiasis.

Owing to the interaction between man, the environment (water) and time (the rainy season), there is the possibility of prevention and control of schistosomiasis.

This is supported by Nelson, Williams & Graham (2001, p.172) who point out that snails are cold-blooded and reproduce more rapidly in summer than in winter. Therefore, because schistosomiasis is a product of perturbed ecological processes, control of the disease needs to focus on reducing contact between host, snail and parasite when they are most active.

The environments need to be made safe and this could be achieved through:

- Snail control
- Empowerment through health education
- Water and sanitation provision
- Prevention of further spread by treating infected persons

- **Snail control**

Controlling populations of snail hosts through the use of molluscicides at one time was considered the only effective way of preventing large-scale infection in communities living near aquatic habitats. With the advent of safe drugs, such as

praziquantel, this strategy has declined in popularity. Yet, it can still play a crucial role in controlling the spread of the disease (Rollinson and Simpson, 2002, p.203).

Since the size of snail populations, rates of infection, and the production of cercariae are strongly influenced by the local climate, rates of transmission of schistosomiasis are in a constant state of flux. Snail control, when appropriate, is only employed at certain times of the year. Several methods are used to control snail populations (Woolhouse and Chandiwana, 2003, p.21).

Snail populations can also be controlled by the introduction or augmentation of existing crayfish populations; as with all ecological interventions (Feachem and Caincross, 2000, p.113).

Selective molluscicide treatment in snail – infested bodies of water at main human contact points is the preferred way to approach controlling snail populations. Metallic salts, such as copper sulphate, were among the first agents used, and were most effective when applied to standing bodies of water (Schwartz et al, 2005, p.60). Copper sulphate was introduced by dragging burlap sacks filled with large crystals behind slow moving boats. This compound worked well enough, but it also limited algal growth, that in turn affected growth patterns of fish that served as primary sources of protein (Rozen, Issakov and Brazowski, 2004, p.190).

Newer molluscicides, such as nicotinanilide, organotin, dibromo-nitrazo-benzene, sodium pentachlorophenate, tritylmorpholine, sodium dichloro-bromopheno,

niclosamide, and acetamide analogs replaced copper sulphate, as these were deemed safer to the environment (Diamant, 2000, p.23).

### **Environmental impact**

Niclosamide is the only remaining commercially available molluscicide. While niclosamide is biodegradable, its “side effects” included the death of many fish species, as well as the targeted snail populations (Grobusch et al, 2003, p.166).

It acts by depleting glycogen stores, and is the drug of choice for some adult tapeworm infections in humans. It also used to be a drug of choice for schistosomiasis, but too many patients suffered from the same side effect of depletion of glycogen stores. This led in some cases to coma, an unacceptable outcome of treatment. Its use is limited by cost. Plant-derived molluscicides have proven too variable in their effectiveness and are difficult to manufacture (Nicolls et al, 2005, p.74).

Laboratory and field experiments employing microbial pathogens to snails and snail-specific metazoan parasites give a hint to possible future control strategies for schistosomiasis (Doherty, Moody and Wright, 2001, p.1071).

In one instance, when *Biomphilaria glabrata* was sequentially infected, first with *S. mansoni*, then with the trematode, *Ribeiroia guadeloupensis*, the double infection resulted in the elimination of the human pathogen, while retaining infection with the snail parasite (Billing, Winkenwerder and Hunninen, 2002, p.26).

In another experiment, it was shown that *Microsporidium* spp. can interfere with the development of the sporocyst stage of *S. mansoni*. More of these kinds of associations most likely exist in nature, and discovering them may result in the development of a useful adjunct to current control strategies (Gryseels, Polman and Clerin, 2006, pp.1106-1118).

A number of predator/competitor snail species are also receiving more and more attention as potential control agents. In well-controlled situations, such as small, artificial ponds, experiments carried out in Grenada, Martinique, Guadeloupe, Puerto Rico, and St. Lucia showed that Ampullariidae (*Pomacea glauca* and *Marisa cornuarietis*) and Thiaridae (*Tarebia granifera* and *Melanoides tuberculata*) snails outperformed *Biomphalaria* spp. for space and resources (Bou and others, 2001, p.221). Competitor snail species were also used successfully as a follow up measure after molluscicide use in some rivers of central Venezuela (Iarotski & Davis, 2000, p.127).

In Namibia so far there is no snail control programme and there is no schistosomiasis control policy. The next preventative measures would be to control or manage the environment.

- **Environmental management**

Environmental management for schistosomiasis control has had a great impact on water development projects which generally aggravate or introduce the schistosomiasis problem. There is vast experience of control of schistosomiasis in irrigation schemes applying environmental management strategies (Maguire, 2005, p.3277).

The environmental management include strategies such as lining canals, reducing conditions that favour the damming of water in the field, good water management to allow periodic drying of some parts of the irrigation system, canal maintenance, good management of night storage ponds by including by-pass canals in the design and appropriate layout of villages (far from irrigation water).

Environmental management and sustainable transmission control should by all means be promoted. These measures aim at reducing people's contact with infested water by supplying safe domestic water and sanitation, and/or at reducing snail breeding by environmental measures (Patz, Graczyk and Geller 2000, pp.1395-1405).

Such control measures should be incorporated in particular at the planning stage in water resource development projects. It may appear that the installation costs of this type of measures are high, but the impact on schistosomiasis transmission is long-lasting, and there are other health and social benefits which justify the investment (Fairley, 2003, p.398).

As already stated, it is of major concern in Namibia so far there is no environmental management programme and there is no schistosomiasis control policy.

- **Water and sanitation provision**

The provision of safe and adequate water supplies and sanitation contributes to reducing the prevalence and severity of schistosomiasis (Schwartz et al, 2001, p.114).

It must, however, be noted that provision of safe water and sanitation as a means of controlling schistosomiasis is not used in isolation. It has to be used in combination with chemotherapy, snail control and health education. However, where the water and sanitation component has not been included, the effects have been short-lived, indicating the importance of water and sanitation in consolidation and sustaining any schistosomiasis control programme.

It must also be realised that, in special cases such as water development projects, inclusion of environmental management, water and sanitation at the project design stage would not be very expensive, if there were effective intersectoral consultation (Patz, et al, 2000, pp.1395-1405). A rural water supply programme is in place in Namibia, but provision of water supply does not reach all the villages. A rural sanitation programme is in place, but it covers only schools. The Ministry of Health and Social Services has a sanitation programme but so far the coverage is low (MoHSS, 2004, p2). The next phase following a sanitation programme is usually to prevent the spread by treating those infected.



- **Prevention of further spreading by treating infected person**

The main principle here is to “break” the link of the life – cycle of the parasite in its human stage. This is accomplished through chemical means like drugs. In most countries, the standard dose of praziquantel is 40 mg/kg per treatment. Drug combinations may also help to improve treatment success rates and prevent the development of resistance (Zhou, 2005, p.99).

The combination of artemether and praziquantel is being tested in clinical trials in China and Egypt. However, use of this combination is not planned in malaria-endemic areas because of the risk that it might induce resistance to artemisinins in malaria parasites (Chen, 2001, p.114).

Periodic treatment is now established as a central component of schistosomiasis control. Experience with community-based chemotherapy to control schistosomiasis has demonstrated that appropriate drug treatment lowers worm burdens in human and prevents or reverses disease caused by all schistosome species (Utzinger et al, 2005, p.70).

Several useful approaches for community – based treatment have been developed to match the epidemiology of schistosome infection and associated disease. These include mass treatment, selective population treatment and phased treatment (Engels, Wang and Palmer, 2006, p.898).

After the withdrawal of metrifonate from the market, only two drugs are currently available for the treatment of schistosomiasis namely, oxamniquine and praziquantel (Cioli, 2004, p.418).

According to Webber and James (2001, p.169), Praziquantel, is the current drug of choice for schistosomiasis, which can reverse pathology – in as little as six months after treatment in *S. haematobium* infections. Praziquantel is also preferred mainly because of its reasonable price and to its activity against all schistosome species. A single oral dose of 40 mg/kg is generally sufficient to give cure rates of between 60-90% and reductions of 90-95% in the average number of excreted eggs. In addition to the original German producer E. Merck/Bayer, praziquantel is now also produced in Korea and China, and is formulated in several countries, including Egypt and Brazil. Praziquantel is also first drug of the choice in Namibia (WHO, 2004).

In spite of the recent price reductions, praziquantel is far from being available in the field, and in several African countries, people with schistosomiasis have no access to treatment in the early stages of the disease, with the ensuing risk of subsequent serious morbidity (Mutapi, 2005, pp.1108-1118).

Oxamniquine has been the drug of choice for the Brazilian national control programme over the last 20 years, and several million people have been treated both in Brazil and elsewhere with an overall good record regarding both efficacy and safety. In more recent years, the price of oxamniquine has not undergone the substantial decrease as seen for praziquantel, so that the latter drug is now less

expensive and is likely to replace oxamniquine even in Brazil. It is thus possible that, due to decreased demand, the production of oxamniquine may come to an end, as happened with metrifonate (WHO, 2004).

The withdrawal of the drug would be a dangerous situation, since it would leave praziquantel as the only available antischistosomal drug, with serious consequences in the event that the parasite developed resistance to praziquantel. Considerable progress has been made in the elucidation of the mechanism of action of oxamniquine, but this is unlikely to be exploited for the development of improved analogs, owing to the lack of incentives for research on new anti-schistosomal compounds (Stoll, 2003, pp392-396).

### **Treatment**

Community-based treatment should first be targeted at school-age children. This high risk group can be reached through the primary school system, in collaboration with the educational sector. Even in areas where school enrolment rates are low, outreach activities can be designed to ensure good coverage. In school-based delivery systems, integration with geohelminth control, nutrition and/or other interventions as a package should be the aim. In order to enhance the effect of regular chemotherapy, long-lasting improvement in hygiene and sanitation should be promoted. This includes the provision of safe water in sufficient amounts to cover all domestic needs, as well as sanitation and appropriate health education (Mason, Patterson and Loewenson, 2002, pp. 88-93).

Vulnerable groups such as fishermen, irrigation workers or communities with exceptionally high prevalence rates, should also have access to regular treatment for schistosomiasis, and appropriate prevention measures promoted within their respective working environments. Integrated control activities with other sectors such as agriculture and water resource development programmes, including small-scale irrigation schemes, should therefore be planned from the beginning. In some instances, the use of snail control may also be indicated (Cetron et al, 2001, p.1274).

The appropriate treatment and re-treatment schedules in any given endemic setting will be influenced by a variety of factors, including duration and intensity of exposure. The time intervals when re-treatment becomes necessary depend ultimately on the transmission pattern in a given endemic setting. However, this study carried out in an area of moderate to high transmission of *S. haematobium*, suggests that regular treatment of schoolchildren at the standard dose of praziquantel at intervals of two years may be appropriate to prevent substantial urinary tract pathology and therefore would control morbidity.

## **2.5 Time and situational factors**

With time and situational factors the impact of uncontrollable factors are highlighted. Time in this discussion relates to the period of greatest infection. In the population under study the infestation with the parasite occurs mainly during rainy the season. The peak months for infection are September to May. Although schistosomiasis is not a communicable disease, the infected person may spread the infection by discharging eggs in urine or faeces in water for a period of five to ten years, if not

treated. With regard to situational factors school children might find themselves in situations over which they have no control like low socio-economic status which can predispose them to infection (Cetron et al, 2001, p.1274).

## **2.6 Socio-economic status**

Overall, schistosomiasis can be characterized as a disease of poverty. However, the evidence linking social resources, economic status, and infection at community and household levels needs to be better defined. These relationships can be described through quantitative as well as qualitative analysis of changes taking place over time, taking into account the nature of transmission and following the migration of households/family members. Suitable sites for research on social and economic determinants would be locations where new water resources development projects are taking place and where control programmes are being implemented.

In addition the majority of the people in the district (Outapi) depend on subsistence farming and fishing, and the latter activity obviously brings them into contact with water and eventually leads to infection by the parasite(s), which affects a variety of organs and may be either acute or chronic (Hinalulu et al, 2000,p.26).

Because it is a chronic insidious disease, it is poorly recognised at early ages, and becomes a threat to economic development as the disease disables men and women during their most productive years. It is particularly linked to agricultural and water development schemes. It is typically a disease of the poor who live in conditions

which favour transmission and have no access to proper care or effective prevention measures.

## **2.7 Empowerment through health education**

Health education aims to promote and reinforce healthy behaviour with full participation of both the individual and the community. Schistosomiasis could largely be prevented by changing human behaviour. Health education is of paramount importance to achieve this. It helps people to understand that their own behaviour. Water use practices like indiscriminate urination and defecation and failure to use available screening services or to comply with medical treatment are all key behavioural factors in the transmission of the disease and its effects (Cioli and Pica-Mattocchia, 2003, p.6).

School health programmes are particularly useful in the control of schistosomiasis. Not only is the 6-17 year age-group always most at risk for the disease, but this type of programme can be easily implemented at the peripheral level, and tailored to the varying epidemiological disease distribution in a cost-effective manner, and combined with a range of other health promoting interventions, of which health education, the systematic treatment of soil-transmitted nematodes and nutritional supplementation are the most obvious (Denhill, King and Swanepoel, 2000, p.84).

In health education, there is a great need to adapt communication strategies to the local realities. Messages should be simple and realistic (Mao, 2002, p.661). Promotion of health care seeking behaviour could be a message to start with. Health

education messages should always keep pace with the implemented control interventions and the proposed preventive measures. There is a need for more involvement of (local) social scientists to adapt messages to local traditional paradigms (Stoll, 2003, p.394).

Other high-risk groups, such as fishing communities or families living on irrigation schemes, may need particular attention as well (Wright, 2001, p.590). Community participation is essential in any disease control programme. This could involve the community installing its own water supply, cooperating with health authorities to reduce contact with unsafe water sources or ensuring compliance with diagnostic and treatment schedules (Minggang and Zheng, 2002, p.12).

Community participation helps to reduce costs and ensures the continuity and sustainability of control measure.

## **2.8 Summary**

The literature review discussed the major factors contributing to and associated with the contraction, transmission, persistence and also epidemiology, intervention and control of schistosomiasis. The next chapter will address the research design and methodology.

## **CHAPTER 3**

### **Research Design and Research Methodology**

#### **3.1 Introduction**

The focus of this chapter is on the research design and the method used in this study. The purpose of this study was to explore and describe factors that could be associated with persistence of the high infection rate of schistosomiasis in school children between the ages 6 - 17 years in the Outapi health district.

#### **Specific objectives**

The specific objectives of this study are as follow:

- To describe the incidence and magnitude of schistosomiasis in school children in the Outapi health district.
- To identify the possible factors that may be associated with the high persistence rate of schistosomiasis in the Outapi district.

#### **3.2. Research design**

In this study a quantitative, explorative, comparative, descriptive design was used to compare two groups:

- A case group, which comprised of all the school children attending school for the 2006/7 period at selected schools situated along the water canal and Olushandja dam in the Outapi district, who tested positive for schistomiasis.
- The second group was the control group, which was comprised of all the school children attending school for the the period 2006/7 at selected schools



situated along the water canal and Olushandja dam in the Outapi district for the period 2006/2007 who tested negative for schistosomiasis.

These two groups will be described in more detail under the headings of study population and sampling procedure.

### **Quantitative research**

Hair, Bush and Ortshaw, (2002, p.43) mentioned that quantitative research is commonly associated with surveys or experiments and is still considered the mainstay of the research industry for collecting marketing data. They note that quantitative research places emphasis on using formalized standard questions and predetermined response options in questionnaires or surveys administered to large numbers of respondents. In this study a questionnaire was used to 248 respondents, namely school-children between the ages 6-17 years.

A comparative design compares the scores of two groups, only one of which was affected by event or treatment (Bless & Higson-Smith, 2001, p.70). In this study two groups were compared, namely the case group and the control group. The one group consisted of learners who were affected by the disease whilst the second group consisted of learners who were not affected by the disease. These two groups were then compared to identify any variable(s) that may be associated with the disease.

Descriptive studies have as their main objective the accurate portrayal of the characteristics of a person, situation or groups, and the frequency with which certain phenomena occur (Polit & Hungler, 2004, p. 613). This study is descriptive as it

describes the possible factors associated with the persistence of infection as stated in the objectives.

### **Explorative research**

Stead and Struwig (2001, p.20) define the exploratory approach as research into an area that has not been studied and in which a researcher wants to develop initial ideas and more focused research questions. Welman and Kruger (2001, p.24) add that the purpose of exploratory research is to determine whether or not a phenomenon exists, and to gain familiarisation with such phenomenon. In this study the researcher went into an unknown area, namely the Outapi district, where the incidence of schistosomiasis remains high.

### **3.3 Study population**

Polit and Hungler (2004, p.229) describe the population as the entire aggregation of cases which meet a designated set of criteria. The criteria needed to define and describe this population were that it included all school children between ages 6 to 17 years in the Outapi district in Namibia for the period 2006/2007. This population numbered 4000. This number is for school children between ages 6-17 years in the Outapi school circuit.

Following the identification of the main population, a first sampling procedure was implemented to identify two new sub-groups. This activity will be discussed under sampling procedure and sampling size.

### **3.4 Sampling procedure and sampling size**

#### **Sampling procedures**

According to Stead and Struwig et al (2001, p.45) sampling is about carefully selecting a sub-set of a specific population that can be shown to share the properties or variables of the population. This author adds that findings from the sample can then be employed to make inferences and to varying degree of confidence, about the larger population. Gilbert, Churchill and Dawn (2002, p.46) acknowledges that sampling techniques can be divided into two broad categories namely, probabilities and non-probability sampling.

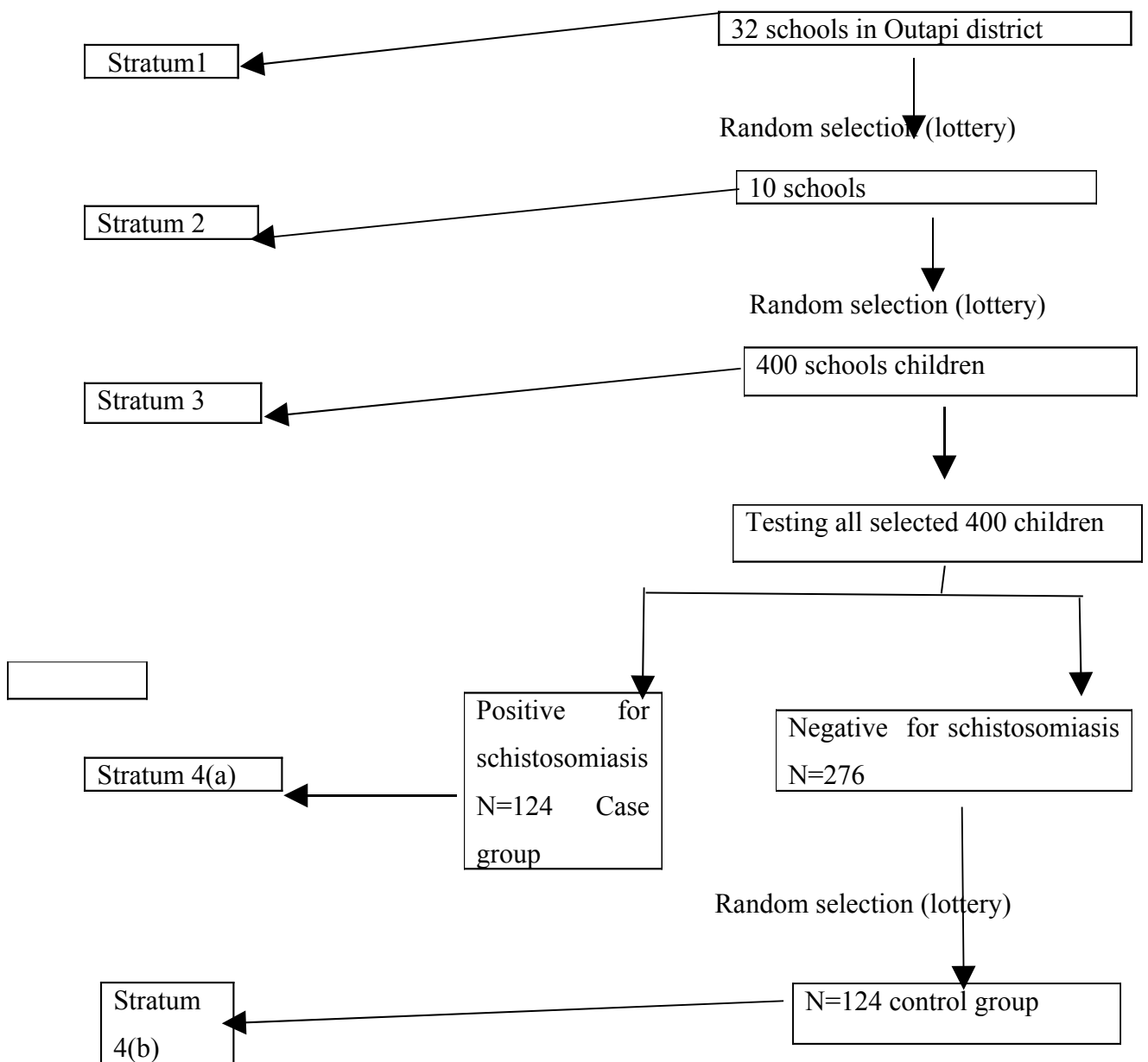
In this study stratified random sampling was employed. Stratified random sampling is a technique that divides the population into different groups called strata, so that each element of the population belongs to one and only one stratum. Then within each stratum, random sampling is performed (Bless and Higson-Smith, 2001, p.91).

There are 32 schools in Outapi school circuit, 10 of which were randomly selected as well as 400 school children. Forty (40) children were selected from each of these schools. These 400 randomly selected children were all tested for the parasite. 124 of these 400 children were found positive and the remaining 276 were found negative.

By progressing through the different strata, random sampling was employed and more specifically the lottery method. In this study this method was applied by grouping the population together by giving it a number and then drawing the required sample size without looking to them.

The 124 children who tested positive were called the case group. Out of the 276 children who tested negative, 124 children were randomly selected and these 124 negative children were called the control group. In figure 3.1 an outline of the procedure is indicated.

**Figure 3.1 Sampling technique: Stratified random sampling**



As can be seen in figure 3.1, all the learners who tested positive for schistosomiasis were included in the study. No further sampling was done on the case group. The group will be referred to in this study as the case group.

Also evident in figure 3.1 is that a total of 276 tested negative for schistosomiasis. From these 276 tested negative, the 124 were randomly selected to be used as the control group. This control group was not matched exactly to case. The motivation was that by means of probability sampling the influence of extraneous variables would be minimised.

### **3.5 Research instruments**

Two instruments were used.

1. Biophysical measurement type instruments used, namely:

A reagent strip to test for haematuria was used on all 400 randomly selected school children.

2. The second instrument utilised a questionnaire to obtain information from the case group and the randomly selected control group.

#### **3.5.1 The reagent strip**

The reagent strip is an internationally proven and accepted diagnostic tool with tested validity and reliability. Additional reference to its validity and reliability will be made under the appropriate heading (see point 3.7).

The haematuria reagent strip is the method for urine examination where one can dip a reagent strip into a urine sample for less than one (1) minute and compare the

results with a colourimetric scale. This method is recommended by WHO (World Health Organisation) for *schistosoma haematobium* testing and accepted by the Ministry of Health as the only *schistosoma haematobium* diagnostic tool (MoHSS, 2000, p. 17).

### **3.5.2 The Questionnaires**

The Questionnaire is regarded as a self report technique. The questionnaire is the common thread for almost all data collection methods (McDaniel and Gates, 2000, p.32). A questionnaire is a data collection technique in which a respondent is asked to respond to the same set of questions in a predetermined order (Saunders, Lewis and Thornhill, 2003, p.41).

According to McDaniel et al (2000, p.32) there are number of considerations which must be kept in mind in designing a good questionnaire namely:

- Does it provide the necessary information to achieve the goals of the study?
- Does it fit the respondents?
- Is it easy to edit, code and process the data?

In this study the questionnaire meets all three considerations.

Questionnaires can be either of the self-administered type, or interviewer-administered type (Saunders et al, 2003, p.41). According to Gilbert and Churchill (2002, p.22) questionnaires are less expensive than interviews, they do not require a large staff of skilled interviewers, they can be administered in large numbers all at one place and time; anonymity and privacy encourage more candidates and honest

responses; there is a lack of interviewer bias; speed of administration and analysis; they are suitable for computer-based research methods and put less pressure on respondents.

In this study, self-report techniques (questionnaires) were used, because the questionnaire does provide the necessary information to achieve the goals of the study.

Gilbert and Churchill et al (2002, p.22) states that the major disadvantage the questionnaire offers is little flexibility to the respondent with respect to response format and the possibility of low response rates, which can lower the researcher's confidence in the result. The bias associated with self-selection makes them scientifically worthless unless response rates are high.

In this study the problem of low response was eliminated as the questionnaire was "interviewer- administered" and selection was done randomly.

### **3.6 Compilation of the instruments**

In this study the type of questionnaire used was a close-ended questionnaire. This questionnaire was compiled on the basis of the literature and available policies from the Ministry of Health and Social Services as well as concepts from the framework of the study (see chapter 2, point 2.1). The researcher and one assistant used the questionnaire as an interview schedule for those school children who were not able to complete it independently. The role of the assistant will be discussed under point 3.8 (data collection).

In table 3.1 an outline is provided of the compilation of the questionnaire and its connections to the framework.

**Table 3.1 The correlation of the questionnaire with the framework of the study.**

<b>Questions</b>	<b>Framework</b>	<b>Comments</b>
2. Name of school	Health promotion	To identify the gap of health promotion factors
3. Grade	Health promotion	To identify the gap of health promotion factors
4. Gender	Epidemiological	To identify gender-related factors
5. Age	Epidemiological	To identify age -related factors
6. Care-takers	literature	To identify care takers
7. Eating anything before going to school	Epidemiological	To identify eating habit-related factors
8. Taking something to eat at school	Epidemiological	To identify eating habit-related factors
9. Working caretaker	Epidemiological	To identify socio-economic related factors
10. Pass through water to and from schools	Health promotion	To identify the gap of health promotion factors
11- 12. Play in water	Health promotion	To identify the gap of health promotion factors
13. Fetch drinking water	Health promotion	To identify water-related factors
14. Boil drinking water	Health promotion	To identify the gap of health education factors
15. Get water for bathing	Health promotion	To identify water-related factors
16. Knowledge of diseases	Health promotion	To identify the gap of health educational factors
17. Mode of transmission	Health promotion	To identify the gap of health educational factors



18. Signs and symptoms	Health promotion	To identify the gap of health educational factors
19. Information of schistosomiasis	Health promotion	To identify the gap of educational factors
20. Bilharzia a health problem	Health promotion	To identify the gap of health promotion factors
21 - 22. Family member contracted the disease	Epidemiological	To identify disease-related factors
23. Family member received treatment	Epidemiological	To identify disease-related factors
24. Prevention of the disease	Health promotion	To identify the gap of health educational factors
25 - 26. Having latrine at school/household	Health promotion	To identify the gap of educational factors
27 - 29. Use of latrine	Health promotion	To identify disease-related factors
30-31. Health education as a subject	Health promotion	To identify the gap of educational factors
32. Water at school	Health promotion	To identify water-related factors

### 3.7 Testing of the instruments

The testing of the instrument involved the following activities:

- Testing for validity
- Testing for reliability
- Pilot testing

#### Testing for Validity

Validity refers “the accuracy and truth of the data being produced in terms of the concept being investigated, the people and objects being studied and the methods being used” (Raimond, Sines and Appleby, 2001, p.108).

In this study the following measures were taken into account to ascertain face and content validity. For face validity the instrument (questionnaire) was submitted to three colleagues and supervisors to evaluate if the items were representative of the purpose of the study (Polit & Hungler, 2004, p.374).

For content validity, the literature as well as the existing policies of the Ministry of Health and Social Services were utilized (MoHSS, 2004, p. 2).

### **Testing for Reliability**

Reliability refers to the degree to which the instrument can be depended upon to yield consistent results, if used repeatedly over a time on the same person or if used by two different investigators (Brink, 2004, p.171). This aspect of reliability testing for the questionnaire was tested during the pilot testing. For this study, stability was tested by means of equivalence.

### **Equivalence**

The equivalence approach is when different observers or raters are using the same instrument to measure the same phenomena (Polit and Hungler et al, 2004, p.248). They afterwards compare the results. In this study the researcher and researcher

assistant tested this instrument separately and compared the results. Both the researcher and an assistant researcher obtained the same results. This aspect was done as part of the pilot study. The reliability for the reagent strip was an inherent asset and it is an internationally marketed product.

### **Pre - testing**

Pre-testing is the collection of data prior to the experimental intervention, trial administration of a newly developed instrument to identify flaws or assess time requirement (Polit and Hungler ,2004. p.259).

A pilot study was conducted at the Onesi health district. This district is in the same study area but was not included in the study.

The pilot study is done for the following reasons:

- To correct confusing words in the questions
- To identify problems with the design.
- To test for reliability

In the pilot study, 40 school children were requested to complete the questionnaires. This study did not reveal any major difficulties and the questionnaires needed only minor adjustments. Reliability was tested to determine if two persons will obtain the same results from a single responded. This aspect was met.

### **3.8 Data Collection**

In this study two types of approaches were used to collect data, namely biophysiological measures and questionnaires (self reports).

- Biophysiological measures

Biophysiological measures are used to assess the physiological status of research subjects. (Polit & Hungler, 2001, p.314). In this study the urine of school children was collected to assess for the possible infestation of the parasite *Schistosoma haematobium*. A haematuria reagent strips was used to test for *Schistosoma haematobium* parasite.

- **Completion of the questionnaires (self reports)**

The self reports (questionnaires) have been discussed under point 3.6. In this study the researcher and one assistant researcher collected the data. This assistant researcher was trained for one day to ensure that he had a common perception and understanding of the questionnaire and haematuria reagent strips.

The data collection took two weeks and was conducted from 1 March – 14 March 2007. During the process of data collection the following strategies were used:

- Detection of the infection by means of a urine reagent strip.
- Administering the questionnaire

Some of the learners were allowed to fill in questionnaires themselves, while an assistant researcher helped some of them in filling questionnaires.

On the visits to the schools, learners were provided with sterile labelled 100 ml containers and requested to provide a urine specimen. These urine specimens were collected between 10h00 and 13h00 everyday.

### **3.9. Permission to conduct research**

The permission for this study was obtained from:

- The Post-Graduate Committee of the University of Namibia
- The Director of Education of the Omusati region
- Circuit School Inspector of Outapi
- Health Inspector of the Outapi health district
- School Principals – Outapi circuit

Written permission documents were received (see appendices).

### **3.10. Ethical considerations**

To comply with the principles of human dignity and respect, especially self-determination, children had the right to participate in the study or refuse to do so.

Most of children approached were willing to participate in the study in order to determine their infection status.

The researcher explained the purpose of the study and ensured the learners of the confidentiality of the findings. Names and addresses were not required and this was an additional way to protect the anonymity of the participants.

The researcher is aware of the possibility of children being regarded as a “captive audience” with little opportunity to refuse a request like research participation, but they were informed that they could withdraw at any time. The school Principals were regarded as Guardian parents because these children are under age 18.

### **3.11 Data analysis**

Descriptive and inferential statistics were used. For descriptive statistics, central value, (mean) were utilised and for inferential statistics, correlations were done. The

assistance of a statistician (Mr. Peter Iiyambo) from the University of Namibia (UNAM) was used. The data were also graphically presented in tables and bars.

The results of data will follow in the next chapter.

The data were organised for analysis under learners who tested positive for infection (cases), and learners who tested negative for infection (controls). First a description of the data was done. Averages (means) were calculated. The study was also based on exploration and describing the factors which could be associated with the high incidence of disease. The strength of association was determined by means of the Chi-square test. This test merely indicates whether there is a statistically significant correlation between certain factors.

### **3.12 The hypotheses**

Null hypothesis and alternative hypothesis were stated with regard to the Case and Control groups. In table 3.2 the null hypotheses are indicated.

**Table 3.2 Null hypothesis**

<p><b>Null hypothesis (Ho)</b></p>
------------------------------------

<p>There will be no statistical significant difference between case and control groups with regard to correlations of the variables under study namely:</p>
---

- |  |
|--|
| <ul style="list-style-type: none"><li>• Age</li><li>• Gender</li><li>• Caregiver</li></ul> |
|--|

- Eating anything before going to school
- Taking something to eat at school
- Working caretaker
- Pass through water to and from schools
- Play in water
- Boil drinking water
- Get water for bathing
- Knowledge of diseases
- Information on schistosomiasis
- Prevention of the disease
- Having toilets at school/household
- Health education as a school subject

In table 3.3 the alternative hypotheses are indicated.

**Table 3.3 Alternative hypotheses**

**Alternative hypotheses (H<sub>a</sub>)**

There will be a statistical significant difference between case and control groups with regard to correlations of the variables under study namely:

- Age
- Gender
- Caregiver
- Eating anything before going to school
- Taking something to eat at school

- Working caretaker
- Pass through water to and from schools
- Play in water
- Boil drinking water
- Get water for bathing
- Knowledge of diseases
- Information on schistosomiasis
- Prevention of the disease
- Having toilets at school/household
- Health education as a subject

The acceptance or rejection of these hypotheses will be discussed in chapter 5.

### **3.13 Summary**

In this chapter the research design and methods were discussed. A discussion on how a comparative descriptive design could assist in identifying applicable factors was provided. The relevant data collection method and process of data analysis were outlined. The applicable hypotheses were stated.

The next chapter, namely chapter 4, will be on data analysis.



## **CHAPTER 4**

### **Analysis and discussions of the findings**

#### **4.1. Introduction**

Surveillance for schistosomiasis is necessary for establishing endemicity and in the planning of control operations. Many areas of the world are as yet unsampled while some have been sampled without making definite data available on the socio-economic factors that have an influence on the schistosomiasis prevalence in such localities. This study was designed to look at a number of parameters including the factors contributing to the incidence and magnitude of schistosomiasis in schoolchildren in the Outapi health district, the possible factors that may be associated with the contraction, transmission and persistence of schistosomiasis in the Outapi district, and appropriate preventative and control measures.

During this study two research instruments were used namely, questionnaires and reagent strips. The results of these instruments were analysed and discussed in this chapter. The final conclusions will be discussed in chapter 5, during which the acceptance or rejection of the hypotheses will be elaborated on.

**NOTE:** With the presentation of the probability result, the following information is provided:

A p-value presented at greater than ( $>$ ) 0.05 is regarded as statistically insignificant.

A p-value presented at less than ( $<$ ) 0.05 is regarded as statistically significant.

#### **4.2. Findings of the infection rate with *S. haematobium* (Reagent Strip)**

A total of 400 school children (250 males and 150 females) were tested. *S. haematobium* was found in males and females alike. Of the 400 school children, 124 (77 males and 47 females) tested positive (they were then classified as the case group). The remaining 276 thus tested negative.

The total positive results of 124 out of a sample size of 400 indicate an infection rate of 31%. The only available data to compare it with is the data provided for the year 2000 as supplied by the Ministry of Health and Social Services. These data were national and not local and indicate an infection rate of 52% (MoHSS, 2000, p.23).

Thus, this data can only be compared with national data of the year 2000 and not with more recent data that pertains to the Outapi district specifically. The next topic is on the results obtained from the questionnaires. In the presentation of some of the findings by means of figures, the x - axis utilised counts and not percentages.

### **4.3 Results obtained by means of the questionnaires**

**Note:**

The results as expressed by means of correlation statistics only indicate to possible associations and **not to a cause – effect relationship**. This aspect is applicable to all the findings discussed in this chapter.

#### **4.3.1 Caregiver (N= 124 Case and N= 124 Control group)**

The results indicated that 65 (52.4%) of the case group and 68 (54.8%) of the control group indicated that they are being taken care of by both parents (father and mother), while 39 (31.5%) of the case group and 40 (32.3%) of the control group indicated that they are being taken care of by grandparents.

With a Pearson Chi-Square test statistic at 3.014 and a p-value of  $0.390 > 0.05$ , the conclusion is that there is no statistically significant difference between case and control groups. Therefore in this study the caregiver does not play a role as factor associated with the persistence of the disease in this study. This means that there is

no relationship between the two categorical variables (caregiver and the persistence of the disease).

#### **4.3.2 Eating anything before going to school (N= 124 Case and N= 124 Control group)**

The results indicated that 78 (62.9%) of the case group and 73 (58.9%) of the control group indicated that they ate something before going to school, while 40 (32.3%) of the case group and 37(29.8%) of the control group indicated that they did not eat something before going to school.

A Pearson Chi-Square test statistic of 3.482 and a p-value of  $0.175 > 0.05$  was obtained. The conclusion is that there is no statistically significant difference between case and control groups. Therefore in this study eating anything (food) before going to school does not play a role as factor associated with the persistence of the disease in this study. This means that there is no relationship between the two categorical variables (eating anything before leaving to school and the persistence of the disease).

#### **4.3.3 Taking something to eat at school (N= 124 Case and N= 124 Control group)**

The results indicated that 44 (35.5%) of the case group and 44 (35.5%) of the control group indicated that they took something (food) to eat at school, while 80 (64.5%) of the case group and 80 (64.5%) of the control group indicated that they do not take something to eat at school.

A Pearson Chi-Square test statistic of 0.000 and a p-value of  $1.000 > 0.05$  was obtained. The conclusion is that there is no statistically significant difference between case and control groups. Therefore in this study taking something (food) to eat at school does not play a role as factor associated with the persistence of the disease in this study. This means that there is no relationship between the two categorical variables (taking something to eat at school and the persistence of the disease).

#### **4.3.4 Working caretaker (N= 124 Case and N= 124 Control group)**

The results indicated that 71(57.3%) of the case group and 66 (53.2%) of the control group indicated that at least one of their caretakers are working, while 53(42.7%) of the case group and 58 (46.8%) of the control group indicated that their caretakers are not working.

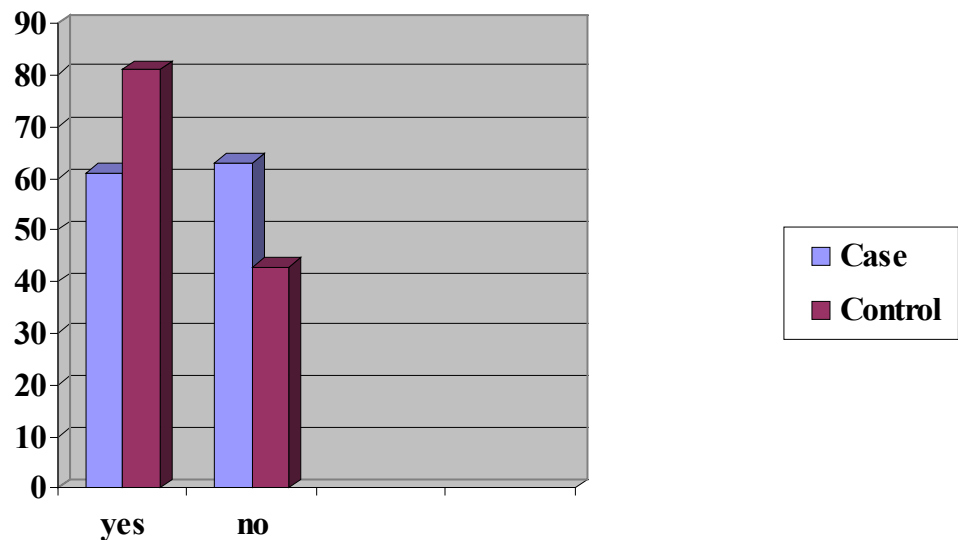
A Pearson Chi-Square test statistic of 0.408 and a p-value of  $0.523 > 0.05$  was obtained. The conclusion is that there is no statistically significant difference between case and control groups. Therefore in this study working of caretaker does not play a role as factor associated with the persistence of the disease in this study.

This means that there is no relationship between the two categorical variables (working of caretaker and the persistence of the disease).

#### **4.3.5 Knowledge on preventative and control measures (N=124 case and N=124 control group)**

The findings showed that 61 (49.2%) of the case group and 81 (65.3%) of the control group indicated that they had knowledge on how to prevent and control schistosomiasis.

**Figure 4.1 Knowledge on preventative and control measures (Case=124 and Control =124)**



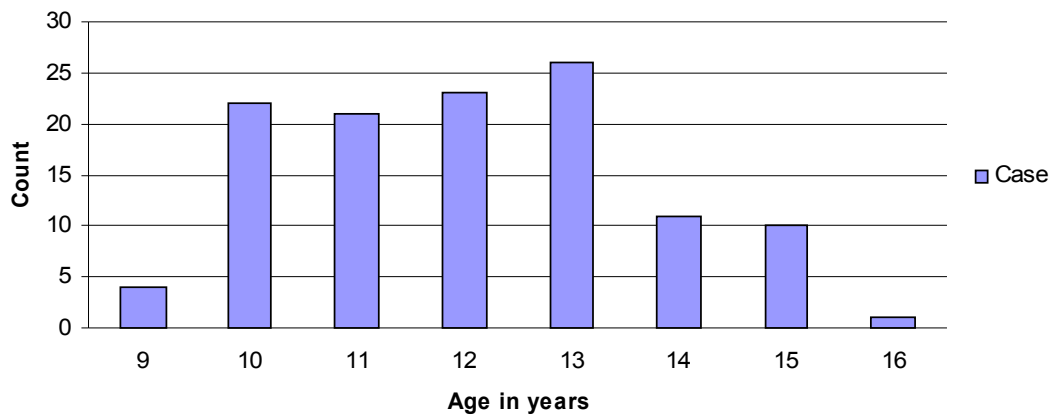
A statistically significant correlation was found between the case and control group with regard to this item where p-value is  $0.010 < 0.05$ , ( $p < 0.05$ ), in using both the Pearson Chi-Square test and Fisher's Exact Test is  $0.015 < 0.05$ . Therefore the conclusion is that in this study a lack of knowledge in preventative and control measures does play a role as a factor associated with schistosomiasis infection rates.

According to Carvalho and Lima (2007, p 376) knowledge on schistosomiasis prevention is important. People should avoid swimming or bathing in contaminated or potentially contaminated water and also avoid water bodies of unknown safety.

#### 4.3.6 Infection according to ages (N = 124)

The results as indicated in figure 4.2 show that the most affected learners are in the age group 10 to 13 years, which showed that a total of 96 (77%) of the case group fell within this age group.

**Figure 4.2 Age distribution of infected learners**



There seems to be a general trend in the observations which shows that the percentage of children infected with schistosomiasis tend to generally decrease as their age increases, because the findings indicated that there is a significant drop in infection rate from 14 – 16 years.

With a Pearson Chi-Square test statistic is 28.271 and the p-value is less than 0.0005 obtained, the conclusion is that we do have sufficient evidence at a 95% confidence level to conclude that age plays a role as a factor associated with schistosomiasis infection rates.

According to Chitsulo et al (2000, p.44), the prevalence and severity of schistosomal infections vary with age. Children and adolescents are infected most often and are infected most heavily. Infections peak in individuals aged between 10 and 19 years. In persons older than 19 years, the prevalence of active infection and egg counts slowly declines in populations living in endemic areas. However, end-stage complications may persist or worsen. This decline in active infection may reflect that individuals have an increasing host immune response or a decreasing exposure to contaminated water as they age (Chitsulo et al, 2000, p.44).

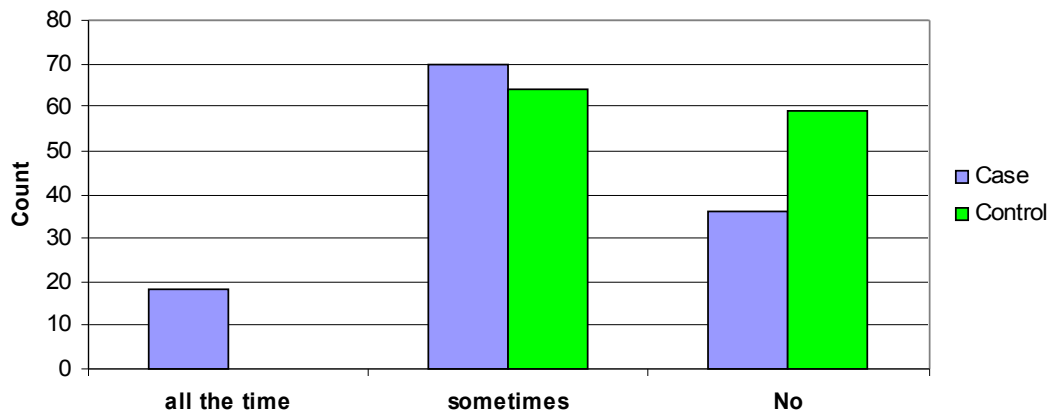
#### **4.3.7 Infection according to gender (N = 124)**

The results indicated that 47 (37.8%) females are infected compared to 77 (62.2%) males. This means that males are more infected than females. The Pearson Chi-Square test statistic was 1.346 and the p-value was  $0.510 > 0.05$ . The conclusion is that there is no statistically significant difference; therefore in this study gender does not play a role as a factor associated with the persistence of the disease. This is also confirmed by Elliot et al (2001, p.622) that in some endemic areas, rates of symptomatic infection are lower in females than in males. This may reflect lifestyle differences between men and women regarding the likelihood of bathing or drinking from contaminated streams or irrigation ditches.

#### **4.3.8 Infection caused by passing through water on the way to school (Case = 124 and Control = 124)**

The results indicated that 70 (56.5%) of the case group and 64 (51.6%) of the control group indicated that they pass through water on the way to school.



**Figure 4.3 Infection caused by passing through water on way to school****(Case=124) (Control =124)**

With a Pearson Chi-Square test statistic at 24.837 and the p-value less than 0.0005 obtained, the conclusion is that we do have sufficient evidence at a 95% confidence level to conclude that in this study passing through the water on their way to school also plays a role as a factor associated with a high incidence of the disease in this study. According to Carvalho and Lima (2007, p.377) a person may get infected through contact with contaminated water. The parasite in its infective stage is called a cercaria, it swims freely in open bodies of water.

#### **4.3.9 Boiling water for drinking (N= 124 Case and N= 124 Control group)**

The results showed that 46 (37.1%) of the case group and 45 (36.3%) of the control group indicated that they boil water for drinking, whilst 78 (62.9%) of the case group and 79 (63.7%) of the control group indicated that they do not boil drinking water.

With a Pearson Chi-Square test statistic at 3.052 and a p-value of 0.217 > 0.05, the conclusion is that there is no statistically significant difference between case and

control groups. Therefore in this study the boiling water for drinking purposes does not play a role as factor associated with the persistence of the disease in this study.

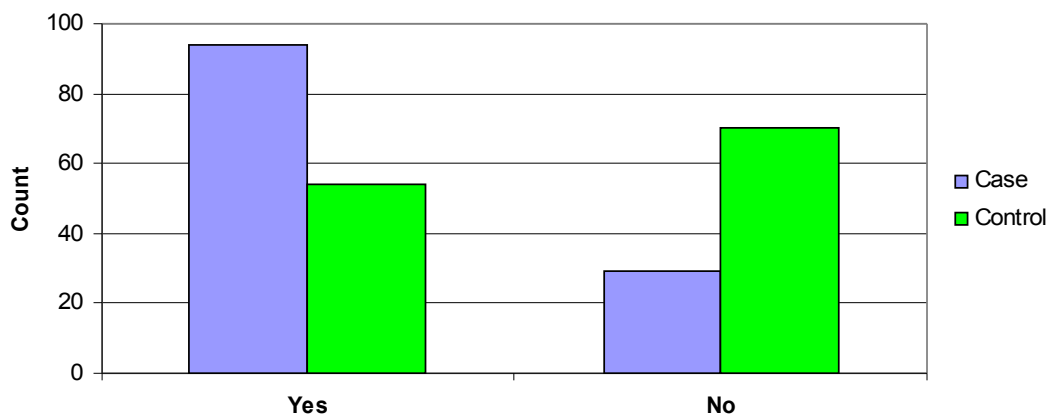
An observation from the researcher was that the boiling of water was not done consistently, hence this result, as infected water might have been used in-between.

According to Hunter (2003, p. 20) boiling of water is a simple, inexpensive, culturally acceptable schistosomiasis control strategy that kills schistosoma parasite in water.

#### 4.3.10 Infection caused by using drinking water from the canal (N=124 Case and N=124 Control group)

As indicated in figure 4.4 below, 94 (75.8%) of the case group and 54 (43.5%) of the control group indicated that they use untreated water from a canal.

**Figure 4.4 Collecting of drinking water at canal (Case=124) (Control=124)**



A Pearson Chi-Square test statistic of 28.791 and a p-value of  $0.000 < 0.0005$  was obtained. The conclusion is that we have sufficient evidence at 95% confidence level

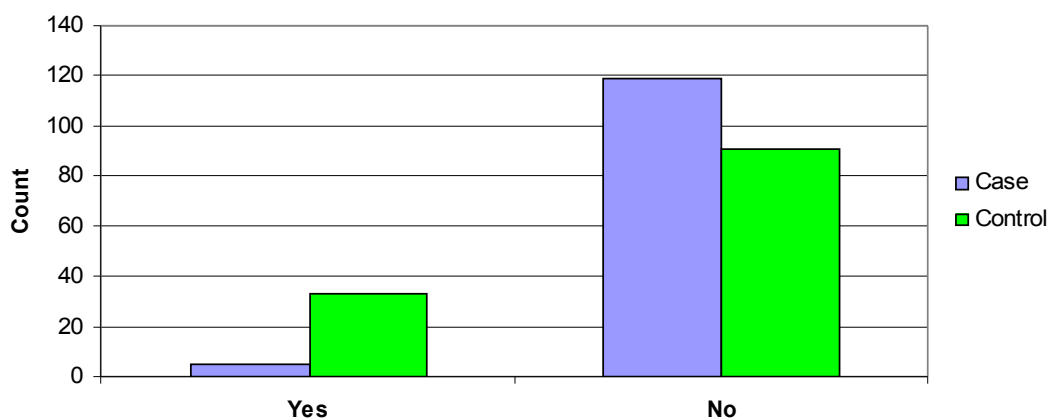
to conclude that using water from canal for drinking purposes plays a role as a factor associated with a high schistosomiasis incidence, because the water is treated.

According to Chitsulo (2000, p.42) the provision of safe water supplies and sanitation contributes to the reduction of the prevalence and severity of schistosomiasis. Drinking safe water is important in schistosomiasis control.

#### 4.3.11 Lack of toilets at households (N=124 case and N=124 control group)

The results as indicated in figure 4.5 showed that 119 (96%) of the case group and 91 (73.4%) of the control group indicated that they do not have toilets at their house.

**Figure 4.5 Access to home toilets (Case=124 and Control =124)**



Pearson Chi-Square test statistic is 24.365 and the p-value is less than 0.0005 was obtained. In additions, the p-value for Fisher's Exact Test is also less than 0.0005. In

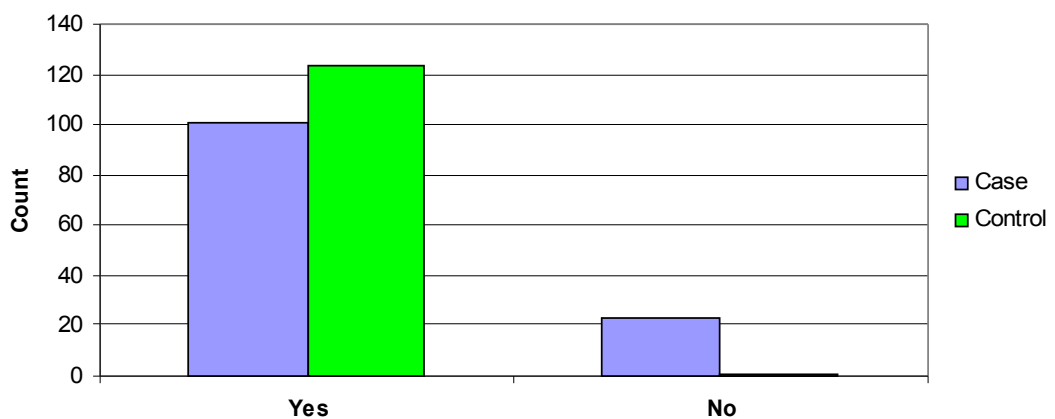
both situations, the conclusion is that we have sufficient evidence at 95% confidence level to conclude that in a lack of toilets at the household is associated with a high schistosomiasis incidence.

According to Engels et al (2005, p.68), the presence of simple toilets will reduce the spread of parasitic eggs to water in rivers and dams, and secures access to safe water bodies for irrigation, bathing, laundry and other household activities. Therefore, a lack of toilets in households is associated with a high schistosomiasis incidence.

#### **4.3.12 Health education as a school subject (N=124 case group and N=124 control group)**

The results indicated that 101 (81.5%) of the case group and 123 (99.2%) of the control group indicated that they have health education as a subject at school.

**Figure 4.6 Exposure to health education as a school subject (Case=124 and Control =124)**



A Pearson Chi-Square test statistic of 22.327 and a p-value is  $p < 0.0005$  was obtained. In addition, the p-value for the Fisher's Exact Test was  $p < 0.0005$ . In both situations, the conclusion is we have sufficient evidence at a 95% confidence level to conclude in this study that not having health education as a subject at the school could be a factor associated with the persistence of schistosomiasis.

According to Cioli (2003, p.6), health education with emphasis on schistosomiasis prevention and control is important. This education may include knowledge of the complex life-cycle of the parasite, the importance of the intermediate host snails and the possibility for breaking the transmission of the parasite by means of following the various steps in the integrated control, including snail control with a chemical called Endod.

#### **4.3.13 Infection caused by playing in water (N= 124 Case and N= 124 Control group)**

The results indicated that 62 (50%) of the case group and 54 (43.5%) of the control group indicated that they play in water. A Pearson Chi-Square test statistic of 1.044 and a p-value is  $0.593 > 0.05$  was obtained. The conclusion in this study is that playing in water in this study does not play a role as a factor associated with the persistence of schistosomiasis in the district.

According to Carvalho and Lima (2007, p.377) a person may get infected through contact with contaminated water. The parasite in its infective stage is called a

cercaria, it swims freely in open bodies of water. This means that playing in contaminated water is a factor associated with the persistence of schistosomiasis infection.

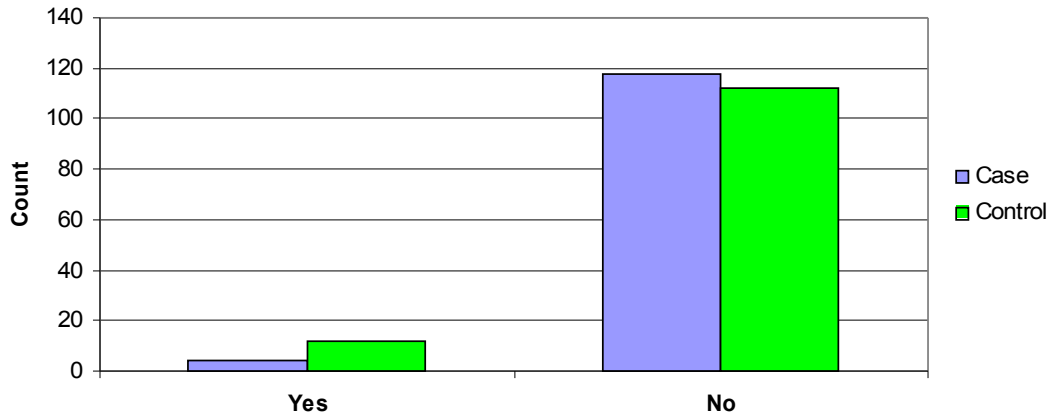
#### **4.3.14 Using tap water for domestic purposes (drinking) (N= 124 Case and N= 124 Control group)**

The results showed that 118 (95.2%) of the case group and 110 (88.7%) of the control group indicated that they do not use treated tap water for drinking. A Pearson Chi-Square test statistic of 5.544 and a p-value of  $0.063 > 0.05$  was obtained. The conclusion is that not using tap water for drinking does play a role as a factor associated with the persistence of schistosomiasis in the district. The results from this finding also indicated that tap water could be regarded as being infection-free.

This is confirmed by Bergquist et al (2005, pp. 112-113) that humans are infected when they enter or come in contact with schistosome-infested water. Schistosomiasis is primarily a disease due to extreme poverty – people get infected because they do not have access to safe water supplies and proper sanitation. He also explained that people acquire the infection during the course of routine domestic, agricultural or occupational duties.

#### **4.3.15 Using tap water for bathing (N= 124 Case and N= 124 Control group)**

The results indicated that 118 (95.2%) of the case group and 112 (90.3%) of the control group indicated that they do not use tap water for bathing.

**Figure 4.7 Using tap water for bathing (Case= 124 and Control =124)**

A Pearson Chi-Square test statistic of 6.157 and a p-value is  $0.046 < 0.05$  was obtained. The conclusion is that in this study using other sources of water like streams, dams or canals for bathing other than tap water increases vulnerable to schistosomiasis infection.

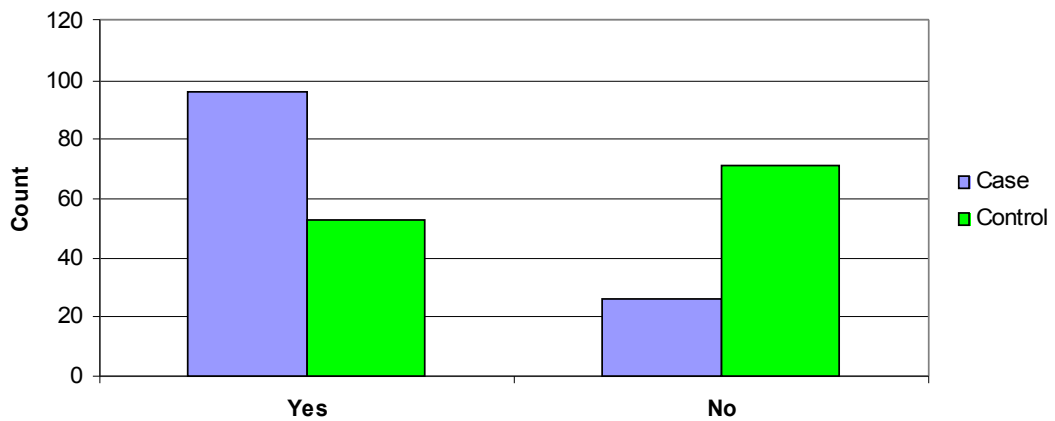
Therefore water sources other than tap water play a role as a factor associated with the persistence of schistosomiasis in the district.

According to Engels (2005, p.67) safe water supply is central to control of schistosomiasis. The provision of safe water supplies catering for all domestic needs not only drinking water but also washing facilities, cattle watering facilities and bathing, reduce not only transmission but also contamination since human contact with natural water bodies is reduced.

#### **4.3.16 Using canal water for bathing (N=124 Case group and N=124 Control group)**

The results indicated that 96 (77.4%) case group and 53 (42.7%) control group indicated that they are using water from canal for bathing.

**Figure 4.8 Using canal water for bathing (Case=124 and Control =124)**



A Pearson Chi-Square test statistic of 35.286 and a p-value less than  $p < 0.0005$  was obtained. The conclusion in this study is that using canal water for bathing is identified as a factor associated with the persistence of schistosomiasis in the district. This finding supports the results of item 4.3.4 where the drinking of canal water led to an increased infection rate with schistosomiasis.

Chitsulo et al (2000,p.44) confirms that people get infected because they do not have access to safe, potable water, and maintain transmission because of the absence of proper excreta disposal systems. Infection is acquired during the course of routine domestic, agricultural or occupational duties.

#### **4.3.17 Signs and Symptoms (N=124 case and N=124 Control group)**

The findings showed that 61 (49.2%) of the case group and 81 (65.3%) of the control group indicated that they had knowledge on signs and symptoms schistosomiasis.



The statistically significant correlation was found between the case and control group with regard to this item where p-value is  $0.010 < 0.05$ , ( $p < 0.05$ ), in using both the Pearson Chi-Square test and Fisher's Exact Test is  $0.015 < 0.05$ .

Therefore the conclusion is that in this study a lack of knowledge on signs and symptoms may play a role as a factor associated with schistosomiasis infection rates. This is also confirmed by Iarotski (1998, p.116) knowledge of signs and symptoms of schistosomiasis prevent further damage to liver, lungs and spleen. He further emphasised that schistosomiasis seriously weakens its victims and in some cases impairs the function of kidneys.

#### **4.3.18 Source of schistosomiasis information (N=124 case and N=124 Control group)**

The results indicated that 65 (52.4%) of the case group and 68 (54.8%) of the control group indicated that they are getting schistosomiasis information from school, while 39 (31.5%) of the case group and 40 (32.3%) of the control group indicated that they are getting information from the clinic.

With a Pearson Chi-Square test statistic at 3.014 and a p-value of  $0.390 > 0.05$ , the conclusion is that there is no statistically significant difference between case and control groups. Therefore in this study the source of information does not play a role as a factor associated with the persistence of the disease in this study.

According to Nelson (2001, p.26) the aim of health education in schistosomiasis is to help people understand that their own behaviour, principally water use practices and

indiscriminated urination and defecation as well as failure to use available screeningservices. He further said that in countries where schistosomiasis is endemic public information can be disseminated through posters, films, the mass media especially radio and community meetings by health workers.

#### **4.3.19 Schistosomiasis a health problem in the area (N=124 case and N=124 Control group)**

The results indicated that 70 (56.5%) of the case group and 64 (51.6%) of the control group indicated that schistosomiasis is health problem in their areas.

With a Pearson Chi-Square test statistic at 24.837 and the p-value less than 0.0005 obtained, the conclusion is that we do have sufficient evidence at a 95% confidence level to conclude that in this study living in schistomiasis problematic area plays a role as a factor associated with a high incidence of the disease in this study.

According to Ross (2002, p.1216) the adequate diagnosis and treatment of patients with symptomatic schistosomiasis is the primary component of any morbidity control programme.

#### **4.3.20 Family members affected by schistosomiasis (N=124 case and N=124 control group)**

The results indicated that 94 (75.8%) of the case group and 54 (43.5%) of the control group indicated that one of their family members were affected by schistosomiasis A Pearson Chi-Square test statistic of 28.791 and a p-value of  $0.000 < 0.0005$  was obtained. The conclusion is that we have sufficient evidence at 95% confidence level

to conclude that having a family member suffering from schistosomiasis plays a role as a factor associated with a high schistosomiasis incidence.

According to Schutte (1995, p.366) community-based health education, where health workers have better understanding of and closer contact with the community, results in better co-operation of the inhabitants in seeking diagnosis and treatment advises.

#### **4.3.21 Affected family members received schistosomiasis treatment (N=124 case and N=124 Control group)**

The results indicated that 47 (37.8%) of case group and 77 (62%) control group indicated that their family member received schistosomiasis treatment.

According to Hartz (2001, p.777) the primary objective of chemotherapy in schistosomiasis control is the reduction and prevention of morbidity whenever anti-schistosomal drugs are to be used the objectives of treatment must be clearly defined. He further emphasised that Praziquantel is effective in all forms of schistosomiasis, both in the acute stage and in patients with extensive hepatosplenic involvement, even when cure is not obtained, egg counts in faeces or urine are often considerably reduced.

#### **4.3.22 Knowledge on mode of transmission (N=124 case and N=124 control group)**

The results indicated that 61(49.2%) of case group indicated that a person may be infected by contact with water containing bilharzias parasite, while 81(65.3%) of

control groups indicated that person may be infected by swimming in the water canal.

According to Carvalho and Lima (2007, p 376) knowledge on schistosomiasis prevention is important. People should avoid swimming or bathing in contaminated or potentially contaminated water and also avoid water bodies of unknown safety.

#### **4.3.23 Family member that contracted the disease (N=124 case and N=124 control group)**

The results indicated that 94(75.8%) of case group indicated that their sisters contracted disease while 54(43.5%) of the control group indicated that their brothers contracted the disease.

According to Schutte (2004, p.366) community-based health education, where health workers have better understanding of and closer contact with the community, results in better co-operation of the inhabitants in seeking diagnosis and treatment advises.

#### **4.3.24 Schistosomiasis prevention measures (N=124 case and N=124 control group)**

The finding showed that 61(49.2%) of case group indicated that the best schistosomiasis prevention measures is to reduce contact with infected water, while 81(65.3%) of control group indicated that the best prevention measures is to use protective gear during water contact activities.

This is confirmed by Bergquist et al (2005, pp. 112-113) that humans are infected when they enter or come in contact with schistosome-infested water. Schistosomiasis is primarily a disease due to extreme poverty – people get infected because they do not have access to safe water supplies and proper sanitation. He also explained that people acquire the infection during the course of routine domestic, agricultural or occupational duties.

#### **4.3.25 Availability of toilets and water at schools (N=124 case and N=124 control group)**

The results indicated that both 248 (100%) case and control group indicated that they have tap water and toilets at their schools.

According to Engels et al (2005, p.68), the presence of simple toilets will reduce the spread of parasitic eggs to water in rivers and dams, and secures access to safe water bodies for irrigation, bathing, laundry, drinking and cooking etc.

#### **4.3.26 Using the bush as toilets due to unavailability of toilets at households (N=124 case and N=124 control group)**

The finding showed that 119(96%) of the case and 91(73.4%) of the control group indicated that they are using the bush as toilets due to lack of toilets.

According to Engels et al (2005, p.68), the presence of simple toilets will reduce the spread of parasitic eggs to water in rivers and dams, and secures access to safe water bodies for irrigation, bathing, laundry, drinking and cooking etc.

#### **4.4 Summary**

In this chapter all the findings were analysed. Significant correlations were found between the case group and the control group. Specific statistically significant correlations were found between contact with canal water (drinking, bathing, passing through) and the infection. The applicable null hypotheses were therefore rejected and this aspect will be highlighted in chapter 5 in detail.

## **CHAPTER 5**

### **Conclusions, recommendations and limitations**

#### **5.1 Introduction**

In this chapter the research findings are summarised and conclusions are drawn. Based on these conclusions, recommendations are formulated and presented within the limitations recognised to exist within this study. These limitations will be presented and placed within context. The discussion will be based on the order and focus of the macro arguments, namely the purpose and objectives of the study.

#### **5.2 The purpose of the study**

The purpose of this study was to describe and explore any factors (variables) that could be associated with the persistence of the high infection rate of schistosomiasis infection in schoolchildren between the ages of 6 and 17years in the Outapi health district, in order to implement appropriate prevention strategies.

### **5.3 The conclusions and recommendations with regard to the stated objectives**

The formulated objectives were evaluated and analysed according to data, findings and literature collected. The following conclusions are based on the objectives.

#### **5.3.1 Conclusions and recommendations with regard to objective 1**

##### **Objective 1**

To describe the incidence and magnitude of schistosomiasis in schoolchildren in the Outapi health district

##### **Conclusion**

Based on findings that 124 (31%) of the schoolchildren tested positive for schistosomiasis. It is concluded that infection with the schistosoma parasite is still a public health problem in the Outapi health district.

The following recommendations are submitted:

- Health education and promotion in regard to schistosomiasis should be introduced in schools where it is lacking and strengthened in schools where it is presently taught.
- School teachers should be trained in schistosomiasis detection, prevention and control.
- Environmental health staff should be trained in all aspects and measures related to schistosomiasis prevention and control.

- The Outapi health district should have a schistosomiasis control focal person, so they can liaise with the teachers who have been trained in schistosomiasis detection to develop community-based follow-up programme.
- The Ministry of Health should also extend control of morbidity at the community level; this requires building additional capacity at ministerial levels and creating community awareness about the schistosomiasis problem.

### **5.3.2 Conclusion with regard to objective 2**

#### **Objective 2**

To identify the possible factors that may be associated with the contraction, transmission and persistence of schistosomiasis in the Outapi district.

#### **Conclusion**

The conclusion with regard to objective 2 is based on statistically significant correlations that were found with regard to four (4) independent variables namely, age, water contact, lack of toilets at household and health education as a subject at school.

In addition, the null hypotheses that were stated with regard to these specific hypotheses were rejected (see table 5.2).

The conclusions with regard to objective 2 are thus as follow water contacts, lack of latrines, children younger than 14 and lack of health education and promotion in schools, are all factors that contribute to the transmission and persistence of this disease.



These four abovementioned items were regarded as being statistically significant, meaning that they could be regarded as factors that are associated with the high incidence of schistosomiasis in the Outapi district.

**Table 5.1 Factors identified as being associated with the persistence of a high schistosomiasis infection rate**

Factor	Chi-square	Comments
Age (9 – 13 years of age)	$X^2 = 23.55$ $P < 0.05$	Ages younger than 14 were identified as a factor associated with the persistence of schistosomiasis
Water contact <ul style="list-style-type: none"> <li>➤ Passing through water to school</li> <li>➤ Not using tap water for bathing</li> <li>➤ Collecting drinking water from canal</li> <li>➤ Using water canal for bathing</li> </ul>	$X^2 = 27.751, P < 0.05$ $X = 6.191, P < 0.05$ $X^2 = 5.607, P < 0.05$ $X = 46.162, P < 0.05$	Water contact was also identified as a factor associated with the persistence of schistosomiasis
Lack of toilets in households	$X^2 = 33.007$ $P < 0.05$	Lack of latrines were identified as a factor associated with the persistence of schistosomiasis
Health education as a subject at school	$X^2 = 19.723$ $P < 0.05$	Lack of health education was identified as factor associated with

The four (4) null hypotheses that were therefore rejected, based on the findings as indicated in the description as well as table 5.1, are outlined for more clarity in table 5.2.

The null hypotheses were that, there will be no statistically significant difference between case and control groups with regard to correlations with the variables under observation, namely:

- Age
- Health education
- Lack of toilets
- Water contact.

**Table 5.2 The null hypotheses that were rejected**

Variable	Chi-square	Comments
Age	$X^2 = 23.55$ $P < 0.05$	There is a statistically significant correlation difference; therefore the null hypothesis is rejected.
Water contact		There is a statistically significant correlation difference; therefore the null hypothesis is rejected.
➤ Passing through water to school	$X^2 = 27.751, P < 0.05$	
➤ Not using tap water for bathing	$X = 6.191, P < 0.05$	
➤ Collecting drinking water from canal	$X^2 = 5.607, P < 0.05$	

➤ Using water canal for bathing	X=46.162, P<0.05	
Lack of latrines at household	X <sup>2</sup> = 33.007 P < 0.05	There is a statistically significant correlation difference; therefore the null hypothesis is rejected.
Health education as subject at school	X <sup>2</sup> = 19.723 P < 0.05	There is a statistically significant correlation difference; therefore the null hypothesis is rejected.

The findings as indicated in table 5.1 and table 5.2 are similar to other quoted studies in the literature review and the conclusion of the researcher is that they are associated with the persistence of schistosomiasis.

- With regard to the age factor, that age is one fairly common pattern of a high prevalence rate of active infection in children, who excrete relatively large quantities of schistoma eggs, and a lower prevalence rate of active infection among adults.

Schistosomiasis infection usually peaks at ages between 10 and 17 years of age.

In this study the researcher found that the peak at the Outapi district is between 9 and 13 years of age.

- With regard to water contact, man-made water resources (lakes, canals and irrigation systems) have been observed to aid in the transmission of schistosomiasis in areas around those man-made sources. The infection is likely to be associated with water contact behaviour.

### **5.3.3 Recommendation with regard to objective 2**

The following recommendations will be based on the statistical analyses that have shown a significant difference between the case group and the control group with regard to the correlations found.

- Specific health education should be provided to school children. Young schoolchildren may experience problems in internalising and comprehending abstract concepts like “parasite”.
- “Cartoon-like” drawings and banners which would speak to children could be considered as a vehicle / medium of giving information.
- “Adventure walks” could be held with younger children to show them alternative routes to cross water canals.
- Children could, as part of geography lessons, draw maps of safe routes
- The concept of prevention, when fishing, should be emphasised in a realistic manner. If possible the use of correct protective footwear should be encouraged.
- Life science subjects could consider field trips to water canals and encourage learners to identify the positive as well the negative aspects of these water canals, or any other open water sources in the Outapi Health district.

- Provision in the curriculum could be made for visiting lecturers like Health Inspectors. These visiting lecturers could assist the more mature learners (15 years and older), on elementary and cheap ways to deal with waste disposal and sanitation issues.
- Learners in grade 10 and onwards may be taught how to perform detection tests (reagent strip haematuria) in biology classes.

### **Community involvement**

- It has been demonstrated over time that when a community takes ownership of a programme, the success rate of such a programme increases significantly. Ownership may be accomplished by disseminating the current high prevalence rate, as well as providing the necessary information on how a prevention programme could eradicate or decrease the infection rate.
- Community awareness and consumer demand should be strengthened. Because the actual damage in schistosomiasis is done in childhood with the disease presenting usually at adult age, the community must understand the natural history of the disease and the need for early treatment to prevent damage in the future.
- The sinking of boreholes should be considered to increase the availability of safe water. The regional councillors should be approached for this. The findings have indicated that tap water, which is provided by boreholes, is infection-free.
- With regard to the issue of household toilets, this incorporates a financial consideration. Not all people would be able to afford it. People should be encouraged to be innovative and utilise local material like wood, grass etc. to build their latrines. The Ministry of Health and Social Services could be

approached for assistance in the form of building material as per their rural sanitation policy and guidelines.

#### **5.4 The stated conclusions and the framework of the study**

This study was conducted within an epidemiological and health promotion framework. An eclectic approach was followed where relevant concepts from both frameworks were taken.

From an epidemiological perspective it was concluded that the persons and their contribution to being infected was mainly age-related. The children between 9 and 13 years of age were more affected. It was also found that the management of the environment, namely contact with canals and unprotected water, was associated with a high infection rate.

From a health promotion perspective, a statistically significant correlation was found with regard to health education received and being infected. Those who did not receive the education correlated with a higher infection rate.

#### **5.5 Limitation of the study**

The limitation of this study is methodological in the following regard:

- **Characteristics of the population**

Although the assumption was made that children would answer honestly and with integrity to reasonable questions posed during the research and completion of the

questionnaires, some children may have answered questions in a manner which they perceived as being more polite and not what they believed or knew.

This participant effect, whereby the answer given is thought to be the one that the researcher expected, is commonly referred to as the Hawthorne effect.

- **Population size**

The study population is a small sample, being limited to the participants or respondents of only one district

- **Reliability aspect**

Reliability aspects appeared not to be obtained in two items. These items appeared to be influenced by an understanding of certain concepts. The children between ages of 6 and 9 might have interpreted questions on causes of schistosomiasis and playing in water, incorrectly.

## **5.6 Final conclusion**

The research showed that schistosomiasis is still a health problem among schoolchildren, especially at schools that are along the water canal and Olushandja dam. It has identified four independent variables that demonstrated significant correlation with infection with schistosomiasis.

## **5.7 Further research**

A comparative descriptive design is also used to generate hypotheses. It would be possible to formulate hypotheses to test all factors for which statistically significant correlations have been found. It is also recommended that this study could be repeated, but in another district or region.

### **5.8 Summary**

In this chapter the factors that were considered to be associated with the incidence and persistence of schistosomiasis were identified, conclusions were drawn and recommendations were made.

The study highlighted the linkage between the interactions of man (schoolchildren) and the water canal as well as other unprotected water and the resultant infection with schistosomiasis. The positive effect of health education as a school subject was also highlighted.

Within the context of the environment and health education, certain recommendations were submitted



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## **ANNEX 1**

### **Permission letter to conduct research from post graduate committee – UNAM**

# UNIVERSITY OF NAMIBIA

Private Bag 13301, 340 Mandume Ndemufayo Avenue, Pionierspark, Windhoek, Namibia



## FACULTY OF MEDICAL AND HEALTH SCIENCES

Letter of permission:  
Post graduate students

PGSC/106/1135

Date: 4.9.2006

Dear Student: Ms. L. Usika

The post graduate studies committee has approved your research proposal.

Title: Shistosomiasis among school children 5-17 years in Outapi health district.
--

You may now proceed with your study and data collection.

It may be required that you need to apply for additional permission to utilize your target population. If so, please submit this letter to the relevant organizations involved. It is stressed that you should not proceed with data collection and fieldwork before you have received this letter and got permission from the other institutions to conduct the study. It may also be expected that these organizations may require additional information from you.

Please contact your supervisors on a regular basis.

Faculty representative on Post graduate committee

Prof. A van Dyk

UNAM  
FACULTY OF MEDICAL AND  
HEALTH SCIENCES  
P/BAG 13301 WINDHOEK  
5.9.2006

## **ANNEX 2**

**Application letter to the Omusati region  
education Director requesting permission to  
conduct research in schools**

Enquiries: LA Uusiku  
Tel: 065 – 220628 (w)  
Fax: 065 – 220303  
Cell: 081 129 2980

P.O Box 400  
OSHAKATI  
10 November 2006

The Director  
Ministry of Education  
Omusati Region

Dear Mr. Kafidi

**Re: Application to conduct a Schistosomiasis research among School children at Outapi Health District in Omusati region**

I am Leonard – Amutenya Uusiku employed by the MoHSS at Environmental Health Services, Oshakati as an Environmental Health Officer since 1998 to date.

Therefore I would like to conduct a research on Schistosomiasis in 10 schools in Omusati region especially those schools along Olushandja Dam and water Canal. My title is: Schistosomiasis among school children between the ages of 6 - 17 years in the Outapi health district in Namibia

This research is a fulfillment of the requirements for the Masters in Public health degree at University of Namibia.

Therefore I am humbly requesting your office for approval of the proposed research for March 2007.

Attached is approval letter from post graduate committee - University of Namibia.

Thank you

Yours Sincerely

Mr. LA Uusiku



## **ANNEX 3**

**Permission letter to conduct research in school  
from the Omusati region education Director**



REPUBLIC OF NAMIBIA  
MINISTRY OF EDUCATION  
OMUSATI REGION

Tel: (065) 242518  
Fax: (065) 241516

Private Bag 2020  
ONDANGWA  
NAMIBIA

Enq: Mr. Veiyo L. Nangombe  
Ref: 10/1

30 January 2007

To: Mr. Leonard A. Uusiku  
P.O. Box 400  
OSHAKATI

Dear Mr. Uusiku

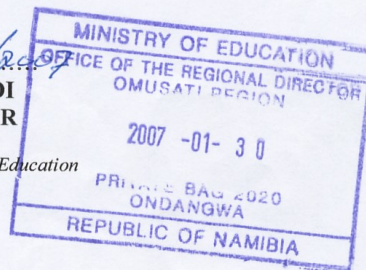
**SUBJECT: PERMISSION TO CONDUCT A SCHISTOSOMIASIS RESEARCH  
AMONG LEARNERS IN OMUSATI EDUCATION REGION**

1. Your letter of request on the subject in reference dated 10 November 2006 is hereby acknowledged.
2. You have also indicated during our telephonic conversation earlier this month that you will conduct your research in March 2007.
3. We have the pleasure to inform you that permission is hereby granted, conditionally that:
  - 3.1. Your research should not interrupt normal school programmes and activities;
  - 3.2. You should contact the school principal to get his/ her approval prior to visiting the school;
  - 3.3. Also inform concerned Inspector/s of Education prior to conducting your research in affected circuit/s;
  - 3.4. Learners should participate in the research on voluntary basis.
4. Should there be any queries, please do not hesitate to contact us.

Sincerely yours,

*mf 30/01/2007*  
MR. LAMEK T. KAFIDI  
REGIONAL DIRECTOR

Cc: All Inspectors of Education



## **ANNEX 4**

**Application letter to school principals  
requesting permission to conduct research in  
their schools**

Enquiries: LA Uusiku  
Tel: 065 – 220628 (w)  
Fax: 065 – 220303  
Cell: 081 129 2980

P.O. Box 400  
Oshakati  
20 February 2007

The School Principals  
Ministry of Education  
Omusati Region

Dear Sir/ Madam

**Re: Application to conduct a Schistosomiasis research among School children at your school.**

I Leonard A. Uusiku would like to conduct a research on Schistosomiasis about 40 learners per school of the age between 6 to 17 years preferably Grade 3 - 7 at your school.

Therefore I am humbly requesting your office to allow us to conduct this research between 12 March to 23 March 2007. The Preferable sampling time is between 10H00 and 14H00.

Attached is approved letter from the Director of Education, Omusati Region.

Thank you

Yours Sincerely

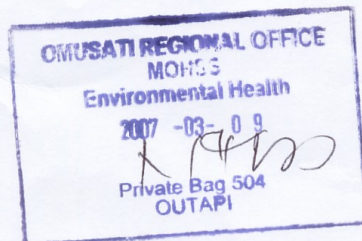
LA Uusiku

## **ANNEX 5**

### **List of identified schools for data collection**

**THE FOLLOWING SCHOOLS WILL BE VISITED DURING THE RESEARCH:**

1. ONTOKO PRIMARY SCHOOL ✓
2. OKAFA PRIMARY SCHOOL ✓
3. OLUPAKA COMB. SCHOOL ✓
4. OKANIMEKWA COMB. SCHOOL ✓
5. NAKAYALE PRIMARY SCHOOL (OMBAAJELE )
6. OMPAKOYA COMB.SCHOOL ✓
7. OSHAALA COMB.SCHOOL ✓
8. OMWIFI COMB. SCHOOL ✓
9. OLUVANGO COMB. SCHOOL (OKAPOPO )
10. OUMA COMB. SCHOOL ✓



## **ANNEX 6**

### **One of the tools used in data collection**





## **ANNEX 7**

### **Questionnaire used for data collection**

***QUESTIONNAIRE ON SCHISTOSOMIASIS***

*By*

**Leonard Uusiku**

**QUESTIONNAIRE**

*Submitted in fulfillment of the requirement for the*

**MASTERS IN PUBLIC HEALTH**

*Faculty of Medical and Health Science*

***UNIVERSITY OF NAMIBIA***

*Supervisor: Prof. LS Small*

*Co-supervisor: Mr. P. Tshifugula*



(c) No

7. Do you take something to eat at school? (Please tick the appropriate box)

(a) Yes, all the time

(b) Yes, sometimes

(c) No

8. Is at least one of your caretakers working? (Please tick the appropriate box)

(a) Yes

(b) No

(c) Not sure

9. How many are you in family / House? (Please tick the appropriate box)

(a) Adult

(b) Children

***SECTION B: CONTACT SITUATION WITH WATER***

10. Do you pass through water on your way to school? (Please tick the appropriate box)

(a) Yes, all the time

(b) Yes, sometimes

(c) No

11. Do you play in water? (Please tick the appropriate box)

(a) Yes, all the time

(b) Yes, sometimes

(c) No

12. If yes, where? (Please tick the appropriate box)

(a) Oshana

(b) Canal

(c) (c) Other (specify) \_\_\_\_\_

13. Where do you get water for drinking? (Please tick the appropriate box)

(a) Tap

(b) Dam

(c) Canal

(d) Well

(e) (e) Other (specify) \_\_\_\_\_

14. Do you boil water for drinking? (Please tick the appropriate box)

(a) Yes, all the time

(b) Yes, sometimes

(c) No

15. Where do you get water for bathing? (Please tick the appropriate box)

(a) Tap

(b) Dam

(c) Canal

(d) Well

(e) (e) Other (specify) \_\_\_\_\_

### ***SECTION C: DISEASE KNOWLEDGE***

16. Do you know anything about bilharzias? (Please tick the appropriate box)

YES  NO

17. If yes, how does a person become infected? (Please tick the appropriate box)

(a) Contact with water containing bilharzias parasite

(b) Contact with snails

(c) Irrigation

(d) Fishing

(e) Swimming

(f) Others (specify) \_\_\_\_\_

18. What are the signs and symptoms of the disease? (Please tick the appropriate box)

(a) Diarrhea

(b) Vomiting

(c) Bloody urine

(d) Bloody stool

(e) Abdominal pain

(f) Others (specify) \_\_\_\_\_

19. Where did you get this information on bilharzias? (Please tick the appropriate box)

(a) Village headman

(b) Clinic

(c) Media

(d) School

(e) Friends

(f) Family

(g) Other (specify) \_\_\_\_\_

20. Do you think bilharzias a problem in your area? (Please tick the appropriate box)

(a) Yes

(b) No

(c) Not sure

21. Have you or any family member contracted this disease? (Please tick the appropriate box)

(a) Yes

(b) No

(c) Not sure

22. If yes, who contracted this disease? (Please tick the appropriate box)

- (a) Mother
- (b) Father
- (c) Brother
- (d) Sister
- (e) Relative

23. Do you know that he/ she received any medication? (Please tick the appropriate box)

- (a) Yes
- (b) No
- (c) Not sure

24. What do you do to prevent being infected with bilharzias? (Please tick the appropriate box)

- (a) Reduce contact with infected water
- (b) Application of chemicals
- (c) Weeding the canal bank regularly
- (d) Use protective gear during water contact activities
- (e) Other (specify) \_\_\_\_\_

***SECTION D: AVAILABILITY OF ABLUTION FACILITIES AT HOME AND SCHOOLS***

25. Do you have a latrine at your school? (Please tick the appropriate box)

- (a) Yes
- (b) No

26. If you do not have latrine at your school, where do you go when you need to urinate / defecate? (Please tick the appropriate box)

- (a) In the bush
- (b) In the water
- (c) Elsewhere (specify) \_\_\_\_\_

27. Do you have latrine in you household? (Please tick the appropriate box)

- (a) Yes
- (b) No

28. If yes, how often you use it? (Please tick the appropriate box)

- (a) All the time
- (b) Sometimes
- (c) Never

29. If you do not have latrine, in your household where do you go when you need to?

(Select all that apply)

- (a) Neighbor latrine
- (b) In the bush
- (c) In the water
- (d) Other places (specify) \_\_\_\_\_

30. Do you have Health education as a subject at your school? (Please tick the appropriate box)

- (a) Yes
- (b) No

31. If no, where do you get health information? (Please tick the appropriate box)

- (a) Clinic
- (b) Community health worker
- (c) Regional Council
- (d) Church
- (e) Other (specify) \_\_\_\_\_



32. Where do you get water at your school? (Please tick the appropriate box)

- (a) Tap
- (b) Well
- (c) Canal
- (d) Dam
- (e) Other (specify) \_\_\_\_\_

***SECTION E: URINE SAMPLE TEST RESULTS***

33. Infection sample results

- (a) Positive
- (b) Negative

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**Thank you very much for completing the questionnaire.**

If you have further questions or comments, please contact:

Mr. Leonard Uusiku  
Faculty of Medical and Health Services  
University of Namibia  
Cell 0811292980