ASSESSMENT OF PREVALENCE AND ASSOCIATED FACTORS FOR URINARY SCHISTOSOMIASIS AMONG PRIMARY SCHOOL GOING CHILDREN IN MPONGWE DISTRICT, ZAMBIA

By

Patrick Sakubita

A dissertation submitted to the University of Zambia in partial fulfilment of the requirements of the degree of Master of Science in Epidemiology

THE UNIVERSITY OF ZAMBIA

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DECLARATION

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ABSTRACT

Schistosomiasis, also known as bilharziasis is a disease that results from infection with parasitic trematode worms of the genus *Schistosoma*. Schistosomiasis is acquired when free-swimming parasitic larvae known as cercariae penetrate the skin of people exposed to infested freshwater. The disease impedes school attendance and leads to absenteeism, ill-health and weak memory, poor performance and productivity, disability and death. In tropics and sub-tropics, human and water contacts can be potential risk factors of schistosomiasis. Domestic activities such as washing clothes and fetching water in infected water expose women and children to infection. In Zambia, urinary schistosomiasis caused by the trematode *Schistosoma haematobium* has been a major public health problem for many years. We conducted this study to investigate the prevalence of schistosomiasis among school going children and associated factors for contracting urinary schistosomiasis in Mpongwe district.

We used a multi-stage cluster sampling method to select study participants. The first stage involved selection of schools, at second stage selection of classrooms and the third stage consisted of simple random sampling for selection of respondents from the various classes. Probability proportion sampling to size was applied in assigning appropriate numbers of pupils that constituted the sample size. Data were collected using structured questionnaires on electronic tablets. A questionnaire was administered to all selected pupils providing a urine sample to collect information on the sex, age, water contact activities, symptoms of urinary schistosomiasis, knowledge about the disease, and past praziquantel treatment. We collected urine samples to analyse for presence of schistosome eggs to determine prevalence and geographical distribution of the disease. Schistosomiasis risk factors were assessed by Fisher's exact test to compare categorical variables. The level of significance was set at 95% and all p-values less than 0.05 were considered statistically significant.

We interviewed a total of 390 (100%) pupils between the ages of 5-14years from 15 schools of which 206 (52.8%) were female and 184 (47.2%) were male. The median age for the study participants was 12 years (IQR 7, 14) and all the four positive cases were males accounting for 1% prevalence rate. Of the four positive male case-patients, two (50%) reported previous history of suffering from schistosomiasis atleast once prior to the current infection. The majority of the pupils, 330 (85.5%) reported taking preventive chemotherapy for Schistosomiasis during the mass drug administration conducted in May 2017 with a therapeutic coverage of 83%.

Our study found that urinary schistosomiasis prevalence rate was currently at 1%. We found that previous history of schistosomiasis was associated with acquiring new infections. Mass drug administration may have contributed to the decreased prevalence rate. We recommend strengthened community health education to target the at-risk age groups, regular screening of children and the community in order to facilitate early access and linkage to health services. Active disease surveillance for schistosomiasis is also recommended for prompt detection of outbreaks. We also recommend that future studies should employ different study designs at different times of the year.

Key words: *Schistosomiasis, Mpongwe, Prevalence, Risk factors, Primary School Children*

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ABBREVIATIONS

CDC	Centre for Disease Prevention and Control
CSO	Central Statistical Office
DEBS	District Education Board Secretary
DEO	District Education Office
DHIS 2	District Health Information System version 2
DHO	District Health Office
GPS	Global Positioning System
IQR	Interquartile Range
MDA	Mass Drug Administration
MoE	Ministry of Health
MoH	Ministry of Health
PZQ	Praziquantel
QGIS	Quantum Geographic Information System
Schisto	Schistosomiasis
USA	United States of America
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background

Schistosomiasis, also known as bilharziasis or snail fever is a disease that results from infection with parasitic trematode worms of the genus Schistosoma. It is documented that six schistosomes species are responsible for human schistosomiasis, but the more commonly reported on in literature are namely (Schistosoma) S. haematobium, S. mansoni and S. intercalatum (Ntonifor et al., 2012). Literature has shown that the main species of schistosomes that infect humans are S. haematobium, S. japonicum and S. mansoni with wide distribution (Sady et al., 2015). Other types include S. malayensis and S. guineensis. It is important to note that the adult worms of all species reside within the blood vessels of the mammalian hosts. However, S. haematobium is responsible for urogenital schistosomiasis whereas the other species mainly affect the intestines and the liver (WHO, 2013).

Schistosomiasis is acquired when free-swimming parasitic larvae known as cercariae penetrate the skin of people exposed to infested freshwater. The clinical presentation of schistosomiasis includes an early phase characterised by a dermatitis in the area where the cercariae penetrate the skin of a human host. This can be described as a systemic acute phase caused by the migration of the juvenile worms known as schistosomula through the circulatory system (WHO, 2017, Casmo *et al*., 2014). Acute urinary schistosomiasis may lead to fever, dysuria and haematuria, whereas intestinal schistosomiasis may cause fever, abdominal pain, bloody diarrhoea and tender hepatosplenomegaly. If not treated, symptoms of chronic schistosomiasis may emerge after 5-15 years. The chronic phase can be divided into early and late stages (Bruun and Hansen, 2008).

Finally, an organ specific chronic phase resulting from the eggs laid by adult female *Schistosoma* species in the mucosa of the urogenital tract and the intestine. It is in such that acute inflammation progressively becomes chronic, and hyperaemia, abnormal growths such as polyps and internal haemorrhage are gradually replaced by fibrosis and thickening of the tissues. Bladder cancer is a late stage consequence of *S. haematobium*

infection, while embolization of eggs from the intestine to the liver through the portal system is typical of infection with the other *Schistosoma* species and is responsible for progressive liver fibrosis, portal hypertension and ascites (WHO, 2013).

Children are often heavily infected and may suffer severe morbidity later in their adulthood if not treated. Morbidity is usually as a result of trapped schistosoma eggs in the liver, bladder and kidneys among other organs. The consequences of chronic untreated schistosomiasis include anaemia and growth retardation especially in children. In older people who are untreated, *Schistosoma mansoni* infections are associated with hepatosplenomegaly, portal hypertension, ascites and life threatening variceal bleeding (Secor *et al.*, 2017). For *S. haematobium*, complications such as nephropathy and in some cases bladder cancer have been reported. In addition, it is evident that the socioeconomic consequences on developing countries is enormous especially in Africa where it constitutes a major public health burden in children who are at high risk of being infected. The disease impedes school attendance and leads to absenteeism, ill-health and weak memory, poor performance and productivity, disability and death (Ayoya *et al*., 2012).

In tropics and sub-tropics, human and water contacts can be potential risk factors of schistosomiasis. Fresh waters, natural and artificial dams are areas where schistosomiasis infection and transmission dynamic has been reported to take place (Knowles *et al*., 2015). The persistent human infection has been directly linked to contact with fresh water infested with snail intermediate hosts during fishing and swimming in ponds or dam water, and increasing contact with agricultural and irrigation contaminated water systems (Gurarie *et al.*, 2015, Knowles *et al*., 2015). Schistosomiasis is more rampant in poor rural communities especially places where fishing and agricultural activities are dominant. Domestic activities such as washing clothes and fetching water in infected water expose women and children to infection. Recreational activities like swimming and poor hygiene also make children vulnerable to schistosomiasis (WHO, 2017).

In Zambia, urinary schistosomiasis caused by the trematode *Schistosoma haematobium* has been a major public health problem for many years. The infection affects people of all ages, however, children bear a huge burden. Indeed, efforts to control the disease have focused on mass treatment of school-aged children, with praziquantel (PZQ) advocated

for schools where the prevalence of the disease is 50% or higher (Simoonga et al., 2008). School-age children (aged 5–14 years) in endemic areas such as Zambia have been the primary target of preventive chemotherapy interventions. In view of their recent exposure to infection and consequently the early stage of their chronic lesions, children would also benefit most from treatment interventions. Treatment during childhood therefore prevents chronic morbidity in later years (WHO, 2013). Such treatment may be repeated annually to ensure that levels of infection are kept below levels associated with severe morbidity. However, in communities where reinfection rates are very high, chemotherapy alone may not suppress morbidity and needs to be combined with other interventions such as health education, improvement in the water supply and sanitation, and control of intermediate host snails where applicable (Simoonga *et al*., 2008). The study set out to investigate the prevalence of urinary schistosomiasis among school going children and factors associated with contracting urinary schistosomiasis in Mpongwe district.

1.2 Statement of the problem

Schistosomiasis is among the eight neglected tropical diseases that have remained a public health problem in Zambia for decades despite some control efforts. This is evident from the almost unchanging prevalence rates over time. National statistics indicate that schistosomiasis prevalence ranges between 2% to 77% with some parts of the country having prevalence rates of as high as 99% (MOH, 2014).

It is well documented that about 85% of those who suffer from schistosomiasis live in sub-Saharan Africa. Women washing clothes in infested water are at risk of infection. Poor hygiene practices, playing in mud and infested water make children vulnerable to infection. The risk of infection is highest amongst those who live near lakes or rivers (WHO, 2013). The infection is more prevalent in rural districts especially those close to water bodies such as lakes, rivers, streams, and dams (MOH, 2014).

Schistosomiasis prevalence and morbidity is highest among school children, adolescents and young adults. Thus, the negative impacts on school performance and the debilitation caused by untreated infections demoralize both social and economic development in endemic areas. In this same study conducted recently, it was reported that urogenital

schistosomiasis, caused by *S. haematobium*, is characterized by hematuria, dysuria, bladder wall pathology, hydronephrosis, and it can also lead to squamous cell carcinoma. In adults, the infection can cause genital ulcers and other lesions resulting in poor reproductive health, with sexual dysfunction and infertility. On the other hand, intestinal schistosomiasis, caused by *S. mansoni*, presents with bloody diarrhoea and bowel ulceration, chronic infections progressing to hepatomegaly and/or associated with periportal liver fibrosis, portal hypertension, and hematemesis (Kayuni *et al*., 2017).

The parasites and snail intermediate hosts that cause schistosomiasis in its different forms are well known and documented in literature. However, knowledge on prevalence, intensity and distribution of schistosomiasis infection especially in some rural areas such as Mpongwe district is scanty, underestimated and not well documented.

This study primarily focused on urinary schistosomiasis which was predominantly more common compared to intestinal schistosomiasis in the area at the time when the Ministry of Health conducted a survey which showed a prevalence of 12.8% for the latter in the 19 schools surveyed.

1.3 Study Justification

Studies have shown that human infections with *schistosomes* are widespread in Zambia. This is despite being classified as a moderately endemic country for this infection. Additionally, a recent modelling study suggested an average schistosomiasis prevalence of 26% among school aged children, there is a lack of published data on the present occurrence and distribution of these infections (Shawa *et al*., 2014).

Results in a study conducted by Simoonga *et al*., (2008) showed that the risk of infection with urinary schistosomiasis is diverse in character, and therefore there is need to undertake further localized studies to establish exposure risk factors. Apart from assessing prevalence rates, the study showed that risk factors were not studied in the study sites nor was mapping conducted to quantify the distribution of the problem. There was a lack of information on locally conducted studies that have sought to explore knowledge surrounding local conditions related to exposure states and interventions implemented so

as to inform future programming with evidence based knowledge in such a resource constrained economy.

The Zambian government has also set a goal to eliminate schistosomiasis as one of the eight neglected tropical diseases in the country by 2020. More publications are therefore necessary to identify current gaps that will help planning for interventions and add to information necessary for programme evaluation.

The current study aimed to provide updated epidemiological knowledge that could be useful in pin-pointing the most pertinent exposures and therefore improve on utilization of resources on interventions that would yield the most beneficial results. In view of schistosomiasis elimination initiatives being promoted nationally, focus on information that attempts to address the local risk and associated factors particular to Mpongwe which have perpetuated schistosomiasis endemicity is crucial. The findings of this study may significantly contribute to improving the health of learners in Mpongwe district with emphasis on application of evidence based interventions. Thus after implementation of the recommendations of the study, it is expected that schistosomiasis cases would reduce and findings would add to the body of knowledge information necessary for programme planning, and monitoring.

The potential benefits of this study included contribution of knowledge that may help in in pin-pointing high-risk populations and transmission sites which is crucial in developing relevant and focused control interventions to reduce the burden of these infections. The study may also add knowledge that may assist in providing a robust baseline necessary for monitoring program implementation and impact evaluation.

1.4 Research question

What are the prevalence and associated factors for urinary Schistosomiasis among school going children in Mpongwe district?

1.5 Objectives

1.5.1 General objective

To explore the prevalence of schistosomiasis among school going children and factors associated with contracting urinary schistosomiasis in Mpongwe district.

1.5.2 Specific objectives

1. To determine the prevalence of schistosomiasis among school going children aged 5-14 years in Mpongwe district.
2. To determine factors associated with schistosomiasis transmission in the school going children in Mpongwe district.
3. To map the distribution of schistosomiasis infestation among school going children using the geographical information system (GIS) in Mpongwe.

1.6 Theoretical or Conceptual Framework

Figure 1.1 shows some proximate determinants that predispose communities to schistosomiasis infection such as contact with water bodies contaminated with the snail intermediate host, lack of toilets which perpetuates the transmission cycle as people discharge the eggs in the environment through excrements and lack of knowledge on disease prevention.

The framework also shows various interventions such as mass drug administration, use of toilets, knowledge on disease prevention and control, snail destruction that have proved useful in interrupting the transmission cycle in other countries.

In view of the foregoing, operational definitions of key variables, their associated indicators and means of measurement are provided in table 1.1 to guide the current study processes.

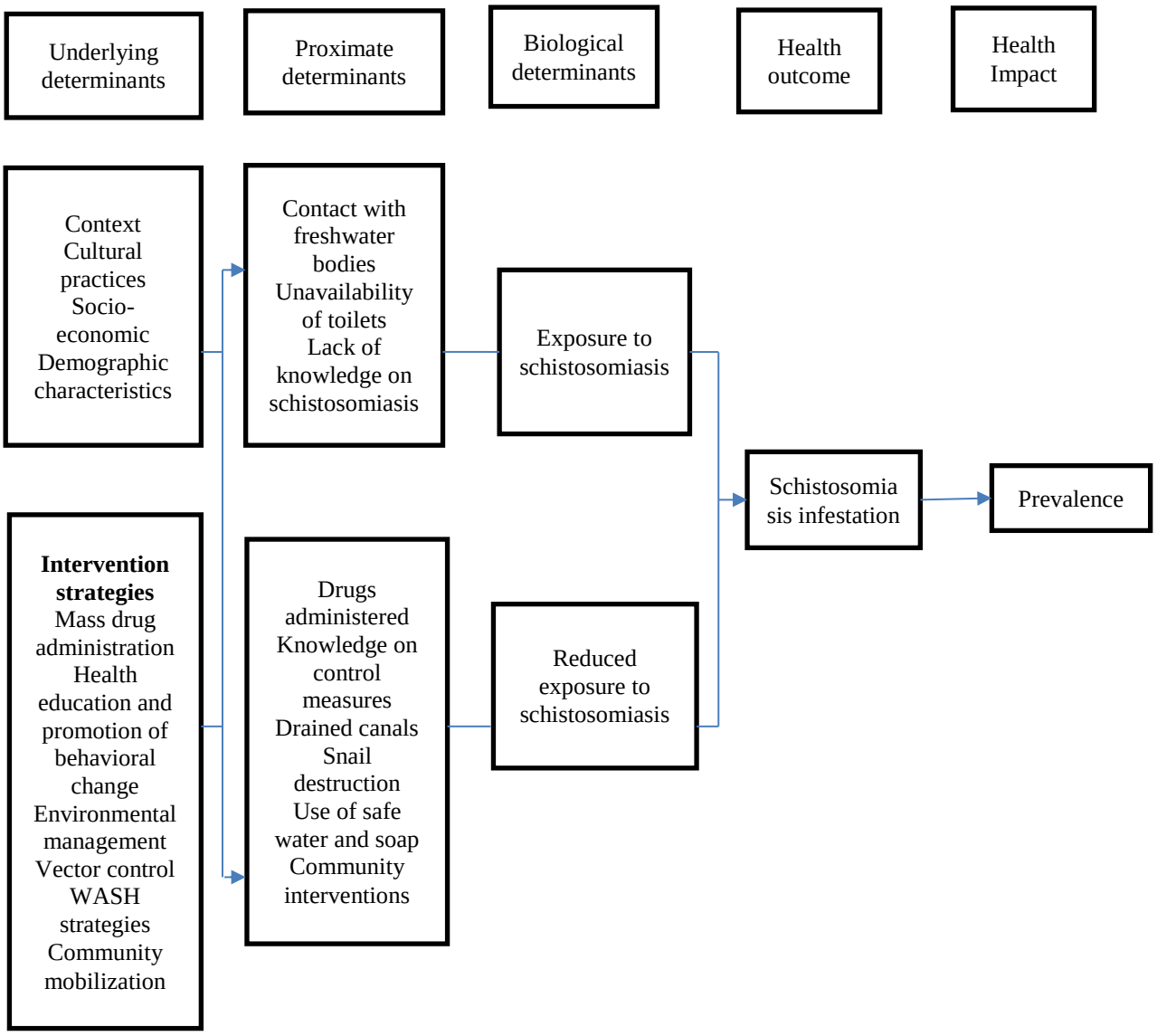

Figure 1.1: Proximate determinants of Schistosomiasis transmission (Lassi *et al*., 2014)

Table 1.1: Operational definitions of variables

Variable	**Indicator**	**Measurement**
Case status	Positive or negative	Binary
Mass drug administration	Number taken the drugs	Ratio
Socio economic status	Low, Middle or High	Ordinal
Contact with water	Number of times with water contact	Nominal
Knowledge of disease	Low, Medium or High	Ordinal
Use of toilet	Yes or No	Binary
Sex	Male or female	Binary
History of disease	Yes or No	Binary

CHAPTER TWO

LITERATURE REVIEW

2.1 Global overview

Schistosomiasis affects almost 240 million people worldwide, and more than 700 million people live in endemic areas. The infection is prevalent in tropical and sub-tropical areas, in poor communities without potable water and adequate sanitation. Urogenital schistosomiasis is caused by *Schistosoma haematobium* and intestinal schistosomiasis by any of the organisms *S. guineensis*, *S. intercalatum, S. mansoni, S. japonicum*, and *S. mekongi*. Several million people all over the world suffer from severe morbidity as a consequence of schistosomiasis (WHO, 2017).

Additionally, schistosomiasis is reported in more than 93 countries and it is reported in literature that globally, *S. haematobium* is the most prevalent species and accounts for 200, 000 deaths annually (Gurarie *et al*., 2015).

2.2 Burden of disease in Africa and Sub-Saharan region

More than 85% of infested populations are severe and mainly found in sub-Saharan Africa, where more than 20 million suffered from a severe form of schistosomiasis complications (Ntonifor *et al*., 2012).

In the region, as a neglected tropical disease of poverty, schistosomiasis ranks second among the most widespread parasitic diseases in Africa. Neglected tropical diseases are causes of about 534,000 deaths annually in sub-Saharan Africa and an estimated 57 million disability-adjusted life-years are lost annually due to the neglected tropical diseases. The neglected tropical diseases exert great health, social and financial burden on economies of households and governments (Adenowo *et al*., 2015).

A review of disease burden estimated that more than 200, 000 deaths per year are due to schistosomiasis in sub-Saharan Africa. The burden of disease due to schistosomiasis is however reported to be underestimated (WHO, 2017).

2.3 Recent disease estimates for Zambia

Schistosomiasis is endemic in Zambia and transmission has continued to occur almost on a steady basis despite efforts to control the disease. One of the recent estimates of schistosomiasis prevalence in Zambia placed the country at 22.1% nationwide in 2012. Historical data shows that prevalence rates were 26.6% in 2003 and 27.9% in 2010. Additionally, 48.4% of the population requiring preventative chemotherapy were school-aged children (Sokolow and Rickards, 2014). Results of the most recent mapping exercise conducted in Zambia depicted in figure 2.1 below highlights the current Schistosomiasis endemicity for Zambia.

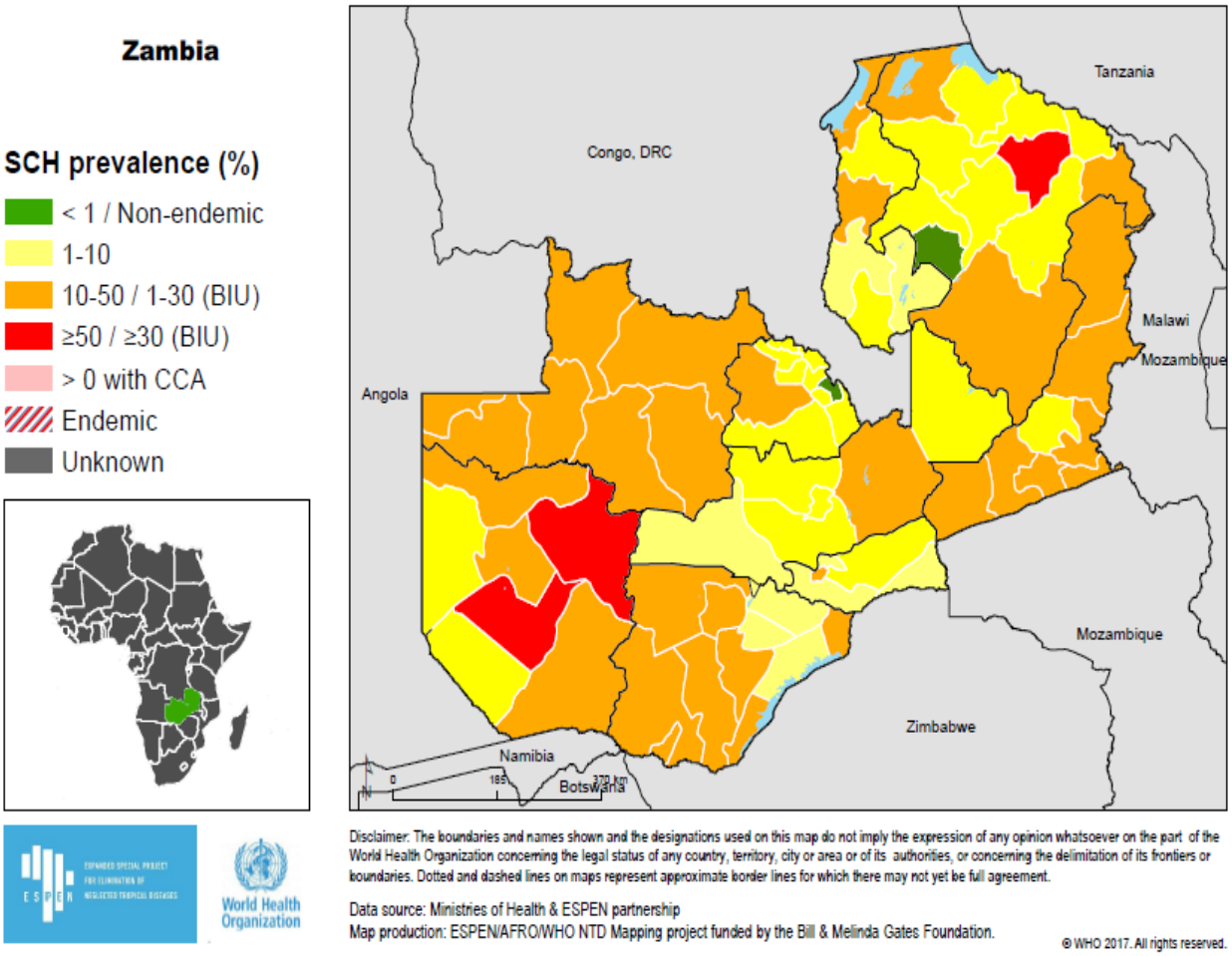

Figure 2.1: Current Schistosomiasis endemicity for Zambia (Source: WHO, 2017)

2.4 Available data on Copperbelt province

There was paucity of information on studies conducted to characterize current burden of schistosomiasis on the Copperbelt province. There have been very few unpublished studies that have been conducted recently aimed at to characterizing the current distribution patterns of the disease. These were mainly undertaken in localized set ups especially following a rise in number of cases of schistosomiasis noted in some schools.

The most recent information on disease prevalence in the province was from a survey conducted in 2012/ 2014 by the Ministry of Health which reported the highest prevalence in Mpongwe district and the lowest in Ndola district (MOH, 2014).

2.5 Mpongwe District Schistosomiasis Profile

There were few studies that I found on schistosomiasis that had attempted to assess prevalence in Mpongwe recently and explore risk or associated factors for transmission of the disease. However, Ministry of Health conducted a mapping for *S. haematobium* at which time the prevalence was estimated at 12.78% (MOH, 2014).

2.6 Most at risk age group to Schistosomiasis

It is well documented that school-age children (aged 5–14 years) in endemic areas are the primary target of preventive chemotherapy interventions. This is due to the fact that children are at highest risk of infection. In view of their exposure to infection and consequently the early stage of their chronic lesions, children would also benefit most from treatment interventions (WHO, 2013).

2.7 Risk factors for schistosomiasis transmission

Current studies have demonstrated that various factors are responsible for the continuous and persistent transmission of schistosomiasis in sub-Saharan Africa. These include climatic changes and global warming, proximity to water bodies, irrigation, dam construction and socio-economic factors such as occupational activities and poverty (Adenowo *et al*., 2015).

Recent evidence from a study of 120 children conducted in Zimbabwe revealed that 98 (81.7%) of the children indicated that they did not consistently use the toilet representing a major risk factor for schistosomiasis transmission. The other risk factors for schistosomiasis were bathing and swimming in rivers and dams 80 (66.7%), watering the vegetable gardens using unprotected water sources 77 (64.7%) and crossing rivers on their way to school bare footed 31.7% (Nyati-Jokomo and Chimbari, 2017).

Much study in the recent past has focused on exploring knowledge, practices and attitudes towards interruption of disease transmission. Findings of one such study suggests that empowering children with knowledge and attempting to modify their water contact, and improved human waste disposal practices are necessary for schistosomiasis control (Maseko *et al*., 2016).

In another study evaluating the effectiveness of health education interventions, the researchers looked at outcomes of interest which included prevalence, incidence or transmission of schistosomiasis, behaviour change associated with infection, or changes in knowledge of the disease. Their findings suggest that health education had a beneficial impact on knowledge and understanding of schistosomiasis within the target groups. However, further research is needed due to the poor quality of the included studies (Price *et al*., 2015).

2.8 Diagnosis of schistosomiasis

Schistosomiasis is diagnosed through the detection of parasite eggs in stool or urine specimens. Antibodies and/or antigens detected in blood or urine samples are also indications of infection. For urogenital schistosomiasis, a filtration technique using nylon, paper or polycarbonate filters is the standard diagnostic technique. Children with *S. haematobium* almost always have microscopic blood in their urine which can be detected by chemical reagent strips. (WHO, 2017).

2.9 Issues surrounding Schistosomiasis treatment

The WHO strategy on use of anthelminthic drugs now makes it possible to control schistosomiasis in poor and marginalized communities. In highly endemic areas, severe

morbidity due to schistosomiasis can be prevented by regular treatment of at risk groups. Praziquantel has been safely administered alongside albendazole and ivermectin, in areas where these drugs have been used separately for preventive chemotherapy (WHO, 2017, Phillips *et al*., 2017).

Mpongwe district has in the past made some efforts to conduct mass drug administration programmes in primary schools through school health and nutrition programmes in order to interrupt transmission pathway of schistosomiasis. From the available records at the district health office, it was reported that previously the district managed to reach approximately 81% in 2015 and 79% in 2016 primary school children with preventive treatment. In the most recent campaign conducted in May 2017 targeting 34, 939 primary school pupils, the district provided chemotherapy using praziquantel to 28, 973 children representing an overall coverage of 83% (DHIS 2, 2017) .

In 2012 more than 35 million people, 83% of them in sub-Saharan Africa, were treated for schistosomiasis. Experience from China and Egypt shows that preventive chemotherapy, mass treatment without individual diagnosis, with high coverage can result on significant impacts on indices of infection and also reduced requirements for praziquantel. Treatment several times during childhood is likely to prevent disease in adulthood (WHO, 2017, Kabuyaya *et al*., 2017).

Studies have clearly shown that this disease has been successfully eradicated in Japan, as well as in Tunisia. Others countries such as Morocco and some Caribbean Island countries have made significant progress on control and management of this disease. Brazil, China and Egypt are taking steps towards elimination of the disease, while most sub-Saharan countries are still groaning under the burden of the disease (Adenowo *et al*., 2015).

A study conducted in Kenya showed that the community heavily relied on mass drug administration. To overcome this situation there was need to increase community based directed services on control, prevention and treatment of schistosomiasis and intestinal worms through engagement of the community directly (Macharia *et al*., 2016).

While there are substantial benefits gained from treatment, one study found that less than one third of the primary school children took preventive treatment for schistosomiasis at the last mass drug administration. Fear of side effects of praziquantel, lack of knowledge of schistosomiasis transmission and prevention and lack of teacher support to take preventive treatment are some of the factors associated with the low uptake of praziquantel among primary school children (Muhumuza *et al*., 2013).

2.10 Other control programmes

It is evident that with the scale-up of preventive chemotherapy, national campaigns will transition from morbidity to transmission focused interventions thus formal investigation of actual or expected declines in environmental transmission is needed as 'end game' scenarios arise. Surprisingly, there are no international or national guidelines to do so in sub-Saharan Africa. (Stothard *et al.*, 2017).

Therapeutic vaccines represent an alternative to chemotherapy (praziquantel) to control this disease. However, the lack of epidemiological data on parasite prevalence may hamper control interventions and the development of vaccination strategies (Senghor *et al.*, 2014).

2.11 Water and Sanitation

Good water supplies and use of safe excreta disposal facilities are very useful in control of schistosomiasis transmission or its interruption. One study conducted recently showed that since schistosomes infect people by passing through intact skin, water supply improvements can prevent schistosome infection through prevention of contaminated water contact. Further, access to and use of, adequate sanitation will catch most Schistosoma eggs and prevent miracidia from infecting intermediate host snails. Additionally, the use of soap or detergent during water contact appears to confer some protection from infection depending on the duration of water contact (Grimes *et al*., 2015).

2.12 Health education and promotion activities

Programmes designed for information dissemination on preventive and control measures must be tailored to the needs of the local community in order to yield positive results. In

a study conducted in Kenya it was established that provision of efficient health education to people residing in schistosomiasis endemic areas is imperative for an effective and sustainable control programme in order to save the lives and future of the most vulnerable population (Mwai *et al*., 2016).

In addition, findings from a recent study conducted in Nigeria showed that apart mass drug administration, school and community-based health education regarding good personal hygiene and sanitary practices is imperative among these communities in order to significantly reduce the transmission and morbidity of schistosomiasis (Dawaki *et al*., 2016).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study design

The study employed a cross sectional study design using primary data collected from sampled primary schools in Mpongwe district from 15 February 2018 to 25 March 2018.

3.1.1 Study setting

The study was conducted in Mpongwe district situated of the Copperbelt province. Mpongwe district is one of the three rural districts and it is the second biggest in terms of land surface area covered. The main occupation for the local residents is mainly subsistence farming and fishing for populations living along water bodies. The district has many water bodies which include lakes, rivers, streams and dams. During the last mapping exercise conducted on the distribution of schistosomiasis species, Mpongwe district had the highest prevalence of *S. haematobium* at 12.78% in the Copperbelt province (MOH, 2014). The problem in Mpongwe was that the distribution of schistosomiasis and its associated exposures in the population were not well documented. Reporting on this disease had mainly been through passive surveillance. There were issues surrounding knowledge on other intervention strategies implemented to address schistosomiasis in the district apart from use of drugs to control the disease. In addition, new infections of urinary schistosomiasis had continuously been reported and were highest among the school-going age group (DHIS 2, 2017).

The district had a total of 96 schools of which 10 are secondary, 49 government (primary), 29 community and 8 private schools. The total number of government and private amounted to 86 primary schools. Almost all schools are predominantly rural in view of the current status of the district which is still classified as a rural district. This study was conducted in the primary schools that were sampled in the sampling frame since that is where the subjects of interest were likely to be found (MOE, 2017).

There are 20 health facilities and two level one hospitals in Mpongwe district namely Mpongwe Mission and St. Theresa (Ibenga) hospitals respectively.

3.2 Study population

The criteria needed to define and describe the population included primary school going children between ages 5 to 14 years in the Mpongwe district is given below. In accordance with central statistical office 2010 population estimates, the 2017 total population for Mpongwe district was projected at 129, 391. Out of this, the population for school going children between the ages 5 to 14 years for 2017 was estimated at 39, 515 (CSO, 2013).

3.3 Inclusion criteria

To be a part of this study a pupil must have been a resident of Mpongwe district for atleast 3 months at the time of the study and aged between 5 to 14 years who were currently attending primary school in any of the schools in Mpongwe district. This is in view of considerations for exposure state and incubation period for acute *Schistosoma* infections generally given as 2 to 6 weeks.

3.4 Exclusion criteria

Primary school children in the target age group who had taken medication for schistosomiasis (praziquantel) within the last three weeks prior to or during data collection and those suffering from other serious illnesses were excluded from the study.

3.5 Data collection methods

In this study data was collected from the study participants using structured questionnaires to facilitate answering of objectives set out in the research design matrix showed in table 3.1. This was conducted with the aid of two research assistants who were trained prior to the study. Electronic tablets were utilized for data collection throughout the study in the study sites.

In this study, I collected urine samples for analysis of presence for schistosoma eggs that would help in determination of the prevalence and geographical distribution of the disease in the population. The study participants were interviewed and requested to provide a urine sample in a container that was provided by the study within specified time frames.

The urine samples were stored in a cool box at temperatures between 2 to 8 degrees Celsius and transported to a designated district hospital laboratory processing and examination.

Table 3.1: Research Design Matrix

Objective	**Unit of analysis**	**Data collection tool/s**
To determine the prevalence of schistosomiasis among school going children aged 5-14 years in Mpongwe district.	Pupils and urine samples sampled randomly	Questionnaire and single urine samples
To determine factors associated with schistosomiasis transmission in the school going children in Mpongwe district.	Pupils selected through a multi-stage cluster sampling method	Questionnaire
To map the distribution of schistosomiasis infestation among school going children using the geographical information system (GIS) in Mpongwe.	Sampled schools	GPS coordinates

3.6 Geographical distribution of schistosomiasis

To determine the geographical distribution of schistosomiasis infection prevalence, positions of all primary schools participating in the study area were mapped using Samsung Galaxy Tab A hand-held electronic devices with an estimated accuracy of ± 10 meters. Data were downloaded with differential correction into a GPS database and analyses were performed using QGIS version 2.18. Mapped school prevalence was categorised according to WHO prevalence thresholds for mass drug administration: 0.1-9.9%, 10–49.9% and 50-100% (Odiere *et al*., 2012).

3.7 Parasitological methods

A questionnaire was administered on each pupil providing a urine sample to collect information on the sex, age, water contact, symptoms of urinary schistosomiasis, knowledge about the disease, and past praziquantel treatment.

After administration of the questionnaire, 50 mL screw-capped containers pre-labelled with serial correlated with the questionnaire number was given to each participant for the collection urine samples.

The samples were transported within 6 hours of collection in suitable cool boxes at temperatures between 2 and 8 °C for processing and eventual laboratory examination at Mpongwe mission hospital laboratory on recommendation of the district health office.

Urine filtration techniques were used for analysis of egg counts. The urine samples were examined for haematuria using a dipstick test and then examined for the presence of *S. haematobium* eggs by a sedimentation method. The laboratory performed two filtrations of 10mL each on a single urine sample using a filter at which stage the filters were examined for *S. haematobium* eggs under a light microscope and number of *S. haematobium* eggs were counted. All parasitological examinations were performed by trained laboratory technologists. Egg counts of *S. haematobium* were performed and recorded as eggs per 10 millilitres of urine (EP10 mL) obtained from each study participant, and the intensity of infection was graded as light (1-50 EP10 mL) or heavy (> 50 EP10 mL) (WHO, 2002).

In order to assure validity and reliability of the analysis results, 20% of the samples were re-examined for the presence of *Schistosoma* eggs by a senior laboratory scientist for quality control purposes.

3.8 Sampling

3.8.1 Sample size estimation

The minimum sample size was computed using the formula for prevalence study. A prevalence of 12.78 % found in one previous surveys conducted in Mpongwe district was used in the computation of the minimum sample size required for this study (MoH, 2014).

Where n=sample size, z=1.96 (95%significance level), p=prevalence, Ɛ=precision (error)

$n = z^2 \times p(1-p) / \varepsilon^2$

$n = 1.96^2 \times 0.13 \times 0.87 / (0.05)^2$

n = 173.79 therefore the sample size is 174

10% was added to account for nonresponse rate. Increasing numbers by approximately 10% is one means of compensating for anticipated non-response by WHO in surveillance of chronic diseases. This ensured that the total number of people actually participating in the survey was at least the minimum required (WHO, 2005).
Therefore, 174 + 17.4 = 191.4 (192)

Then we multiplied by 2 to take care of the design effect in view of use of a sample size not in conformity with the formula.

Required sample size was given as 192 x 2 = 384

Total number of enrolled pupils = 390

3.8.2 Sampling method

The sampling method used to select participants was a multi-stage cluster sampling method. Probability proportion sampling to size was applied in assigning appropriate numbers of pupils that constituted part of the sample per school The first stage involved the selection of schools, then the second stage comprised selection of classrooms and the third stage consisted of simple random sampling for selection of respondents from the various classes with subjects of interest.

The sampling frame was consolidated using information for the total number of children enrolled in primary school within the age group of interest from the 86 primary schools in the district through available registration books.

A list of all primary schools in this case 86 with school going children from 5-14 years was generated. A list of pupils per schools from all schools was made in order to determine the sampling interval and determine the random number to apply to the

calculated sampling interval. I then determined that I was going to collect data in 15 schools given my logistical capabilities from the generated list by applying a sampling interval to the aggregated sub-populations of the schools. I determined the sampling Interval (SI) using the formulae SI = P/n, where P was the total number of primary school children in 2018 and n was given by the number of clusters (SI=31,850/15=2,123). To determine the first cluster for investigation, a random draw of numbers was made from 1 and the corresponding sampling interval (2,123) using a mobile phone application known as random sample generator which was given as 1,720. The school with the closest number of school children to the SI number was chosen first. Subsequent schools were selected by adding the number of children from the initial school to the SI.

At second stage (classroom level), I selected an even number of pupils to participant in the study based on the available classrooms with pupils from 5 to 14 years of age in the different grades meeting the criteria. All classrooms with subjects of interest were given an opportunity to make up the required sample size.

The third stage involved application of simple random sampling to select the respondents from each class in the different grades. Random numbers were automatically generated using an application and then pupils with correcting numbers were selected for interview and eventual submission of a urine sample.

A total of 26 children were selected from each of the 15 schools to make up the required sample size of 390.

3.9 Validity of research instruments

Validity refers to 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 (Heale and Twycross, 2015).

In this study, some measures were taken into account to ascertain face and content validity. For face validity the instrument (questionnaire) was submitted to colleagues and supervisors to evaluate if the items are representative of the purpose of the study. Health workers and teachers in Mpongwe district went through the data collection tool and their recommendations were taken into account in improving the tool.

For content validity, the literature as well as the existing policies of the Ministry of Health were utilized to ensure conformity to national guidelines and international norms.

3.10 Reliability of research instruments

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 (Heale and Twycross, 2015). Pre-test of the instruments was conducted in Masaiti district amongst school going children following translation of the tool into lamba language which is also spoken in the proposed study site to determine whether they will bring out the required responses from respondents. The exercise was undertaken from 2nd to 6th October 2017 following translation into Lamba.

The pilot study was aimed at determining the reliability of the questionnaire including the wording, structure and sequence of the questions.

3.11 Data management and analysis

Following data collection, the questionnaires were thoroughly checked for completeness and for consistency. Thereafter, the questionnaires were coded and entered into entered in Microsoft excel 2013 for cleaning and then exported to STATA version 14) for analysis using STATA version 14.2 SE (Stata corp, College Station, TX 77845, USA).

I utilised a weighted survey analysis in view of survey data that was collected with a design effect set at 1.2 to account for multi-stage clustering. The relationships between characteristics of infection (prevalence) and other such as age, sex, social economic status water contact, mass drug administration, history and knowledge of disease, were tested.

The data were tested for normality assumption using a histogram and Q-Q plots. The median and interquartile range were reported for age since the data was not normally distributed. Fisher's exact test was used to compare categorical variables in view of observations that were less than five.

3.12 Ethical considerations

Ethical approval was sought from ERES CONVERGE IRB (**Ref. No. 2017-Jul-027**) for permission to proceed with the proposed study. Permission was granted by the Ministry

of Education through Mpongwe District Education Office to conduct this study in primary schools of Mpongwe district. The Zambia National Health Research Authority equally gave permission for the study to be conducted (**MH/101/23/10/1; Date 11th December 2017**).

Parents and guardians gave written consent allowing children to participate in the study. All children who enrolled in the study signed assent forms for minors prior to participation. All participating children were required to assent to the study willingly and no means of coercion were employed to enrol them into the study. Each participant was then interviewed privately in order to assure privacy and confidentiality.

In addition to administration of a questionnaire, urine samples were collected from all eligible children for parasitological analysis. The samples were collected from the toilets for males and females respectively at different time intervals. Participants were informed that urine samples were only going to be used for the examination for Schistosoma ova after which they would be discarded. The sampling containers were coded with unique identifiers and secured in some biohazard zip locks and then placed in cold boxes.
All information obtained from each study participant was kept confidentially and participants were accorded privacy during the process of sample collection and submission.

No payments, food, nor any other gifts were given to any participants taking part in the study.

Children that were found positive for schistosomiasis were referred to the nearest health facility for treatment with the appropriate medication and dosage per body weight.

3.13 Dissemination Plan

Results from this study will be disseminated to Ministry of Health, Copperbelt Provincial Health Office, Ministry of Education, Mpongwe District Education Office, The University of Zambia School of Public Health and other stakeholders. The report will be published in one of the journals after completion of an abstract and the full scientific paper.

3.14 Limitations

I acknowledge the possibility of an underestimation of the prevalence rate (1%) in view of only a single specimen of urine analysed per pupil. Generally, multiple specimens at different periods from each participant are recommended for better yield of egg count and determination of infection. I could not collect multiple specimens due to challenges in financial resources and time limitation. However, I ensured that each laboratory specimen was double checked by a senior laboratory technologist following initial assessment by a laboratory technologist.

I could not perform multiple logistic regression due to the few number of positive cases with reference to the rule of 1 variable per 10 events (van Smeden *et al*., 2016). However, I compared my findings with multiple studies conducted in similar settings to facilitate understanding of associated factors. I strongly believe that the findings are valid and useful as an epidemiological update on current prevalence in the most at-risk age group and may help shape future control programmes targeted at this vulnerable age group.

CHAPTER FOUR

RESULTS

4.1 Sample characteristics

A total of 390 school going children were enrolled in the study from 15 different schools. The sex ratio (M/F) was 0.9, with 184 boys and 206 girls. The median age was 12 (IQR 7, 14 years). About 13% of the respondents came from households whose guardians did not work, 68% representing the majority were from homes whose guardians were in informal employment and about 18% from households whose guardians were in formal employment as shown in Table 4.1.

Table 4.1: Demographic and socio-economic characteristics of respondents

Characteristic	Total n (%)	Positive (%)	Negative (%)
Sex			
Female	206 (52.8)	0 (0)	206 (53.4)
Male	184 (47.2)	4 (100)	180 (46.6)
Total	390 (100)	4 (100)	386 (100)
Occupation of guardian			
Did not work	52 (13.3)	0 (0)	52 (13.5)
Informal	265 (68.0)	4 (100)	261 (67.6)
Formal	73 (18.7)	0 (0)	73 (18.9)
Total	390 (100)	4 (100)	386 (100)
Name of School (Location)			
Butikili	26 (6.7)	0 (0)	26 (6.7)
Chawama	26 (6.7)	0 (0)	26 (6.7)
Chipese	26 (6.7)	0 (0)	26 (6.7)
Francis Mazzieri	26 (6.7)	0 (0)	26 (6.7)
Ibenga	26 (6.7)	0 (0)	26 (6.7)
Kabya	26 (6.7)	0 (0)	26 (6.7)
Kalunkumya	26 (6.7)	0 (0)	26 (6.7)
Kanyenda	26 (6.7)	0 (0)	26 (6.7)
Kasamba	26 (6.7)	2 (50)	24 (6.2)
Lesa	26 (6.7)	0 (0)	26 (6.7)
Machiya	26 (6.7)	0 (0)	26 (6.7)
Mpongwe	26 (6.7)	0 (0)	26 (6.7)
Munkumpu	26 (6.7)	0 (0)	26 (6.7)
Musanganshi	26 (6.7)	0 (0)	26 (6.7)
Perculiar	26 (6.7)	2 (50)	24 (6.2)
Total	390 (100)	4 (100)	386 (100)

The age distribution for the study participants had a median age of 12 years [median = 12 (IQR 7, 14)]. The respondents' ages ranged from 7 to 14 years. One outlier was aged 7 years but well within the subjects of interest from 5 to 14 years old. Generally, younger children below 7 years old were unwilling to be asked questions and unable to complete assent forms to facilitate enrolment in the study.

4.2 Schistosomiasis prevalence in the sampled schools

The overall prevalence of urinary schistosomiasis in this study was found to be 1% for boys and 0% among the girls. Individual prevalence rates in the two schools that reported positive cases stood at 0.5% respectively. Kasamba primary school recorded two positive cases of the children sampled while Perculiar private school also recorded the same number of positive cases. Ages for the infected were 12 years (25%), 13 years (25%) and 14 years (50%) respectively.

In view of the small sample size and lack of observations in some categories, bivariate analysis using logistic regression proved problematic as a good number of outputs were empty. Fisher's exact test was instead used to test for independence of association at this stage between schistosomiasis case status, social-economic status and water contact activities depicted in Table 4.2. All 390 pupils submitted urine samples for analysis out of which four positive cases were males and all the female pupils were negative for schistosomiasis. At bivariate analysis, males were more likely to suffer from schistosomiasis compared to girls (p=0.049).

History of past infection with schistosomiasis placed the infected and the non-infected at equal risk of acquiring new infections (p=0.029). From the results, past prophylactic treatment during the school health programme placed the pupils at equal odds of infection compared to those who did not take the prophylactic treatment though the p value was insignificant (p=0.107) as shown in Table 4.3.

Figure 4.1 shows the distribution of schistosomiasis in the schools sampled during the study. Peculiar and Kasamba primary schools recorded two (2) pupils each who tested positive for schistosomiasis infection.

Table 4.2: Association between Schistosomiasis case status, social-economic status and water contact activities

Characteristic	Total N (%)	Positive n (%)	Negative n (%)	Fisher's exact test
Sex				0.049
Female	206 (52.8)	0 (0)	206 (53.4)	
Male	184 (47.2)	4 (100)	180 (46.6)	
Total	390 (100)	4 (100)	386 (100)	
Occupation of guardian				0.764
Did not work	52 (13.3)	0 (0)	52 (13.5)	
Informal	265 (68.0)	4 (100)	261 (67.6)	
Formal	73 (18.7)	0 (0)	73 (18.9)	
Total	390 (100)	4 (100)	386 (100)	
Passed through water source to school				0.545
No	260 (66.7)	3 (75.0)	257 (66.6)	
Sometimes	85 (21.8)	0 (0)	85 (22.0)	
All the times	45 (11.5)	1 (25.0)	44 (11.4)	
Total	390 (100)	4 (100)	386 (11.4)	
Played in water open water body				1.000
No	200 (51.3)	2 (50.0)	198 (51.3)	
Yes, all the time	33 (8.5)	0 (0)	33 (8.6)	
Yes, sometimes	157 (40.2)	2 (50.0)	155 (40.1)	
Total	390 (100)	4 (100)	386 (100)	
Source of drinking water				1.000
Tap or borehole	67 (17.2)	0 (0)	67 (17.4)	
Open water body	153 (39.2)	2 (50)	151 (39.1)	
Spring	1 (0.3)	0 (0)	1 (0.1)	
Well	169 (43.3)	2 (50)	167 (43.3)	
Total	390 (100)	4 (100)	386 (100)	
Source of bathing water				1.000
Tap or borehole	63 (16.1)	0 (0)	63 (16.3)	
Open water body	143 (36.7)	2 (50)	141 (36.5)	
Spring	1 (03)	0 (0)	1 (0.3)	
Well	183 (46.9)	2 (50)	181 (46.9)	
Total	390 (100)	4 (100)	386 (100)	
Taken preventive drug during MDA				0.107
No	58 (14.9)	2 (50)	56 (14.5)	
Yes	332 (85.1)	2 (50)	330 (85.5)	
Total	390 (100)	4 (100)	386 (100)	

Table 4.3: Association between Schisto case status, knowledge of disease and practices

Knowledge of Bilharzia				1.000
No	105 (26.9)	1 (25)	104 (26.9)	
Yes	285 (73.1)	3 (75)	282 (73.1)	
Total	390 (100)	4 (100)	386 (100)	
Knowledge on spread of infection				0.372
Swimming, irrigation	185 (47.4)	3 (75)	182 (47.1)	
Contaminated drink or food	3 (0.8)	0 (0)	3 (0.8)	
Did not know	202 (51.8)	1 (25)	201 (52.1)	
Total	390 (100)	4 (100)	386 (100)	
Knowledge on signs and symptoms				0.184
Knew most	244 (62.6)	2 (50)	242 (62.7)	
Knew a few	18 (4.6)	1 (25)	17 (4.4)	
Did not know	128 (32.8)	1 (25)	127 (32.9)	
Total	390 (100)	4 (100)	386 (100)	
History of disease				0.029
No	361 (92.6)	2 (50)	359 (93.0)	
Yes	29 (7.4)	2 (50)	27 (7.0)	
Total	390 (100)	4 (100)	386 (100)	
Knowledge on prevention				1.000
Avoid swimming	206 (52.8)	2 (50)	204 (52.8)	
Use of toilet	1 (0.3)	0 (0)	1 (0.3)	
Did not know	183 (46.9)	2 (50)	181 (46.9)	
Total	390 (100)	4 (100)	386 (100)	
Presence of toilet at school				1.000
No	33 (98.5)	0 (0)	33 (8.6)	
Yes	357 (91.5)	4 (100)	353 (91.4)	
Total	390 (100)	4 (100)	386 (100)	
Usage of toilet at school				1.000
No	17 (4.4)	0 (0)	17 (4.4)	
Yes	373 (95.6)	4 (100)	369 (95.6)	
Total	390 (100)	4 (100)	386 (100)	
Presence of toilet at home				0.283
No	31 (7.9)	1 (25.0)	30 (7.8)	
Yes	359 (92.1)	3 (75.0)	356 (92.2)	
Total	390 (100)	4 (100)	386 (100)	
Usage of toilet at home				0.390
All the time	344 (88.4)	3 (75.0)	341 (88.6)	
Sometimes	13 (3.34)	0 (0)	13 (3.4)	
Never	32 (8.2)	1 (25.0)	31 (8.0)	
Total	389 (100)	4 (100)	385 (100)	

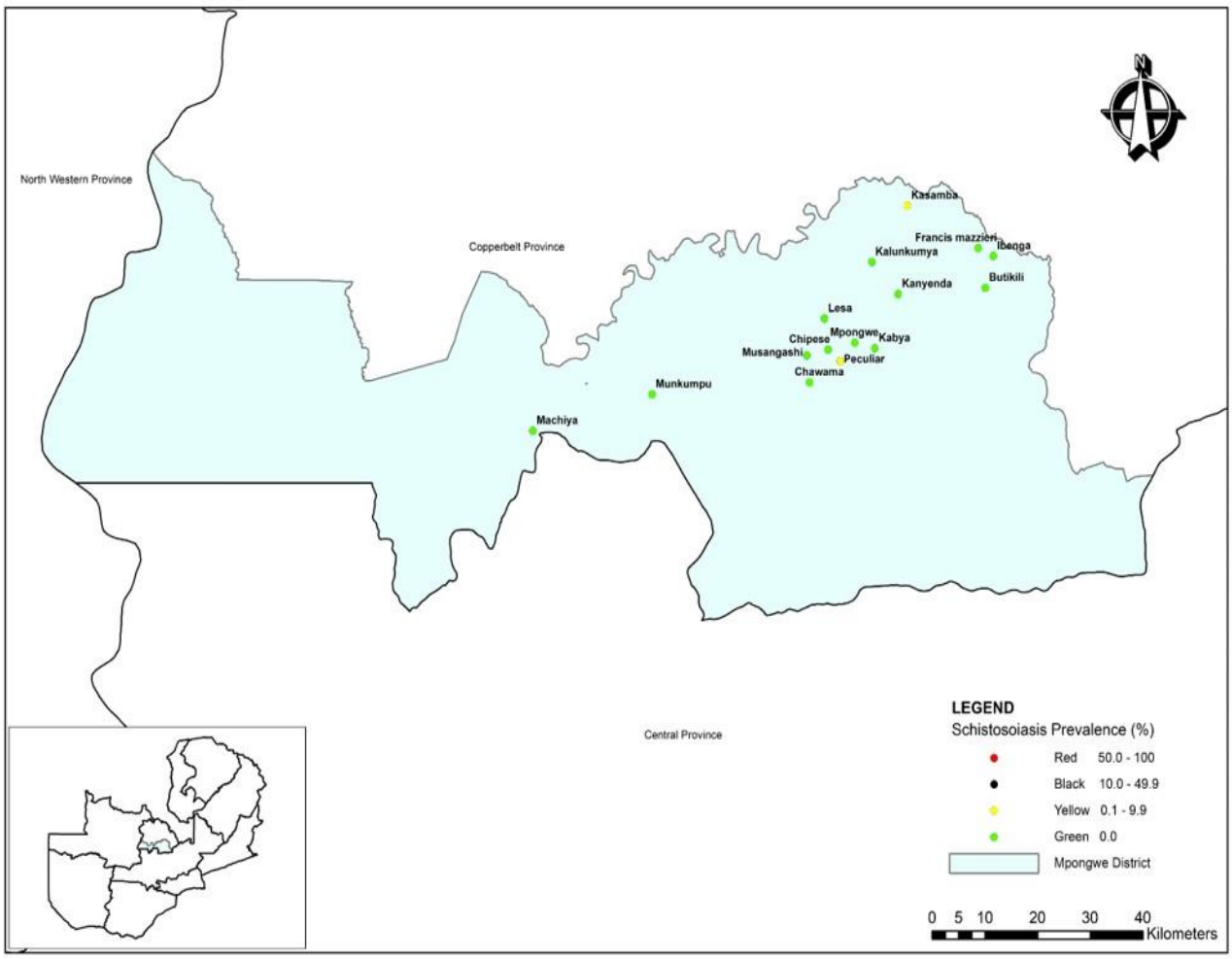

Figure 4.1: Schistosomiasis distribution in sampled schools of Mpongwe district

Figure 4.1 shows the spatial distribution of schistosomiasis among the 15 sampled primary schools that constituted the study site. The schools dotted in green had a prevalence of 0% where as those in red had prevalence rates ranging from 0.1-9.9% indicative of a low prevalence threshold as guided by Word Health Organization.

CHAPTER FIVE

DISCUSSION

5.1 Schistosomiasis prevalence

In this study, I set out to investigate the prevalence of schistosomiasis among school going children from ages 5 to 14 years and risk factors associated with contracting urinary schistosomiasis in Mpongwe district.

I found four positive urinary schistosomiasis cases following laboratory analysis of single urine samples submitted by participants. This accounted for an overall prevalence rate of 1% in all the sampled primary schools in the district. The Ministry of Health conducted a mapping of schistosomiasis countrywide in 2012/2013 among primary schools, *S. haematobium* was endemic in 69 districts while *S. mansoni* was prevalent in 49 districts. Mpongwe district had a reported prevalence rate of 12.8% for S. haematobium (MOH, 2014).

This prevalence rate for *S. haematobium* among the school going children was lower than prevalence rates reported in earlier studies and this was similar to findings from a study conducted in Mozambique where significant decrease in S. *haematobium* was observed in a 5 year period from 60.5% to 38.8% following implementation of chemotherapy (Phillips *et al.*, 2017). A study in Namibia reported that the overall, schistosomiasis prevalence in the surveyed areas was 9.0% indicative of a decrease from previous rates which presented high prevalence areas of around 95% (Sousa-Figueiredo *et al*., 2015).

In another study undertaken in Ghana, recent prevalence of urinary schistosomiasis in the schools ranged from 0 to 10.3% whereas previous prevalence ranged from 1.5 to 52% (Nyarko *et al.*, 2018). The decrease in prevalence among the school going children could be attributed to the mass drug administration programme that was implemented the previous year in all primary schools with high coverages recorded.

Knowledge of schistosomiasis causes, transmission, signs and symptoms and prevention were measured in the study but the results were insignificant. On the contrary, a recent study conducted in Ivory Coast and Mauritania indicated that knowledge of the disease

and the social construction around schistosomiasis influences people's care-seeking choices. The study showed that in one locality (Korhogo) where the population did not use any schistosomiasis prevention strategies, it was clear that a lack of knowledge of schistosomiasis in general influenced the choice of treatment and, more importantly, people's attitude to the disease (d'Arc Koffi *et al*., 2018).

All the four positive cases were males from two schools separate who reported two positive cases each respectively whereas all the females tested negative. This finding is consistent with findings of a studies conducted in Senegal, Ethiopia and Nigeria which demonstrated that majority of boys were more infected with schistosomiasis compared to girls of a similar age group (Senghor *et al*., 2014, Geleta *et al.*, 2015, Atalabi *et al*., 2016). This could possibly be due to high risky behaviours that boys are likely to engage in compared to girls such as frequent swimming in open water bodies and other activities such as fishing which are common in Mpongwe among this age group.

The continued endemicity of *S. haematobium* amongst the school going age group over the years though more recently with lower prevalence will impact negatively on the health and learning outcomes of this vulnerable group as shown in studies conducted in other countries were children missed school due to ill-health from schistosomiasis (Ntonifor *et al*., 2012, Knowles *et al*., 2015, Stothard *et al*., 2017). The sufferers are usually unaware of their infestation status despite on occasions observing unusual signs and symptoms such as bloody urine or painful urination. No comparisons could be made between the urban and the rural parts of the district since the whole district is generally considered as rural. The nature of the study site being a rural district with vast land mass may imply that access to care from health facilities is rare due to long distances to nearby health facilities. Personal feelings such as shyness could also limit discourse on the disease among the pupils and the community at large hence leading to perpetuation of states of illness (Bruun and Hansen, 2008).

My study found that previous history of suffering from urinary schistosomiasis was associated with increased chance of acquiring new infection in future. This finding was similar to observations made in earlier studies conducted in Nigeria and elsewhere (Dawaki *et al*., 2016, Grimes *et al.*, 2015) where it was observed more than a third

(38.8%) of the participants claimed that they had a past history of schistosomiasis. The same studies further showed that laundry, bathing and recreational swimming were among the activities causing most exposure to cercaria-infested water compared to less important activities such collection of drinking water which only involved exposure of small portions of the body for relatively short durations. This observation in Mpongwe district was likely due to the fact that those who suffered from the disease did not seek treatment or perhaps did not get healed from a previous illness with the same disease after treatment. It is also possible that they continuously exposed themselves to the same risk factors that previously predisposed them to acquire the infection. School health and nutrition programmes conducted jointly by ministries of health and education provide opportunities for screening and preventive chemotherapy against the disease. However, such initiatives are usually conducted only once a year due to limitations in human and financial resources hence not all school going children are covered in a given calendar if they had missed school or missed the opportunity for various other reasons.

I also analysed for known associated factors of schistosomiasis such as usage of toilet for urination and water contact activities such as collection of water for cooking and bathing from open water bodies such as lakes, streams, dams and rivers. Analysis of these factors in our study however revealed insignificant results and this was contrary to findings in other studies that demonstrated increased risk of infection from such activities (Knowles *et al*., 2015, Monde *et al*., 2016).

Mpongwe district has many open water bodies such as rivers, streams and dams near most communities that were sampled in the study. At least 50% of those who tested positive for urinary schistosomiasis reported playing in open water bodies sometimes for recreational purposes especially during the hot season. Such activities appear to have placed those who played in water at equal odds of infection compared to those who did not though the associated p-value was not statistically insignificant in our study. On the contrary, a study conducted in Namibia reported that swimming in canals was an important predictor in schistosomiasis infection (Mupakeleni *et al*., 2017).

The majority (95.6%) of school going children reported receiving the preventive chemotherapy while the minority were absent during the school health exercise days. It

was reported that the ministries of health and education last conducted a schistosomiasis mass drug administration exercise in May 2017 in the district with a therapeutic coverage of 83% (DHIS 2, 2017). My study found that taking praziquantel tablets for preventive treatment during the last mass drug administration in primary schools was protective against schistosomiasis infection. This is consistent with findings in other countries such as Sudan where all primary schools were targeted for chemotherapy as a strategy to control morbidity due to schistosomiasis (Lee *et al.*, 2015). The major target were all the primary school pupils who were treated at least once in a year and in some cases twice for areas of high prevalence. The recommended dosage in this strategy is administration of praziquantel 40mg/kg body weight and the chemotherapy was repeated in subsequent years (WHO, 2002).

While mass drug administration programmes have generally been effective, other studies have shown that there is a lack of concern within the global health community for prevention strategies such as emphasis on access to clean water, improved sanitation and hygiene activities that could serve as the pillar of multi-faceted integrated and sustainable disease control programmes (Utzinger *et al*., 2009).

In a study conducted in the Western part of Zambia (Mutengo *et al*., 2014), the researchers demonstrated that variations in infection distribution in different communities have implications for control activities because affected areas may require targeted interventions as opposed to mass interventions. In order to effect a sustained schistosomiasis control programme, there is need to implement various strategies aimed at control of the disease. One study showed that these strategies include indiscriminate mass treatment, snail control, active case finding, and treatment of particular risk groups such as school aged children, snail control and health education (Chimberengwa *et al.*, 2014).

5.2 Strengths

Despite our limitations, our study was able to determine the prevalence and some factors associated with urinary schistosomiasis in primary schools among the school going children. This we believe has provided an important epidemiological update on the disease that is useful for programming and evaluation of control strategies.

5.3 Conclusion

In conclusion, my study found that the prevalence rate for urinary schistosomiasis amongst the primary school going children was currently at 1%. The study also found that previous history of urinary schistosomiasis infection was an important associated factor for acquiring new infections in future. I also found that taking praziquantel tablets for chemotherapy during the last mass drug administration exercise in primary schools was protective against acquisition of schistosomiasis infection. The study demonstrated that schistosomiasis infestation was present in two school localities of the 15 samples schools that were sampled.

5.4 Recommendations

I recommend implementation of strengthened community health education programs to target the at-risk age groups in order to progressively bring the prevalence rate even lower. Regular screening of children in all schools and the community is therefore strongly recommended in order to facilitate early access and linkage to health services. Active surveillance for schistosomiasis is also recommended in the whole district for prompt detection of outbreaks and change in trends of the disease for informed decision making in intervention implementation. This will greatly contribute to Government of the Republic of Zambia's plan of eliminating neglected tropical diseases by the year 2020 in Zambia which includes schistosomiasis.

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APPENDICES

Appendix 1: Information Sheet

Title: Assessment of Prevalence and Risk Factors for Schistosomiasis among school going Children in Mpongwe District, Zambia

INTRODUCTION

This serves to inform you that this study is conducted by Patrick Sakubita, a Master of Science in Epidemiology student in the department of Epidemiology at the University of Zambia.

PURPOSE OF THE RESEARCH:

In this study I am investigating the risk factors for schistosomiasis transmission amongst the school going children. The gathered information will be relevant to the health sector in the country as it seeks to understand the local context pertaining to bilharzia transmission. It will further verify programmes implemented in the control of schistosomiasis. It is hoped that the findings of this study will be used by Ministry of Health and its partners towards achieving its goal of eliminating Bilharzia in the country.

WHY YOU ARE BEING ASKED TO PARTICIPATE

I am asking you to participate in this study because the programme seeks to protect the community and its members from Bilharzia.

PROCEDURES

If you agree to participate in this study, you will be asked to share your perspective on the factors that affect the programme and how well you feel the programme can be implemented. During the interview you will be asked a number of questions and will be required to openly discuss.

RISKS/ DISCOMFORTS

We shall require you to submit a urine sample that will be analyzed for schistosomiasis at the district laboratory. If you agree to take part in the study, there is no physical harm to you, however you may have to recall some experiences that may have caused you emotional distress, or otherwise feelings of discomfort or embarrassed.

BENEFITS

If you agree to participate in this study, there are no direct benefits to you but you will be contributing to the understanding of how well to prevent Bilharzia disease using in your community and in Zambia as a whole.

All children found infected with Schistosomiasis will be referred to the nearest health facility for treatment.

CONFIDENTAILITY

Data collected from you will be kept strictly confidential and can only be shared with your permission and anything you say will be kept completely confidential during the interviews. Your name will not be used to identify you and the information collected. I would greatly appreciate your honest response during the interview.

PRIVACY

All children will be accorded privacy during collection and submission of samples. Each child will be granted personal space and time away from the view of other learners in an enclosed room. The research team will then collect the samples for storage without exposing any participate to public scrutiny.

PARTICIPATION

Your participation in this study is voluntary. You do not have to answer any question you do not want to answer. You can chose to end participation in the study any time you want. You have the right to clarification on any question you do not understand.

<u>For Ethical Queries please contact</u>

The Secretary, ERES Converge
Telephone: +260 955 155 633
+260 955 155 634
Cell: +260 966 765 503
Email: eresconverge@yahoo.co.uk

For any queries please contact

Patrick Sakubita
The University of Zambia
Cell: +260 977691956
Email:sakubitap@gmail.com

Appendix 2: Icipepala Ca Fyebo

Umutwi: Ukufwailisha Ukubapo, Nemasanso ayangalenga ubulwele bwakutunda umulopa pabana abaya kumasukulu mu Mpongwe District, Zambia

IFYAKUTATIKILAPO

Tulukumishibisheni ati ukukufwailisha kulu kucitwa naba Patrick Sakubita abalukusambilila amasambililo ayakulu mucipani cakucingilila amalwashi ayangaponako pesukulu ilikulu ilya University of Zambia.

ICIKULU ICILIMUKUFWAILISHA UKU:

Mulikuku ukusambilila, ndukufwailisha amasanso ayangalenga ubulwashi bwakutunda umulopa pabana abaya kusukulu. Amashiwi twakupoka akofweleshako iciputulwa cabumi mucalo cesu ili cilukufwaya ukwishiba nekumfwisha ifingalengesha ubulwashi bwakutunda umulopa kuliyeyo incende. Nakabili cilukutwalilila ukubona amapekanyo ayacitwa mukucefyako ubulwashi bwakutunda umulopa. Tulukucetekela ati ifikafumamo mulikuku ukufwailisha fikapyungishiwa neciputulwa cabumi nebakubofwako mukulwisha ukushilisha ubulwashi bwakutunda umulopa mucalo cesu ca Zambia.

UMULANDU BAMWIPUSHISHENI UKULIBIMBAMO

Ndukumwipusheni mwebo ati mungalibimbamo mulikuku ukusambilila pakuti aya amapekanyo yalukufwaisha ukucingilila incende nebekalikishi kubulwashi bwakutunda umulopa**.**

IFYAKUKONKA

Kani mwsumina ukulibimbamo mulikuku ukusambilila, mukepushiwa ukulabilapo pafimwishipo pafingalenga amapekanyo ukubula kwenda bwino nefi mwengabona amapekanyo efyo yengabomba bwino. Ilimukalukwambaula, bakamwipusheni amepusho ayafulileko ayalukupengelwa mwebo kuba abakakukile mukwambaula.

AMASANSO/ UKUBULA KUMFYA BWINO

Tulukupengela mwebo ati mwengaleta imikonso yenu pakweba ati bengabonamo kani mwengalukuli utulyongolo tuleta ubulwashi bwakutunda umulopa ku lab yakucipatela. Kani mwasumina ukubulamo ulubali mulikuku ukusambilila, takulipo ukusomenwa

kwamubili ukulikonse, Nangabefyo, mwenganuka ifyamicitikilenipo kunuma ifngalengeshapo mwebo ukusomenwa nekubulo ukumfwapo bwino.

IFYAKUFUMAMO IFIWEME

Kani mwasumina ukubulamo ulubali mulikuku ukusambilila, takulipo ifiweme ifingesa kulimwebo mwenka tau, sombi mukofweleshako ukumfwisha bwino ifituknagacingilila bwino ubulwashi bwakutunda umulopa muncende yenu kabili necalo conse ca Zambia.

Bonse abana abakasangwa na malwishi yakutunda imilopa muli uku ukufwailsha bakabondapa ku cipatala cili mupepi na mwebo.

ICAMFISO

Amashiwi tungapoka kulimwebo yakasungwa lukoso ayamfiso, pano yengambalwa lukoso nabambi nekusuminishiwa lukoso kwenu kwenka eli fyonse ifimukalabila fikasungwa lukoso ifyamfiso mukwambaula konse. Ishina lyenu talikapyungishiwapo pakweba ati mwishikwe ati eko twafumishe ifyebo. Nkatota ukwakuti pakulangisha ukutekanya mumyasukile yenu pa mpindi yakwambaula kwenu nanebo.

ICANKAMA

Pampindi yakupoka ne kupeleka imikosnso, bonse abana bakakwata icamfiso. Onse umwana akalukuli enka mukapinda ukwakubula ebabyakwe pakumpinta imikonse. Akabungwe akakufwailisha kakalukuminta imikonso apakubula ukwishiba neli umo.

UKULIBIMBAMO

Ukulibimbamo mulikuku ukusambilila kwakulipelesha lukoso. Tamwelelwepo ukwasuka amepusho ayo tamulukufwayapo ukwasuka. Mwengasala ukuleka ukulibimbamo mukusambilila pampindi iliyonse iyi mwebene mwatemwa. Mulinensambu shakwipusha pamepusho oyo tamumfwishepo bwino pakuti yalondololwe bwino.

<u>Kani mulukufwaya ukwishibilapo nafimbi pamulandu wa kuku ukusambilila lembeleni neli tumeni lamya kuli ba</u>

The Secretary, ERES Converge
Telephone: +260 955 155 633
+260 955 155 634
Cell: +260 966 765 503
Email: eresconverge@yahoo.co.uk

Kani mulukufwaya ukwishibilapo nafimbi lembeleni neli tumeni lamya kuli ba

Patrick Sakubita
The University of Zambia
Cell: +260 977691956
Email:sakubitap@gmail.com

Appendix 3: Parent/ Guardian Permission Form for Children

WHAT DOES YOUR SIGNATURE AND THUMBPRINT ON THIS CONSENT MEAN

Your signature (or thumbprint/mark) on this form means:

- You have been informed about the program's purpose, procedures, possible benefits and risks.
- You have been given the chance to ask questions before you sign.
- You have voluntarily agreed to be in this program

_____ _____ _____

Name of Participant Signature of Participant Date

Print thumb

Witness (in case of thumb print) _____ sign_____ date _____

Appendix 4: Icitupa Icilukulangisha Ati Abafyashi Basumina Kulibimbamo

Ificalula Ukusaina Neli Ukufwatika Palicici Icipepala

Ukusaina neli ukufwatika pali cici icipepala kulalula ati:

- Bamishibisheni ubukulu bwakufwaisha uku, ifyakukonka eli ifiweme nemasanso.
- Bamipeleni impindi yakwipusha amepusho ili tamungasaina.
- Mwalipelesha mwebene ukubamulikuku ukusambilila.

_____ _____ _____

Ishina lya babulamo ulubali Kusaina kwababulamo ulubali Ubushiku:

Ukufwatika

Imboni (kani kufwatika) _____Ukusaina_____ Ubushiku _____

Appendix 5: Assent Form (Minor Assent Document)

Project Title: **Assessment of Prevalence and Risk Factors for Schistosomiasis among school going Children in Mpongwe District, Zambia**

Investigator: Patrick Sakubita

We are doing a research study about the risk factors for schistosomiasis transmission amongst the school going children. A research study is a way to learn more about people. If you decide that you want to be part of this study, you will be asked to answer some questions and submit samples of your urine in containers that I will provide at the end of the interview. The whole exercise is expected to take less than 20 minutes.

There are some things about this study you should know. If you agree to participate in this study, you will be asked to share your view of the factors that affect the bilharzia, some personal information about your household, and you will be asked a number of questions on your daily life habits that you will be required to openly discuss.

If you agree to take part in the study, there is no physical harm to you, however, you may have to recall some experiences that may have caused you emotional distress, or otherwise feelings of discomfort or embarrassed.

Not everyone who takes part in this study will benefit. A benefit means that something good happens to you. We think these benefits might be that you will be contributing to the understanding of how well to prevent Bilharzia disease in your community and in Zambia as a whole.

If you do not want to be in this research study, we will tell you what other kinds of treatments there are for you.

When we are finished with this study we will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that is okay too. Your parents know about the study too.

If you decide you want to be in this study, please sign your name.

I, _____, want to be in this research study.

_____ _____

(Sign your name here) (Date)

Appendix 6: Icitupa Icilukulangisha Ati Umwanike Asumina Kulibimbamo

Project Title: **Ukufwailisha Ukubako Nefilengesha Ubulwashi Bwakutunda Umulopa Pabanike Abaya Kumasukulu Mu Mpongwe District, Muno Mu Zambia.**

Abakufwailisha: Patrick Sakubita

Tulukaya eli tufwailisha ifingalengesha ubulwashi bwakutunda umulopa pabanice abaya kusukulu. Uku ukufailisha ninshila imo yakusambililamo ifngi pabantu. Kani wasumina ukubulamo ulubali mulikuku ukusambilila, ndukukwipushako amepusho eli nakakulomba ukuleta imikonso yobe mukakopo akanakukupela pakushilisha ukwambaula nobe. Ukwambaula konse takulukufikako kumamineti 20.

Palifimbi ifiwelelwe ukwishibilapo palikuku ukusambilila. Kani usumine ukubulamo ulubalimulikuku ukusambilila, ndukukwipusha ati nawebo ulabilepo pafiwishipo ifingalengesha ubulwashi bwakutunda umulopa, nemepusho pali webo yalukwipushiwa neyapang'anda pobe kabili ulukwipushiwa amepusho aya fulileko pamwewo wobe nefi ucita cilabushiku. Ube umukakulukile mukwambaula uku.

Kani usumine ukubulamo ulubalimulikuku ukusambilila, takulipo ubusanso ubulibonse kumubili obe. Nangaba ifyo, winganukapo fimbi ifi wapitilemo ifyalengeshe webo ukubula ukumfwa bwino neli ukmfwa isnoni.

Talipo ni bonse abalukubulamo ulubali muli bubu busambishi abakusangamo ifweme. Iciweme cilikwalula ati fimbi ifiweme fingacitika kuliwebo. Tulukulanguluka ati ifiweme ifi nipakuti webo ulukulundapo ubwishibilo bwa kucingilila ubulwashi bwakutunda umulopa muncende yobe ne calo conse ica Zambia. Kani wakana ukuba mulikuku kusambilila, tulukukweba inshila shimbi isha kuposehamo kuliwebo.

Pakukshilisha uku kusambilila, twakulemba ifyebo ifi tukasambililamo muli kuku ukusambilila. Mulififi ifyebo tamukabapo ishina lyobe neli ukulangilila ati emo wali muli kuku ukusambilila.

Tekuti ubepo muli kuku ukusambilila kani taulukufwayapo. Kani twatatika ukusambila eli watemwa ukuleka, cili lukoso bwino. Abafyashi bobe nabo balishi uku ukusambilila. Kani watemwa ati ungaba muli kuku ukusambilila, nakukombetela ati ulembe ishina lyobe.

Nebo, _____, ndukufwaya ukuba muli kuku ukusambilila.

_____ _____

(Saina apa) (Ubushiku)

Appendix 7: Questionnaire on Schistosomiasis

Submitted in fulfillment of the requirement for the **MASTERS IN PUBLIC HEALTH**
School of Public Health, **UNIVERSITY OF ZAMBIA**
Supervisor: Dr. Mpundu Makasa
Co-supervisor: Mr. Mumbi. Chola

Note to the respondent

 I need your help to investigate the risk factors for bilharzia in Mpongwe District, Copperbelt province. Information from this research will enable us to come up with possible locally applicable solutions to this problem.

 We would like to collect urine samples from school children. The children who will be found positive will be treated.

 Although the survey is voluntary, your input would be extremely valuable.

 Your responses to this questionnaire will remain confidential and will only be used for the purpose of this study.

Note to Interviewer

 Please do not read out answer options but tick all that apply as respondent answers

SECTION A: GENERAL INFORMATION

GPS Coordinates:

Latitude_____ Longitude_____

1. Date_____

2. Name of the school _____

3a. Sex: Female/ Male 3b. Age (in years) _____

4a. Grade _____ 4b. Name of village_____

5. Who is looking after you? (Please tick all that apply)
(a) Mother
(b) Father
(c) Both
(d) Grandparents
(e) Relatives

6. Do you eat any food before leaving for school? (Please tick one appropriate answer)
(a) Yes, all the time
(b) Yes, sometimes
(c) No

7. Do you carry food to eat at school? (Please tick one appropriate answer)
(a) Yes, all the time
(b) Yes, sometimes
(c) No

8. What does you guardian/s do for his/ her work living? (Please one that applies)
(a) Formal employment
(b) Informal employment
(c) Does not work

9. How many members are in your household?
(a) Adult_____ (18 years and above)
(b) Children_____ (0 to 17 years)

SECTION B: WATER CONTACT

10. What mode of transport do you use to go to school? (Please tick one appropriate answer)
(a) Walk
(b) Bicycle
(c) Ox cat
(d) Other (specify)_____

11. Do you pass through water on your way to school? (Please tick one appropriate answer)
(a) Yes, all the time
(b) Yes, sometimes
(c) No

12. Do you play in river, stream, lake or dam water? (Please tick all that apply)
(a) Yes, all the time
(b) Yes, sometimes
(c) No

13. If yes, where? (Please tick all that apply)
(a) River
(b) Stream
(c) (Other (specify) _____

14. Where do you get water for drinking? (Please tick all that apply)
(a) Tap
(b) River

(c) Stream
(d) Well
(e) Other (specify) _____

15. Do you boil or treat with chlorine water before drinking? (Please tick one appropriate answer)
(a) Yes, all the time
(b) Yes, sometimes
(c) No

16. Where do you get water for bathing? (Please tick one appropriate answer)
(a) Tap
(b) River
(c) Stream
(d) Well
(e) Other (specify) _____

SECTION C: DISEASE KNOWLEDGE

17. Do you know anything about bilharzia? (Please tick one appropriate answer)
(a) Yes
(b) No

18. If yes, how can a person become infected with bilharzia parasites? (Please tick all that apply)
(a) Contact with snails
(b) Irrigation
(c) Fishing
(d) Swimming
(e) Not washing hands before eating
(f) Consuming contaminated food or water
(g) Others (specify) _____

19. What are the signs and symptoms of the disease? (Please tick all that apply)
(a) Diarrhea
(b) Vomiting
(c) Bloody urine
(d) Bloody stool
(e) Fever
(f) Nausea
(g) Abdominal pain
(h) Others (specify) _____

20. Where did you get this information on bilharzia? (Please tick all that apply)
(a) Village headman
(b) Clinic
(c) Radio

(d) School
(e) Friends
(f) Family
(g) Other (specify) _____

21. Do you think that bilharzia is a problem in your community? (Please tick one appropriate answer)
(a) Yes
(b) No
(c) Not sure

22. Have you or any family member suffered from this disease before? (Please tick one appropriate answer)
(a) Yes
(b) No
(c) Not sure

23. If yes, who suffered from the disease? (Please tick all that apply)
(a) Mother
(b) Father
(c) Brother
(d) Sister
(e) Relative

24. Do you know if he/ she received any medication? (Please tick one appropriate answer)
(a) Yes
(b) No
(c) Not sure

25. What do you do to prevent being infected with bilharzia? (Please tick all that apply)
(a) Avoiding swimming in or contact with infected water
(b) Application of chemicals
(c) Weeding the canal bank regularly
(d) Use protective gear during water contact activities
(e) Avoid urinating in water bodies
(f) Use of the toilet regularly
(g) Other (specify) _____

SECTION D: AVAILABILITY OF ABLUTION FACILITIES AT HOME AND SCHOOLS

26. Do you have a toilet at your school? (Please tick one appropriate answer)
(a) Yes
(b) No
(c) Do not know

27. Do you use the toilet at your school? (Please tick one appropriate answer)
(a) Yes

(b) No

If yes, skip to question 29

28. If you do not have toilet 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) _____

29. Do you have a toilet at your village? (Please tick one appropriate answer)
(a) Yes
(b) No

30. If yes, how often do you use it? (Please tick one appropriate answer)
(a) All the time
(b) Sometimes
(c) Never

31. If you do not have a toilet at your village where do you go when you need to? (Please tick all that apply)
(a) Neighbor latrine
(b) In the bush
(c) In the water
(d) Other places (specify) _____

32. Do you wash your hands after using the toilet? (Please tick one appropriate answer)
(a) All the time
(b) Sometimes
(c) Never

33. If yes, do you wash your hands with soap? (Please tick one appropriate answer)
(a) All the time
(b) Sometimes
(c) Never

34. Do your teachers teach you about how you can prevent and control bilharzia at your school? (Please tick one appropriate answer)
(a) Yes
(b) No

35. If no, where do you get health information? (Please tick all that apply)
(a) Clinic
(b) Community health worker
(c) Community meetings
(d) Church
(e) Other (specify) _____

SECTION E: URINE SAMPLE TEST RESULTS

36. Test results for bilharzia
(a) Positive
(b) Negative
(c) Unknown

Thank you very much for completing the questionnaire.

If you have further questions or comments, please contact:

Mr. Patrick Sakubita
School of Public Health
Department of Epidemiology and Biostatistics
University of Zambia

Cell +260 97 7691 956

Appendix 8: Amepusho Pabulwashi Bwa Kutunda Umulopa

Ukupelwa mukufwaisha ukufikilisha amasambililo ya chintubwingi pe sukulu ilikulu lya

UNIVERSITY OF ZAMBIA

Abakofwilisha: Dr. Mpundu Makasa

Abakubofwako: Mr. Mumbi. Chola

Ifi elelwe ukwishiba uwakwasuka

 Tulukufwaisha ubwafwilisho ukufuma kuli mwebo pakufwailisha ifya kukatasha pabulwashi bwa kutunda umulopa mu Mpongwe District, kuno kumi godi. Amasuko muli kuku ukufwailikisha yakatofwako ukusanga inshila shakupwishishamo aya amakatasho.

 Tulukufwaya ukupinta imikonso ukufuma kubana besukulu. Abana bakasanganwa nabubu ubulwashi bakapelwa umuti.

 Nangaba ati ukukufwailikisha kwakulipelesha, ukulabila kwenu kwamakwebo ukwakuti.

 Ukwasuka kwenu kumepusho aya kukaba kwamfiso kabili kukabomfiwa lukoso pamulandu wakufwailisha uku.

Ifi elelwe ukwishiba uwakwipusha

 Namikombeteleni tekubelenga amasuko ayepelwe sombi kamuchonga kufilukupalanako kufi balukwasuka.

SECTION A: GENERAL INFORMATION

GPS Coordinates:

Latitude_____ Longitude_____

1. Ubushiku (date) _____

2. Ishina lyesukulu _____

3a. Sex: Umwanakashi/Umwalalume 3b.Ubukulu (mu myaka) _____

4a. Geledi _____ 4b. Ishina lyamushi_____

5. Nibani abakusunga? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Ba mama
(b) Batata
(c) Bonse

(d) Bambuya
(e) Ulupwa

6. Bushe ulalyapo ifyakulya ifili fyonse ili taungaya kusukulu? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane, impindi shonse
(b) Emwane, shimbi impindi
(c) Imwane

7. Bushe ulapintapo ifyakulya kusukulu? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane, impindi shonse
(b) Emwane, shimbi impindi
(c) Imwane

8. Findo abakusunga bachita pabwikalo bwabo? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Bali panchito yakufola pa mwenshi
(b) Balalibombela
(c) Tababombapo

9. Mulimo banga mung'anda mwenu?
(a) Abakulu_____ (Imyaka 18 ukuyapeulu)
(b) Abanike_____ (ukufuma pa 0 ukufika pamyaka17)

SECTION B: Ukukumankana namenda

10. Nichindo wendelapo pakuya kusukulu? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Ukwenda
(b) Nenjinga
(c) Ichikochikala
(d) Fimbi (londololeni)_____

11. Bushe malapita mumenda pakuya kusukulu? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane, impindi shonse
(b) Emwane, shimbi impindi
(c) Imwane

12. Bushe malangalila munika, mumifolo, nangu mufishiba? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Emwane, impindi shonse
(b) Emwane, shimbi impindi
(c) Imwane

13. Kani efyo, nikwisa? (Namikombeteleni chongeni fyonse ifi alabila)

(a) Kunika
(b) Mumufolo
(c) Fimbi (Londoloieni) _____

14. Nikwisa mufumya emenda yakunwa? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Pompi
(b) kunika
(c) mumufolo
(d) Mumukalo
(e) Fimbi (Londololeni) _____

15. Bushe ulepikako amenda nangu kubikako chlorine kumenda ili tamunganwa? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane, impindi shonse
(b) Emwane, shimbi impindi
(c) Imwane

16. Nikwisa mufumya amenda yakusamba? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Pompi
(b) Kunika
(c) Mumufolo
(d) Mumukalo
(e) Fimbi (Londololeni) _____

SECTION C: IFI WISHIPO PABULWELE

17. Bushe ulishipo ifilifyonse pabulwele bwa kutunda umulopa? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane
(b) Imwane

18. Kani mulishi, bushe umuntu kuti aikatwa shani netulongolo twabulwele bwa kutunda umulopa? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Ukukumankana nabakofwa
(b) Kutapilisha
(c) Ukulobesabi
(d) Ukusamba munika
(e) Ukubula kusamba kumaboko ili tamungalya
(f) Ukunwa amenda nekulya ifyakulya mulitulongolo
(g) Fimbi (Londololeni) _____

19.Nifisa ifilangililo nefishibilo fyabulwashi ubu? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Ukupolomya
(b) Ukuluka
(c) Mitundo yamilopa
(d) Utufi twamulopa

(e) Impepo
(f) Umuselu
(g) Mumala ukusomena
(h) Fimbi (Londololeni) _____

20. Nikwisa mwaumfwile pafya bulwele ubu bwakutunda umulopa? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Kubakulu bamushi
(b) Kuchipatela
(c) Kuchilimba
(d) Kusukulu
(e) Babyanji
(f) Kulupwa
(g) Fimbi (Londololeni) _____

21. Bushe ulukulanguluka ati ubu bulwele bwa kutunda umulopa chingaba chakukatasha mumishi mwenu? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane
(b) Imwane
(c) Nshishibilepo

22. Bushe ulingalwalepo nangu umo uwapalupwa alilwelepo ubu ubulwele? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane
(b) Imwane
(c) Nshishibilepo

23. Kani efyo, nibani abalwelepo? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Bamama
(b) Batata
(c) Indume
(d) Inkashi
(e) Abakwasu

24. Bushe kuti waishiba kani alipokelepo umuti ulionse? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane
(b) Imwane
(c) Nshishibilepo bwino

25. Findo uchita pakulichingilila kulibubu ubulwele bwakutunda umulopa? (Namikombeteleni chongeni fyonse ifi alabila)
(a) Ukukana ukusamba neli ukwangasha amenda ayalimo utolongolo
(b) Ukubikako Imiti
(c) Ukusekwila mumusesho wanika libililibili
(d) Ukufwala ifyakuchingilila ili mulukukumana nemenda
(e) Ukubula ukutundila mumenda

(f) Ukubomfya ifimbusu lyonse
(g) Fimbi (Londololeni) _____

SECTION D: UKUSANGWAPO KWA FIMBUSU FYA MENDA PA NG'NDA NEKUMASUKULU.

26. Bushe mulikwetepo chimbusu pe sukulu lyenu? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane
(b) Imwane
(c) Nshishibilepo bwino

27. Bushe ulabomfyapo icimbusu pasukulu? (Namikombeteleni chongeni ilyasuko limo ililingile)

(a) Emwane
(b) Imwane

Kani efyo, tolokeleni kunamba 29

28. Kani taubomfyako icimbusu pasukulu, nikwisa uko uya kani ulukufwaya ukutunda neli ukunya? (Namikombeteleni chongeni ilyasuko limo ililingile)

(a) Mumpanga
(b) Mumenda
(c) Kumbi (londololeni) _____

29. Bushe mulikwetepo icimbusu pamushi? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Emwane
(b) Imwane

30. Kani efyo, miku linga iyo ubomfyako? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Shonse mpindi
(b) Limolimo
(c) Nshingabomfyapo

31. Kani taubomfyapo icimbusu pamushi, nikwisa uko uya kani ulukufwaya ukutunda neli ukunya? (Namikombeteleni chongeni ilyasuko limo ililingile)

(a) Icimbusu chabenamupalamano
(b) Mumampanga
(c) Mumenda
(d) Shimbi imipunda (londololeni) _____

32. Bushe ulasamba kumaboko pakupwisha ukubomfya icimbusu? (Namikombeteleni chongeni ilyasuko limo ililingile)

(a) Impindi shonse
(b) Shimbi impindi
(c) Nshingabomfyapo

33. Kani efifyo, bushe ulasamba kumaboko ukubomfya sopo? (Namikombeteleni chongeni ilyasuko limo ililingile)
(a) Impindi shonse
(b) Shimbi impindi
(c) Nshingabomfyapo

34. Bushe abasambishi benu balamifundeni ifi wingachingilila nekupwisha ubulwele bwakutunda umulopape sukulu ilyenu? (Namikombeteleni chongeni ilyasuko limo ililingile)

(a) Emwane
(b) Imwane

35. Kani koku, bushe mulapoka kwisa amashiwi yapabumi? (Namikombeteleni chongeni fyonse ifi alabila)

(a) Kuchipatela
(b) Kubabomfi abakufya bumi aba mumushi
(c) Kumamitingi aya mumishi
(d) Kwikelesha
(e) Kumbi (shimbuleni) _____

SECTION E: Ififumako Mukupimwa kwamikonso
36.Ifitumbukako mukupimwa kwabulwele bwakutunda umulopa
(a) Ukusangwapo kwaka lyongolo
(b) UKubula ukusangwapo kwakalyongolo
(c) Ukubula ukwishiba

Natota ukwakuti pakwasuka amepusho aya.

Kani muli namepusho nayambi, neli fyakulabilapo, tumeni lamya neli kulembelako kuli ba:

Patrick Sakubita
School of Public Health
Department of Epidemiology and Biostatistics
University of Zambia
Cell +260 97 7691 956

Appendix 9: Permission Letter from ERES Converge Ethics Review Board

33 Joseph Mwilwa Road
Rhodes Park, Lusaka
Tel: +260 955 155 633
+260 955 155 634
Cell: +260 966 765 503
Email: eresconverge@yahoo.co.uk

I.R.B. No. 00005948
F.W.A. No. 00011697

20th November, 2017

Ref. No. 2017-Jul-027

Principal Investigator
Mr. Patrick Sakubita
University of Zambia
School of Public Health
P.O Box 50110
LUSAKA.

Dear Mr. Sakubita,

RE: ASSESSMENT OF PREVALENCE AND RISK FACTORS FOR URINARY SCHISTOSOMIASIS AMONG PRIMARY SCHOOL GOING CHILDREN IN MPONGWE DISTRICT ZAMBIA.

Reference is made to your corrections dated 16th October, 2017. The IRB resolved to approve this study and your participation as Principal Investigator for a period of one year.

Review Type	**Ordinary**	Approval No. **2017-Jul-015**
Approval and Expiry Date	Approval Date: 20th November, 2017	Expiry Date: 19th November, 2018
Protocol Version and Date	Version-Nil	19th November, 2018
Information Sheet, Consent Forms and Dates	• English.	19th November, 2018
Consent form ID and Date	Version -Nil	19th November, 2018
Recruitment Materials	Nil	19th November, 2018
Other Study Documents	Inquiry Checklists, Questionnaires, FGD Guides.	19th November, 2018
Number of participants approved for study	384	19th November, 2018

Where Research Ethics and Science Converge

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by ERES IRB must be filled in and submitted to us. Late submission of these forms will attract a penalty.
- ERES Converge IRB does not "stamp" approval letters, consent forms or study documents unless requested for in writing. This is because the approval letter clearly indicates the documents approved by the IRB as well as other elements and conditions of approval.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of ERES Converge IRB, we would like to wish you all the success as you carry out your study.

Yours faithfully,
ERES CONVERGE IRB

Prof. E. Munalula-Nkandu
BSc (Hons), MSc, MA Bioethics, PgD R/Ethics, PhD
CHAIRPERSON

Appendix 10: Permission letter from National Health Research Authority

THE NATIONAL HEALTH RESEARCH AUTHORITY
Paediatrics Centre of Excellence
University Teaching Hospital
P.O Box 30075
LUSAKA

MH/101/23/10/1

11th December, 2017

Patrick Sakubita
University of Zambia
Ridgeway Campus
PO Box 50110
LUSAKA

Re: Request for Authority to Conduct Research

The National Health Research Authority is in receipt of your request for authority to conduct research titled **"Assessment of Prevalence and Risk Factors for Urinary Schistosomiasis among Primary School going Children in Mpongwe District, Zambia."**

I wish to inform you that following submission of your request to the Authority, our review of the same and in view of the ethical clearance, this study has been approved to carry out the above mentioned exercise on condition that:

1. The relevant Provincial and District Medical Officers where the study is being conducted are fully appraised;
2. Progress updates are provided to NHRA quarterly from the date of commencement of the study;
3. The final study report is cleared by the NHRA before any publication or dissemination within or outside the country;
4. After clearance for publication or dissemination by the NHRA, the final study report is shared with all relevant Provincial and District Directors of Health where the study was being conducted, and all key respondents.

Yours sincerely,

Godfrey Biemba
Director/CEO
National Health Research Authority

Appendix 11: Permission letter from Mpongwe District Education Office

All correspondence should be addressed to the District Education Board Secretary and not to any individual name.

In reply, please quote No. .....

REPUBLIC OF ZAMBIA

MINISTRY OF GENERAL EDUCATION

Mpongwe District Education Board

9th October 2017

TO WHOM IT MAY CONCERN

RE: PERMISSION TO CONDUCT RESEARCH ON SCHISTOSOMIASIS (BILHAZIA) IN PRIMARY SCHOOLS IN MPONGWE DISTRICT: MR. PATRICK SAKUBITA

This letter serves to introduce the above named who is a postgraduate student pursuing his Masters in Public Health with the University of Zambia.

Mr. Sakubita has been granted permission to conduct a research project at your school before he graduates.

Therefore, assist him collect data needed for his project.

Lungu C. (Ms)
District Education Board Secretary
MPONGWE DISTRICT

REPUBLIC OF ZAMBIA
MINISTRY OF GENERAL EDUCATION
MPONGWE DISTRICT EDUCATION BOARD
09 NOV 2017
DISTRICT EDUCATION BOARD SECRETARY
P.O. BOX 12, MPONGWE

/gnk