

**HUMAN HEALTH EFFECTS OF EXPOSURE TO  
WASTEWATER AMONG RESIDENTS NEARBY RIVER  
MSIMBAZI IN KIGOGO WARD, DAR ES SALAAM**

**By**

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**A Dissertation Submitted to the School of Public Administration and  
Management in Partial Fulfilment of the Requirements for Award of the Degree  
of Master of Health Systems Management (MHSM) of Mzumbe University**

**2017**

## **CERTIFICATION**

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled; “Human health effects of exposure to wastewater among residents nearby river Msimbazi in Kigogo ward, Dar es Salaam” in partial fulfilment of the requirements for award of Master Degree in Health Systems Management (MHSM) of Mzumbe University.

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## **DECLARATION**

I, Mwalilei Gladson, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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## **DEDICATION**

This dissertation dedicated to my grandfather Mr. Timoth Nyangusi for his prayers and encouragements throughout my study period.

## **LIST OF ABBREVIATIONS**

|         |  |
|---------|--|
| CI      | Confidence Interval                          |
| DAWASA  | Dar es Salaam Water and Sewerage Authority   |
| DAWASCO | Dar es Salaam Water and Sewerage Corporation |
| KM      | Kilometres                                   |
| M       | Metres                                       |
| NEMC    | National Environment Management Council      |
| PPE     | Personal Protective Equipments               |
| P-V     | Probability Value                            |
| SPSS    | Statistical Package for Social Sciences      |
| TSHS    | Tanzania Shillings                           |
| UNEP    | United Nations Environment Programs          |
| WHO     | World Health Organization                    |

## ABSTRACT

**Objective:** This study was designed to investigate human health effects of exposure to wastewater among residents nearby river Msimbazi in Kigogo ward, Dar es Salaam, particularly on skin diseases, respiratory conditions and reproductive problems.

**Methodology:** This case control study recruited 200 respondents, among them 100 were exposed in 500 metres from river Msimbazi and 100 were non exposed 2000 metres far from river Msimbazi. Data were collected using administered questionnaires and analysis was made by Statistical Package for Social Sciences (SPSS) version 21.0.

**Findings:** The present study reports findings from 100 (50%) male and 100 (50%) female respondents. A minimum year of the respondents spent in occupation was 1 year and maximum was 22 years. Among of 200 respondents, 47 (23.5%) had history of skin diseases and 20 (10%) respiratory conditions while 37 (18.5%) reported to have reproductive problems. The skin diseases reported were skin itching and rashes 29 (14.5%), black spots on the skin 12 (6.0%) and scabies 6 (3.0%). The reported respiratory conditions included pneumonia 13 (6.5%), asthma 6 (3%) and wheezing 1 (0.5). The reproductive problems were miscarriage 27 (13.5%), low birth weight 5 (2.5%), preterm birth 3 (1.5%) and prolonged time to pregnancy 2 (1%). The factors that were associated with exposure status were existence of source of pollutants that pollutes river Msimbazi ( $p=0.010$ ), number of years that respondents spent in occupation ( $p=0.016$ ), ignorance of respondents on the use of personal protective equipments such that apron was ( $p=0.013$ ), overall ( $p=0.043$ ) and sunglasses ( $p=0.013$ ). Variables such as age less than 35 years ( $p=0.034$ ), distance less than 0.5 kms in proximity from river Msimbazi ( $p=0.005$ ) were significantly associated with skin diseases. Female respondents ( $p=0.005$ ), nature of respondents occupational for survival ( $p=0.048$ ) were significantly associated with respiratory conditions while respondents education level ( $p=0.000$ ), existence of source of pollutants that pollutes river Msimbazi ( $p=0.002$ ) were significantly associated with reproductive problems.

**Conclusion:** Exposure to wastewater was associated with skin diseases, respiratory conditions and reproductive problems more to exposed residents nearby river Msimbazi compared to non exposed.



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## **CHAPTER ONE**

### **INTRODUCTION TO THE STUDY**

#### **1.1 Introduction**

This chapter provides necessary background information, statement of the problem, general objective, specific objectives, general research questions, and specific research questions, justification of the study and significance of the study.

#### **1.2 Background to the study**

Wastewater is widely used globally to address the crisis of water shortage and it poses significant health problems to exposed population (Walls, 2015). Climatic change has resulted into reuse of wastewater for numbers of issues such as domestic, agriculture and irrigation (Drechsel et al, 2015). Globally, wastewater use affects the health of 1.2 billion people annually (WHO and UNICEF, 2000). It is approximated that, about 40% of the World population in 50 years to come will be at high risk of suffering human health effects associated with exposure to wastewater (Mrutu et al, 2013). Some areas of the World especially third World countries, there is the partial wastewater treatment habit and that's increases the magnitude of public health risks to exposed population (UNEP, 2005).

Stockholm (2010) has argued that industrial sector is a major cause of pollutant that affects water sources because it is responsible for dumping 300-400 million tons of heavy metals worldwide including lead, cadmium, copper, arsenic, chromium, iron and zinc. Raghavachari and Naik (2004) addressed health effects associated with exposure to wastewater as a serious problem Worldwide that need immediate solution. Regardless of health effects resulting from exposure to wastewater such as gastrointestinal diseases, skin infections, reproductive disorders, kidney failure, respiratory conditions, cancer and cardiovascular problems, there is lack of National Institutions responsible for addressing associated human effects of exposure to wastewater by 10% of the countries in Asia, Africa and America (Chen, 2007).

Samuel et al. (2014) recognize wastewater as the greatest feature in Africa and the World at large. Several countries like China, Brazil, Italy, Portugal, Turkey, Lebanon, and Palestine make the use of wastewater to support human activities especially agriculture irrigation (Drechsel et al, 2010). There is large scale water

pollution in Africa and the magnitude of wastewater use in most of its countries pose the public into risk of associated health outcomes (Winker et al, 2014). Incidence of diarrhea, skin irritation, kidney failure and respiratory problem is much higher about 46.9% to adults exposed to wastewater through human activities including agriculture irrigation and construction activities (Jonathan and Lodenius, 1988).

According to UNEP (2005) there is little wastewater treatment in developing countries in most of its cities as they lack appropriate capacity to enforce wastewater treatment in order to reduce public health risks associated with it, report shows that about 20% of exposed population suffering from adverse health effects such as respiratory problems, kidney failure, skin diseases, reproductive problems, and cancer (Lam et al, 2015).

In Tanzania, wastewater has been part of potential resource that supports human activities (Black Smith Institute, 2014). Dar es Salaam being the largest city in Tanzania, the history of water supply is the major problem for many years and that made a reason for wastewater use in the entire country to support human activities (Mushi, 2013). Kigogo as one of populated ward in Dar es Salaam, river Msimbazi cut across the area and population living around are great users of its water (Mwegoha and Kihampa, 2010). One study has found that 71% of residents nearby river Msimbazi are exposed to wastewater through human activities including car washing, irrigation, construction and domestic activities. Despite of anticipated human health effects of exposure to wastewater and its human health effects, still there is no public awake on suspected problems since 44% of nearby residents are susceptible to respiratory problems, skin diseases, cholera, and diarrhea (Mwenda, 2014).

Moreover, river Msimbazi constitutes high level of heavy metals including chromium, cadmium and iron from industries and almost 85% of the city population directs its wastes to river Msimbazi that includes dumpsites, sanitation systems and pit latrines (Black Smith Institute, 2014). On the other hand, researchers have tried to investigate effects of heavy metals from river Msimbazi to natural resources found nearby the area, recommendations were made that wastewater from industries should be treated before directing to river Msimbazi but nothing is done yet from the

respective authorities to enforce wastewater treatments (Mwegoha et al, 2012). However, wastewater use has been associated with adverse human health effects to exposed population (WHO, 2006). Given that, there is no research data on suspected health outcomes, it has made a reason for this study to be undertaken in order to ensure up to date information on human health effects of exposure to wastewater among residents nearby river Msimbazi in Kigogo ward in order to restrain wastewater related diseases in the area.

Through research relevant and responsible authorities such as Dar es Salaam Water Supply and Sewerage Authority (DAWASA) and Dar es Salaam Water and sewerage Corporation (DAWASCO), National Environment Management Council, (NEMC) residents nearby river Msimbazi and the Government at large will be aware on exposure factors and identify mechanisms to prevent further health problems in the area.

### **1.3 Statement of the problem**

It is approximated that, 80% of Tanzania small and large industries are located in Dar es Salaam city (Black Smith Institute, 2014). One study has found that 85% of the city institutions especially industries discharge their wastes such as heavy metals, city dumps, and home sewage pipes via river Msimbazi. Kigogo is one of populated ward in Dar es Salaam with water shortage crisis (Mushi, 2009). River Msimbazi has been an important source of water to nearby residents, its population is exposed to wastewater through human activities like domestic use, car washing, construction and agriculture irrigation. The study made by Mwegoha et al. (2012) stipulated that 69% of residents nearby river Msimbazi are not aware on the importance of personal protective equipments such as gloves, masks, gumboots and aprons that reduces risk of exposure to wastewater.

Mwenda (2014) observed that 40% of residents nearby river Msimbazi lives with higher risk of health problems including respiratory, reproductive and skin diseases due to wastewater exposure. Researchers have tried to address the problem through investigating source of pollutants that possibly can lead into adverse health effects to natural resources near the area and proposed wastewater treatment in order to restrain further health outcomes to exposed population (Black Smith Institute, 2014).



However, relevant authorities such as National Environment Management Council are silent while residents are complaining on influence of industrial wastes that pollute river Msimbazi. Little is known on human health effects of exposure to wastewater among residents nearby river Msimbazi in Kigogo ward, for that reason there was a need for proposed study to be undertaken in order to reveal information on human health effects associated with exposure to wastewater from river Msimbazi.

#### **1.4 General research question**

What are the human health effects of exposure to wastewater among residents nearby river Msimbazi?

##### **1.4.1 Specific research questions**

1. What are skin diseases caused by exposure to wastewater among residents nearby river Msimbazi?
2. What are respiratory conditions caused by exposure to wastewater among residents nearby river Msimbazi?
3. What are reproductive problems caused by exposure to wastewater among residents nearby river Msimbazi?

#### **1.5 General objective**

To investigate human health effects of exposure to wastewater among residents nearby river Msimbazi.

##### **1.5.1 Specific objectives**

1. To determine skin diseases associated with exposure to wastewater among residents nearby river Msimbazi.
2. To determine respiratory conditions associated with exposure to wastewater among residents nearby river Msimbazi.
3. To determine reproductive problems associated with exposure to wastewater among residents nearby river Msimbazi.

## **1.6 General hypothesis**

Exposure to wastewater is associated with human health effects among residents nearby river Msimbazi.

### **1.6. 1 Specific hypotheses**

1. Exposure to wastewater is associated with skin diseases among residents nearby river Msimbazi.
2. Exposure to wastewater is associated with respiratory conditions among residents nearby river Msimbazi.
3. Exposure to wastewater is associated with reproductive problems among residents nearby river Msimbazi.

## **1.7 Justification of the study**

This study intended to examine human health effects of exposure to wastewater among residents nearby river Msimbazi in Kigogo ward. Researched study was guided with the following rationale. River Msimbazi found in Dar es Salaam city, cuts across Kigogo ward where residents nearby use polluted water from river Msimbazi as the main source of water for their daily activities such as domestic use, vegetable irrigation and construction use (Mwegoha and Kihampa, 2010). Moreover, industries and city institutions discharge wastes into the river. Residents nearby the river are exposed to wastewater through their activities. Furthermore, little is known on human health effects of exposure to wastewater among residents nearby river Msimbazi that justified the reason for proposed study to be undertaken in order to fill the gap.

## **1.8 Significance of the study**

This research has its importance to the public as follows; the study provides solutions and recommendations which will assist policy makers and planners to propose appropriate policy for industrial waste treatments before discharged to water sources in order to save the public from further outcomes. Also, this study serves as a guide and future reference for other researchers and readers who have inspiration to venture on the same or related research topic. On the other hand, the study provides

awareness on potential hazards associated with exposure to wastewater among residents nearby river Msimbazi and the world at large.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents review of several literatures related to the study. The chapter is organized into two parts, theoretical review that defines concepts and key terms used in the study together with conceptual framework which provides variables that guide the study and empirical research that provides evidenced information pertaining to the study.

#### **2.2 Theoretical literature review**

Badri et al. (1986) has argued that, wastewater has been used in Europe 100 years back as source of water that support human activities due to limited supply of clean water that rises a demand for wastewater reuse. In recent days has been a widening gap between water supply and demand which increases a need for wastewater use in order to reduce water shortage crisis (Bahri et al, 2015). Wastewater is a combination of or more of domestic effluent consisting fecal sludge and greywater (kitchen and bathing water) from commercial establishment and institutions including hospitals, industrial effluent and other urban runoff, agriculture effluent as suspended matter (Corcoran et al, 2010). Wastewater use has turn as a supplement in developed and developing countries to support economic development activities. Contaminants that are found in wastewater are the major problem to exposed population (Kelvin, 2015).

The use of wastewater in developing countries has increased to the maximum number due to inadequate distribution of clean and safe water, industrialization for rapid economic growth has lead into environmental pollution (Ujang, 2000). Developing countries have policies to encourage industrialization to their countries but waste treatment from industries does not given priority to the maximum since volume of industrial waste for final disposal affects environment resources including water sources like rivers (Buckley and Barclay, 2002). These industrial emissions have led to water pollution not only at local level but even at global level. In other countries like Malaysia, South Africa, Indonesia, Egypt, Brazil and Thailand have

open opportunity to problems arises in water and wastewater management within their societies (Jefferis et al, 2001).

Tanzania as one of developing countries, wastewater use has increased in great level from which most of human activities are supported by the use of wastewater from various sources including rivers and constructed dams. Due to industrialization progress in Tanzania, industrial waste has been directed to nearby water sources that pollutes available clean and safe water. Black Smith Institute (2014) explained on increased level of pollution to river Msimbazi which make its water not safe for use either in domestic, construction or irrigation due to suspected diseases around the area includes reproductive disorders, skin diseases and respiratory problems. Because of its location river Msimbazi has been an important resource to nearby residents in Dar es Salaam.

Lodius (1988) described river Msimbazi known as important source of water to nearby residents in the city of Dar es salaam, due to densely population around the area available water sources does not meet the demands for water supply. As Mwegoha and Kihapa (2010) argues on development of industrial production in Tanzania has stimulated ongoing water pollution in river Msimbazi. Many industries discharge wastes to river Msimbazi including heavy metals that threatening potential users including vegetable cultivators, domestic users and natural resources that are found near the area (CEP, 2006). Industrial wastes discharge affects physical and chemical water quality of river Msimbazi (EPA, 2004). Industrial wastes are discharged untreated from different sources including agro-industries, chemical factories, breweries, soap and steel manufacturing that are located in the coastal of Dar es Salaam (CEP, 2006).

A 2014 report from Tanzania National Environment Management Council (NEMC) describe the existence of more than 8 industries including Breweries, Power Companies, Soap factory and Paint discharged its wastes to river Msimbazi that are partly treated and its toxic cycle affect people's health. Although human health impacts resulted from exposure to heavy metals are know but environmental pollution is still increasing due to most of industries directing its end products to

water sources especially in many parts of Latin America (Katzenelson and Shuval, 1976).

### **Definition of key terms**

#### **2.2.1 Wastewater**

Wastewater is defined as a flow of used water discharged from different sources which includes households, institutions, commercial buildings, municipal sewage networks and industries. Most of industries and other sources of wastewater direct its flow to water sources that includes rivers, constructed dams and lakes (Hussain et al, 2002). There are industrial waste and urban waste, from which industrial waste produced from industrial activities that includes useless metals and urban waste results from city activities including home sewerage pipes, city dumps.

#### **2.2.2 Water pollution**

Water pollution is defined by UNEP (1988) as any physical, chemical and biological change of water quality which affects exposed living organisms and makes water unsuitable for beneficial use. Industrial activities has made water pollution became a great feature in Africa and the World at large that threatening survival of the living organisms.

#### **2.2.3 Heavy metals**

As Jarup (2003) defines heavy metals as those metals having specific density of more than 5kg/cm<sup>3</sup>, it is one of the major threats to human health due to its composition including cadmium, chromium, mercury and arsenic metals. Wendy and Martin (2009) mentioned a list of heavy metals including lead, arsenic, zinc, chromium, cadmium, mercury, silver and barium.

#### **2.2.4 Personal protective equipments**

Personal protective equipments (PPE) are equipments that protect users against health or safety risks at work, these including gloves, hats, eye protection, safety footwear (PPE Regulation, 2015). For users who are exposed into any potential hazards or health risks, there is a need of assessing PPE before its use, maintained and stored properly, there should be instruction on how to use and should be used correctly by exposed populations. Consideration should be made in the workplace,

and the suitable PPE will provide enough protection. Eyes should be for safety spectacles, head for helmets, hard hats, body for disposable overalls, aprons, hands and arms for gloves, legs and feet for safety boots.

### **2.2.5 Health effects associated with exposure to wastewater**

Human health effects associated with exposure to wastewater is a serious problem that cause adverse health effects to population, although seriousness of the mechanisms that reduce the effects of the problem is not given priority (WHO, 1999). Evidence from China demonstrated agriculture irrigation using wastewater that is greatly polluted with industrial wastes from different sources cause health effects including skin irritations, cancer, and liver problems that has increased to a greater number as a results of the use of wastewater (Yuan, 1993). Long term exposure to heavy metals like cadmium, copper, lead, nickel, zinc can lead to health effects including kidney failure, cardiovascular diseases, skin cancer, respiratory problems, depressions and ulcers (Oluseyi, 2011).

### **2.2.6 Skin diseases**

Skin diseases is the medical condition that leads into skin infections for example skin become inflamed, skin irritation, black spots on the skin and scabies. Toxins from industrial waste discharge affects health of exposed population and sometimes may lead to health complications including skin irritations (EPA, 2004).

### **2.2.7 Respiratory conditions**

Najem and Feurman (1994) defines respiratory condition is the body condition that encompasses pathological conditions affecting organs and tissues that makes easy gas exchange in living organisms and cause health effects like asthma, pneumonia and chronic cough. As Wendy and Martin (2009) described long term exposure to heavy metals including chromium can cause breathing problems like asthma, cough, and wheezing.

### **2.2.8 Reproductive problems**

Reproductive problems, is any ill health condition that is associated with reproductive systems, that might lead to miscarriage or still birth (WHO, 1999). Human health effects that are likely to result from toxins exposure including

reproductive effects are still birth, miscarriage, prostate and testicular cancer exposure to heavy metals like Chromium results into reproductive disorders and affects immune function. In pregnant women high level of exposure to heavy metals especially lead may cause miscarriage and in men can damage the organs responsible for sperm production (Wendy and Martin, 2009).

### **2.2.9 River Msimbazi**

River Msimbazi is the longest river in Dar es Salaam and flow roughly 36km from Kisarawe hills to shores of Indian Ocean. Its water is highly polluted with industrial activities. Around 232,000 population living near the area face serious health risks whereby fungus infections, skin diseases, respiratory problems and diarrhea are very common to the area (Mwegoha et al, 2012).

Kihampa (2010) argues that, urban institutions in Dar es salaam city discharge their effluents to river Msimbazi including home sewage pipes, hospitals and industries such as manufacturing batteries, textiles, steel paints and chemical processing. Different activities are carried out along river Msimbazi including irrigation for green vegetables farms, car washing and sand extraction for construction. Most of industries waste contains heavy metals that are very harmful to human health including cadmium, chromium, zinc and iron. Cai et al. (1995) indicate that 99.5% of the cadmium exposure can cause to adverse health effects among nearby residents through their daily activities that are conducted without the use of personal protective materials.

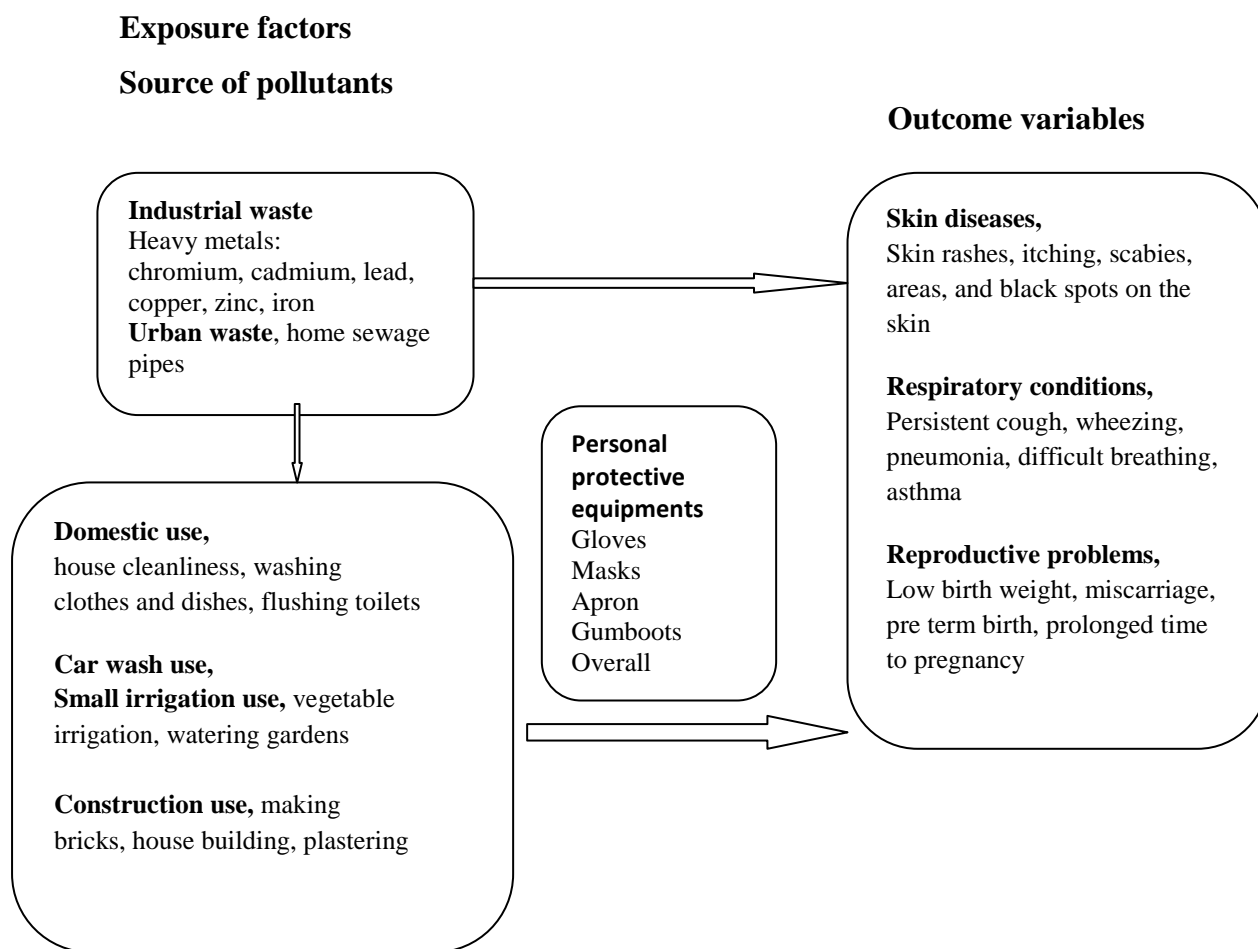
The industrial policy of Tanzania established Sustainable Industrial Development Policy (1996-2020) aimed to enhance sustainable development of industrial sector, with objectives that focus on environment protection, which are the prevention, reduction, control and limitation of damage, and minimization of the risk from generation, management, transportation, handling and disposal of hazardous wastes, other wastes and emissions. For appropriate implementation of this policy, private sectors, government, and environment agencies should rise up their voices in order to protect the public from damage that are caused by environment pollution (Mwenda, 2010).



### 2.3 Conceptual framework

Illustration below describes major variables used in this study, the explanations of which are based on independent, dependent and intervening factors that describe research problem. The description illustrated under this model are based on major pollutants that affects river Msimbazi and its influence on exposure factors like domestic, irrigation, car washing and construction activities that facilitate the occurrence of health outcomes including skin, respiratory and reproductive effects among residents nearby river Msimbazi in Kigogo ward. Ignorance on the use of personal protective equipments increases risk of health outcomes including skin diseases, respiratory diseases and reproductive problems.

**Figure 2.1 Conceptual framework**



**Source:** Researcher's own design

## **2.4 Empirical literature review**

Lam et al. (2015) conducted a study on human health risks of wastewater, human excreta and animal excreta management practices in Southern Asia with comparison to none exposed population. Community become exposed through contact with contaminants during operation of their activities, untreated wastewater contain contaminants like pathogens, heavy metals, hormones. Possible group at risk include those living in the nearby area such as farm workers. For exposed group incidence of diarrhea, skin infection was higher about 32% than non exposed group that proven the effects of wastewater was much higher to daily population who were exposed to wastewater via their human activities.

On the other hand, Batanony et al. (2011) conducted a study on investigating work related health effects among wastewater treatment plants workers who are exposed to wastewater through their daily activities, but were not employing any protection like gloves, aprons, and mask. 43 workers were involved in the study in order to determine association between exposed to wastewater and non exposed group. Respiratory tract problems and cardiovascular were tested, results showed that 20% of wastewater treatment plants workers were at risk of acquiring suspected diseases, whereby symptoms were detected including abdominal pain, wheeze, asthma, dyspnea were more dominant than in the comparison group who were not exposed to treatment plants.

One study conducted by Kelvin (2015) focused on health implications of increasing reuse of wastewater as an adoption to climate change, researcher observed risks associated with population exposed to wastewater were uncertain, there is a need for more research to be conducted before the public will have greater confidence in its use, despite the fact there was no international standards that enforce wastewater treatment in order to minimize risks to exposed population. On other hand an epidemiological literature explained on associated effects in relation to exposure of wastewater near residents, results shows that wastewater exposure increases adverse health effects like low birth weight, birth defects and certain types of cancers that was identified from reported cases among exposed residents. Study proposed that,

there should be mechanisms that will reduce exposure to wastewater in order to decrease further outcomes resulted from wastewater exposure (Vrjiheid, 2000).

Raghavachari and Naik (2004) conducted a study in Eritrea at Asmara city, the objectives were to determine type of pathogens present in the sewage water utilized for cultivation and identified existed pathogens, together with health impacts on farm workers exposed to raw sewage. Findings indicate that 45% farmer's exposed to untreated wastewater was the major cause of the gastrointestinal diseases that affects health of farmers. Negative health impacts were detected including microbial contaminants found to community residents consuming vegetable that are cultivated from untreated wastewater.

As Furhrimann et al. (2014) conducted a study that explained wastewater for agriculture irrigation as a common thing in developing countries. Most of activities are performed with the use of wastewater from which exposure to wastewater associated with chemical hazards that leads into adverse human health impacts. Frequently exposure resulted into health problems that affect people lives around the area. Findings indicate that skin and respiratory problems are very common as a result from exposure factors. Author recommends that, several studies should be undertaken to many parts of the world to investigate on the associated diseases in order to curb further effect to farmers and population at large.

Also Mwenda (2014) conducted a study in Dar es Salaam city along Msimbazi sub catchment area, aimed to find major pollutants that pollute Msimbazi river whereby poorest neighbor use Msimbazi water that is already polluted from urban and industrial wastes. Results were found that, heavy metals like cadmium, chromium, zinc, lead and mercury from industries are major contaminants that pollute river Msimbazi in Dar es Salaam. Chromium concentration was much higher in Kigogo area. Study recommends law enforcement should be emphasized in order to control industrial pollutants through waste treatment. Also researcher proposed the following research should be undertaken to investigate the health related effects of industrial waste discharged in the sub catchment area along Msimbazi river because current study baseline is on levels of industrial pollutants and their effects on water resources among livelihood along Msimbazi sub catchment area.

## **2.5 Research gap**

With consideration of various studies that have been conducted on health effects associated with exposure to wastewater in various part of the World including Tanzania, there are few number of studies that focus on investigating the relationship that exist between exposure to wastewater and its influence on associated human health effects. In Tanzania little studies have been conducted to investigate human health effects of exposure to wastewater, despite of number of studies researched in Tanzania concerning with exposure to wastewater, there is little existing information on human health effects of exposure to wastewater among residents nearby river Msimbazi, that is why, researcher found a need for proposed study to be conducted in order to fill such a gap.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter presents the way a proposed study was designed and conducted , it provides insight on study design, study area, study population, sampling procedure and technique, sample size, tools for data collection, data analysis and ethical considerations.

#### **3.2 Study design**

This proposed research was case-control study that conducted to determine cause and effects relationship that exist among exposed and non exposed group. The emphasize was to explore relationship between exposure to wastewater and associated human health effects among residents nearby river Msimbazi in Kigogo ward.

#### **3.3 Study area**

This study was conducted in Kigogo ward at Kinondoni Municipal in Dar es Salaam city. Dar es Salaam is the largest city in Tanzania. It is located on a natural harbour on the Eastern Indian Ocean coast of Africa. The region is also known as the largest city in Eastern Africa by population and it is regionally significant as economic centre in Tanzania. Kigogo ward was the proposed study area for the reason that river Msimbazi cut across the area, and that river Msimbazi is polluted with wastes resulted from industrial activities and non industrial economic activities. Residents nearby river Msimbazi are exposed into wastewater through human activities including agriculture, domestic and construction activities. The selection of study area was made within a distance of 2000metres from river Msimbazi.

#### **3.4 Study population**

Targeted population was selected based on residents nearby river Msimbazi in Kigogo ward with reflection to inclusion and exclusion criterias. Males and females were chosen in equal bases. The nearby residents who are found within 2000metres far from river Msimbazi were selected to represent the studied population. The population of the study area was divided into two groups that were studied, one group was for exposed population living within 500metres from river Msimbazi and

the other comparison group was made of non exposed population 2000metres far from river Msimbazi.

#### **3.4.1 Inclusion criteria**

This study employed respondents from the age of 18 to 45 years old, for both were exposed and non exposed group who are within 2000metres far from river Msimbazi. The individual inclusion in this study depended on their basic daily activities that employed the use of wastewater from river Msimbazi in Kigogo ward such that domestic use, vegetable irrigation, car washing and construction activities.

#### **3.4.2 Exclusion criteria**

This study did not employ respondents who were above 45 years old and those who were below 18 years old in order to minimize confounder's variables that might be influenced by the age factor. Also those who were not within 2000metres from river Msimbazi were excluded from the study.

#### **3.5 Sampling procedure and technique**

This study recruited non probability sampling method for the purpose of attaining targeted group and to get projected sample, individuals were selected purposely due to their occupational experience such that vegetable irrigation, car washing, and construction activities that represented exposed residents of nearby river Msimbazi in Kigogo ward. This targeted group filled administered questionnaires accordingly to represent the entire population who are within 2000metres from river Msimbazi.

#### **3.6 Sample size**

Sample size was calculated based on the procedures indicated by Sergeant (2017) epidemiological calculator that illustrates two proportion sample size calculation. A total number of 200 respondents were calculated out of 5200 residents nearby river Msimbazi in Kigogo ward.

Formula for sample size calculation was  $n = (Z^2 \times P(1-P)) / e^2$

Where by

Confidence level = 0.95,

Estimated proportion 0.3,

Desired precision of estimate =0.05.

About 200 selected sample size that is within 2000metres from river Msimbazi represent the targeted population.

### **3.7 Tool for data collection**

Administered questionnaires were used to collect intended information to nearby residents who are within 2000metres from river Msimbazi. Questionnaires with the same questions used for both exposed and non exposed group. Questions were divided into demographic characteristics including age, marital status, sex, and monthly income. Exposure factors were distance in proximity from river Msimbazi, wastewater users such as vegetable farmers, car washers and construction technician, years a person spent in occupation, ignorance on the use of personal protective equipments and outcome variables such as personal history on skin diseases, respiratory conditions and reproductive problems with the sub variables.

### **3.8 Plan for data analysis**

Data from the field were collected using administered questionnaires and were coded in excel and imported in Statistical Package for Social Science (SPSS) version 21.0 for analysis, then data were analyzed from descriptive statistics. Demographic characteristics of the respondents were analyzed through frequency, percentages and descriptive statistics. Exposure variables such that respondents occupation for survival, years respondents spent in occupation, ignorance on the use of personal protective equipments and their influence on associated health outcomes such as skin diseases, respiratory conditions and reproductive problems. Cross tabulation were used to find relationship between exposure to wastewater from river Msimbazi and associated skin diseases, respiratory conditions and reproductive problems as outcome variables. Finally, hypothesis was tested with the use of Q-square to

confirm the assumption that exposure to wastewater associated with human health effects among residents nearby river Msimbazi in Kigogo ward.

### **3.9 Ethical considerations**

This study had considered ethical variables for integrity purposes such that the permission for data collection that was given by the government officials from different authorities such as Mzumbe University, Kinondoni Municipal Council and Kigogo ward executive office. Right of respondents was considered in a good judgment since respondents were requested their consent to participate in this study with assurance of highest degree of confidentiality on the provided information.



## **CHAPTER FOUR**

### **PRESENTATION OF FINDINGS**

#### **4.1 Introduction**

This chapter presents the results that were collected from the field in tables and text. The findings presented in this chapter provide answers to specific research questions such as (i) What are skin diseases caused by exposure to wastewater among residents nearby river Msimbazi? (ii) What are respiratory conditions caused by exposure to wastewater among residents nearby river Msimbazi? (iii) What are reproductive problems caused by exposure to wastewater among residents nearby river Msimbazi? Findings are presented in tables whereby table 4.2 demonstrates characteristics of the respondents, table 4.3 presents distributions of demographic factors by exposure status using cross tabulation with measure of association to selected variables and table 4.4 illustrates influence of exposure factors on occurrence of associated health outcomes such as skin diseases, respiratory diseases and reproductive problems by case and control status using cross tabulation.

#### **4.2 Characteristics of the respondents**

Characteristics of the respondents were demonstrated based on social and economic factors that were related with exposure to wastewater among residents nearby river Msimbazi. Number of respondents (200) based on gender whereby 100 (50%) were male and 100 (50%) were female, mean age of respondents were 33.6 years with minimum of 18 years and maximum 45 years. Mean years of a respondents spent in occupation was 7.77 with minimum of 1 year and maximum 22 years and the mean monthly income was 139735 with minimum of 80000 and maximum 300000 thousand Tanzanian shillings. Industrial wastes were the major source of pollutants that affect river Msimbazi about 57% followed by other sources of pollutants including urban wastes. Vegetable farmers were 130 (65%), car washers were 30 (15%) and house construction technicians were 40 (20%).

Table 4.1 demonstrates others variables for more details.

**Table 4.1 Characteristics of respondents and descriptive statistics to selected variables N=200**

| <b>Variable</b>                         | <b>Sub variable</b>                      | <b>Frequency</b> | <b>Percent</b> |
|---|--|------------------|----------------|
| Age                                     | 18 – 35                                  | 118              | 59.0           |
|   | 36 – 45                                  | 82               | 41.0           |
| Education level                         | Never went to school                     | 45               | 22.5           |
|   | Went to school                           | 155              | 77.5           |
| Marital status                          | Single                                   | 48               | 24.0           |
|   | Married                                  | 46               | 23.0           |
|   | Living as married                        | 76               | 38.0           |
|   | Divorced                                 | 18               | 9.0            |
|   | Widow                                    | 12               | 6.0            |
| Occupation for survival                 | Small farmer                             | 130              | 65.0           |
|   | Car washer                               | 30               | 15.0           |
|   | House construction technician            | 40               | 20.0           |
| Monthly income                          | 80000- 180000                            | 166              | 83.0           |
|   | 200000- 300000                           | 34               | 17.0           |
| Years spent in occupation               | 1-11                                     | 165              | 82.5           |
|   | 12- 22                                   | 35               | 17.5           |
| Source of pollutants                    | None                                     | 11               | 5.5            |
|   | Industrial waste                         | 114              | 57.0           |
|   | Urban waste                              | 6                | 3.0            |
|   | Home sewerage pipes                      | 7                | 3.5            |
|   | (industrial waste & home sewerage pipes) | 62               | 31.0           |
| Wastewater users<br>From Msimbazi river | None users                               | 100              | 50.0           |
|   | Domestic use                             | 2                | 1.0            |
|   | Construction use                         | 21               | 10.5           |
|   | Small irrigation use                     | 37               | 18.5           |
|   | Car washing use                          | 18               | 9.0            |
|   | Domestic & small irrigation use          | 19               | 9.5            |
|   | Construction & small irrigation use      | 3                | 1.5            |
| Domestic use                            | None users                               | 179              | 89.5           |
|   | House cleanness                          | 8                | 4.0            |
|   | Washing clothes                          | 2                | 1.0            |
|   | House cleanness & flushing toilets       | 5                | 2.5            |
|   | Washing clothes & flushing toilets       | 3                | 1.5            |
| Construction use                        | None users                               | 175              | 87.5           |
|   | Making bricks                            | 3                | 1.5            |

|                             |  |     |      |
|-----------------------------|--|-----|------|
|                             | Extracting sands                                 | 6   | 3.0  |
|                             | Making bricks & plastering                       | 10  | 5.0  |
|                             | Making bricks & plastering<br>& extracting sands | 6   | 3.0  |
| Irrigation use              | None   | 140 | 70.0 |
|                             | Vegetable irrigation                             | 28  | 14.0 |
|                             | Vegetable irrigation & washing                   | 32  | 16.0 |
|                             | Vegetable after harvesting                       |     |      |
| Major source                | No   | 126 | 63.0 |
|                             | Yes  | 74  | 37.0 |
| Gloves                      | No   | 197 | 98.5 |
|                             | Yes  | 3   | 1.5  |
| Apron                       | No   | 194 | 97.0 |
|                             | Yes  | 6   | 3.0  |
| Mask                        | No   | 198 | 99.0 |
|                             | Yes  | 2   | 1.0  |
| Sunglasses                  | No   | 194 | 97.0 |
|                             | Yes  | 6   | 3.0  |
| Overall                     | No   | 196 | 98.0 |
|                             | Yes  | 4   | 2.0  |
| Gumboots                    | No   | 194 | 97.0 |
|                             | Yes  | 6   | 3.0  |
| Human health effects        | No   | 39  | 19.5 |
|                             | Yes  | 161 | 80.5 |
| Health effects to residents | No   | 105 | 52.5 |
|                             | Yes  | 95  | 47.5 |

#### **4.3 Distribution of demographic factors by exposure status comparing exposed and non exposed residents.**

Table 4.2 presents distribution of demographic factors by exposure status comparing exposed and non exposed residents. Rate of exposure among residents nearby river Msimbazi was associated with ignorance on the use of personal protective equipments since respondents had a faith of using jelly as one of the best protection against exposure to wastewater. Variables such as source of pollutants that pollutes river Msimbazi ( $p=0.010$ ), years a respondents spent in occupation ( $p=0.016$ ), ignorance on the use of personal protective equipments such as apron ( $p=0.013$ ), overalls ( $p=0.043$ ) and sunglasses ( $p=0.013$ ) were significantly associated with increased level of exposure among residents nearby river Msimbazi. Other variables described in the table were not significant since p-value was greater than 0.05.

**Table 4.2: Distribution of demographic factors by exposure status comparing exposed and non exposed residents to selected variables N =200**

| Variable  | Category                               | Exposed ( <b>near</b> ) |      | Non exposed ( <b>far</b> ) |      | P-value      |
|---|--|-------------------------|------|----------------------------|------|--------------|
|   |  | n                       | %    | N                          | %    |              |
| Gender  | Female                                 | 50                      | 25.0 | 50                         | 25.0 | <b>1.000</b> |
|   | Male                                   | 50                      | 25.0 | 50                         | 25.0 |              |
| Age   | 18-35                                  | 57                      | 28.5 | 61                         | 30.5 | <b>0.565</b> |
|   | 36-45                                  | 43                      | 21.5 | 39                         | 19.5 |              |
| Education level                                   | Never went to school                   | 20                      | 10.0 | 25                         | 12.5 | <b>0.397</b> |
|   | Went to school                         | 80                      | 40.5 | 75                         | 37.5 |              |
| Respondents occupational for survival             | Small farmer                           | 65                      | 32.5 | 65                         | 32.5 | <b>1.000</b> |
|   | (Car washer & Construction technician) | 35                      | 17.5 | 35                         | 17.5 |              |
| Source of pollutants that pollutes river Msimbazi | Industrial waste                       | 51                      | 25.5 | 69                         | 34.5 | <b>0.010</b> |
|   | Urban waste                            | 46                      | 23.0 | 29                         | 14.5 |              |
| Years respondents spent In occupation             | 1-11                                   | 76                      | 38.0 | 89                         | 44.5 | <b>0.016</b> |
|   | 12-22                                  | 24                      | 12.0 | 11                         | 5.5  |              |
| Monthly income                                    | 80000- 1800000                         | 80                      | 40.0 | 86                         | 43.0 | <b>0.259</b> |
|   | 200000- 300000                         | 20                      | 10.0 | 14                         | 7.0  |              |
| Use of apron                                      | No                                     | 94                      | 47.0 | 100                        | 50.0 | <b>0.013</b> |
|   | Yes                                    | 6                       | 3.0  | 0                          | 0.0  |              |
| Use of gloves                                     | No                                     | 97                      | 48.5 | 100                        | 50.0 | <b>0.081</b> |
|   | Yes                                    | 3                       | 1.5  | 0                          | 0.0  |              |
| Use of gumboots                                   | No                                     | 95                      | 47.5 | 99                         | 49.5 | <b>0.097</b> |
|   | Yes                                    | 5                       | 2.5  | 1                          | 0.5  |              |
| Use of masks                                      | No                                     | 98                      | 49.0 | 100                        | 50.0 | <b>0.155</b> |
|   | Yes                                    | 2                       | 1.0  | 0                          | 0.0  |              |
| Use overalls                                      | No                                     | 96                      | 48.0 | 100                        | 50.0 | <b>0.043</b> |
|   | Yes                                    | 4                       | 2.0  | 0                          | 0.0  |              |
| Use sunglasses                                    | No                                     | 94                      | 47.0 | 100                        | 50.0 | <b>0.013</b> |
|   | Yes                                    | 6                       | 3.0  | 0                          | 0.0  |              |

#### **4.4 Exposure to wastewater and its associated human health effects**

Table 4.3 verified exposure to wastewater and associated human health effects such as skin diseases 47 (23.5%), respiratory conditions 20 (10.0%) and reproductive problems 37 (18.5%). Findings demonstrated exposure to wastewater associated with skin diseases. The specific skin diseases reported by respondents were skin itching and rashes 29 (14.5%), black spots on the skin 12 (6.0%) and scabies 6 (3.0%). Also

the findings of this study demonstrated exposure to wastewater associated with respiratory diseases. The specific respiratory diseases reported by respondents were pneumonia 13 (6.5%), asthma 6 (3.0%) and wheezing 1 (0.5%). Furthermore, the findings revealed exposure to wastewater associated with reproductive problems. The specific reproductive problems reported by respondents were miscarriage 27 (13.5%), low birth weight 5 (2.5%), preterm birth 3 (1.5%) and prolonged time to pregnancy 2 (1.0%). In addition, factors included age of the respondents ( $p=0.034$ ), distance less than 0.5 kms in proximity from river Msimbazi ( $p=0.005$ ) were associated with skin diseases. Moreover, female respondents ( $p=0.005$ ), respondents occupational for survival ( $p=0.048$ ) were associated with respiratory diseases. On the other hand, source of pollutants that pollutes river Msimbazi ( $p=0.002$ ), respondents level of education ( $p=0.000$ ) and ignorance on the use of sunglasses ( $p=0.023$ ) were significant associated with reproductive problems. Other factors were not significant, table 4.3 demonstrates for more details.

**Table 4.3: Influence of exposure factors on occurrence of skin diseases, respiratory conditions and reproductive problems by case and control status using cross tabulation N=200**

| Variable  | Categories                  | Skin diseases |      |     |      | P-V          | Respiratory conditions |     |     |      | P-V          | Reproductive problems |      |     |      | P-V          |
|---|-----------------------------|---------------|------|-----|------|--------------|------------------------|-----|-----|------|--------------|-----------------------|------|-----|------|--------------|
|   |                             | DP            |      | DA  |      |              | D P                    |     | D A |      |              | DP                    |      | DA  |      |              |
|   |                             | n             | %    | n   | %    |              | N                      | %   | n   | %    |              | n                     | %    | n   | %    |              |
| Gender  | Female                      | 22            | 11.0 | 78  | 39.0 | <b>0.617</b> | 16                     | 8.0 | 84  | 42.0 | <b>0.005</b> | 16                    | 8.0  | 83  | 41.5 | <b>0.174</b> |
|   | Male                        | 25            | 12.5 | 75  | 37.5 |              | 4                      | 2.0 | 96  | 48.0 |              | 21                    | 10.5 | 66  | 33.0 |              |
| Age in years                                      | 18-35                       | 34            | 17.0 | 84  | 42.0 | <b>0.034</b> | 11                     | 5.5 | 107 | 53.5 | <b>0.701</b> | 21                    | 11.5 | 33  | 16.5 | <b>0.908</b> |
|   | 36-45                       | 13            | 6.5  | 69  | 34.5 |              | 9                      | 4.5 | 73  | 36.5 |              | 16                    | 8.0  | 66  | 33.0 |              |
| Education   | Never went to school        | 10            | 5.0  | 35  | 17.5 | <b>0.818</b> | 6                      | 3.0 | 39  | 19.5 | <b>0.397</b> | 29                    | 14.5 | 64  | 32.0 | <b>0.000</b> |
|   | Went to school              | 37            | 18.5 | 118 | 59.0 |              | 14                     | 7.0 | 141 | 70.5 |              | 8                     | 4.0  | 85  | 42.5 |              |
| Distance from Msimbazi river in kms               | 0.5                         | 32            | 16.0 | 68  | 34.0 | <b>0.005</b> | 11                     | 5.5 | 89  | 44.5 | <b>0.637</b> | 7                     | 3.5  | 35  | 17.5 | <b>0.552</b> |
|   | 2                           | 15            | 7.5  | 85  | 42.5 |              | 9                      | 4.5 | 91  | 45.5 |              | 30                    | 15.0 | 114 | 57.0 |              |
| Source of pollutants that pollutes river Msimbazi | Industrial waste            | 25            | 12.5 | 95  | 47.5 | <b>0.177</b> | 10                     | 5.0 | 110 | 55.0 | <b>0.263</b> | 14                    | 7.0  | 97  | 48.5 | <b>0.002</b> |
|   | Urban waste                 | 22            | 11.0 | 53  | 26.5 |              | 10                     | 5.0 | 65  | 32.5 |              | 22                    | 11.0 | 48  | 24.0 |              |
| Respondents Occupation For survival               | Small farmer                | 27            | 13.5 | 103 | 51.5 | <b>0.215</b> | 17                     | 8.5 | 113 | 56.5 | <b>0.048</b> | 26                    | 13.0 | 103 | 51.5 | <b>0.893</b> |
|   | Car washer & Construction T | 20            | 10.0 | 50  | 25.0 |              | 3                      | 1.5 | 67  | 33.5 |              | 11                    | 5.5  | 46  | 23.0 |              |
| Years respondents spent in occupation             | 1-11                        | 40            | 20.0 | 125 | 62.5 | <b>0.591</b> | 17                     | 8.5 | 148 | 74.0 | <b>0.756</b> | 28                    | 14.0 | 123 | 61.5 | <b>0.338</b> |
|   | 12-22                       | 7             | 3.5  | 28  | 14.0 |              | 3                      | 1.5 | 32  | 16.0 |              | 9                     | 4.5  | 26  | 13.5 |              |

|                |               |    |      |     |      |              |    |      |     |      |              |    |      |     |      |
|----------------|---------------|----|------|-----|------|--------------|----|------|-----|------|--------------|----|------|-----|------|
| Monthly income | 80000- 180000 | 38 | 19.0 | 128 | 64.0 |              | 17 | 8.5  | 149 | 74.5 |              | 32 | 16.0 | 123 | 61.5 |
|                | 200000-300000 | 9  | 4.5  | 25  | 12.5 | <b>0.654</b> | 3  | 8.5  | 31  | 15.5 | <b>0.802</b> | 5  | 2.5  | 123 | 13.0 |
| Use of PPE     | No            | 3  | 1.5  | 36  | 18.0 |              | 1  | 0.5  | 38  | 19.0 |              | 2  | 1.2  | 26  | 17.5 |
|                | Yes           | 44 | 22.0 | 117 | 58.5 | <b>0.009</b> | 19 | 9.5  | 142 | 71.0 | <b>0.084</b> | 35 | 17.5 | 114 | 57.0 |
| Apron          | No            | 46 | 23.0 | 148 | 74.0 |              | 19 | 9.5  | 175 | 87.5 |              | 37 | 18.5 | 144 | 72.0 |
|                | Yes           | 1  | 0.5  | 5   | 2.5  | <b>0.689</b> | 1  | 0.5  | 5   | 2.5  | <b>0.580</b> | 0  | 0.0  | 5   | 73.5 |
| Gloves         | No            | 46 | 23.0 | 151 | 75.5 |              | 20 | 10.5 | 177 | 88.5 |              | 36 | 18.0 | 147 | 73.5 |
|                | Yes           | 1  | 0.5  | 2   | 1.0  | <b>0.686</b> | 0  | 0.0  | 3   | 1.5  | <b>0.561</b> | 1  | 0.5  | 2   | 1.0  |
| Gumboots       | No            | 44 | 22.0 | 150 | 75.0 |              | 20 | 10.5 | 174 | 87.0 |              | 35 | 17.5 | 146 | 73.0 |
|                | Yes           | 3  | 1.5  | 3   | 1.5  | <b>0.120</b> | 0  | 0.0  | 6   | 3.0  | <b>0.407</b> | 2  | 1.0  | 3   | 1.5  |
| Masks          | No            | 46 | 23.0 | 152 | 76.0 |              | 19 | 9.5  | 179 | 89.5 |              | 36 | 18.0 | 148 | 74.0 |
|                | Yes           | 1  | 0.5  | 1   | 0.5  | <b>0.374</b> | 1  | 0.5  | 1   | 0.5  | <b>0.058</b> | 1  | 0.5  | 1   | 0.5  |
| Overalls       | No            | 47 | 23.5 | 149 | 74.5 |              | 20 | 10.0 | 176 | 88.5 | <b>0.501</b> | 37 | 18.5 | 146 | 73.0 |
|                | Yes           | 0  | 0.0  | 4   | 2.0  | <b>0.263</b> | 0  | 0.0  | 6   | 2.0  |              | 0  | 0.0  | 3   | 1.5  |
| Sunglasses     | No            | 44 | 22.0 | 150 | 75.0 |              | 20 | 10.0 | 174 | 87.0 |              | 34 | 17.0 | 147 | 73.5 |
|                | Yes           | 3  | 1.5  | 3   | 1.5  | <b>0.120</b> | 0  | 0.0  | 6   | 3.0  | <b>0.407</b> | 3  | 1.5  | 23  | 11.5 |

NB: DP (Disease Present) DA (Disease Absence)

## **CHAPTER FIVE**

### **DISCUSSION OF THE FINDINGS**

#### **5.1 Introduction**

Findings from the study based on key variables that described association exists between exposure and outcome variables. Results showed that exposure variables including respondent's aged less than 35 years and distance less than 0.5 kms in proximity from river Msimbazi were associated with skin diseases, female respondents and respondent occupational for survival were associated with respiratory conditions, existence of source of pollutants that pollutes river Msimbazi, respondents level of education and ignorance on the use of sunglasses were associated with reproductive problems among residents nearby river Msimbazi in Kigogo ward.

#### **5.2 Characteristics of the respondents**

The analysis focused only to 200 respondents from Kigogo ward. Respondents from the age of 18 to 45 years old were interviewed through administered questionnaires, among of 200 respondents 100 were exposed to wastewater from river Msimbazi and 100 respondents were not exposed to wastewater from river Msimbazi. Respondents from the age of 18 to 35 years old were characterized with poor economic status with primary level of education. Vegetable farmers were the most exposed group because vegetable farming relies on wastewater use from river Msimbazi for daily irrigation. Low monthly income among respondents was the pushing factor for wastewater use from river Msimbazi given that respondents cannot afford cost for safe and clean water from suppliers. In urban areas wastewater has been used for non portable applications including irrigation and construction activities (Crook et al 1992).

#### **5.3 Exposure variables and its influence to skin diseases, respiratory conditions and reproductive problems**

Observation study that were conducted by Mrutu et al. (2013) indicates that river Msimbazi contains high level of heavy metals including chromium, cadmium, nickel, zinc and lead from industrial activities. Influence of heavy metals increases risk to



human health effects among residents nearby river Msimbazi through skin contact, inhalation and ingestion. 67% of pollutants that pollutes river Msimbazi resulted from industrial effluents. Accumulation of heavy metals and other pollutants resulted from industrial discharged to river Msimbazi affect the well being of the community around the area due to inefficient industrial waste treatments (Taylor et al, 2003).

The influence of industrial activities has been associated with increased risk of exposure to wastewater among residents nearby river Msimbazi. Human activities such as vegetable irrigation, car washing and house construction were supported with the use of wastewater from river Msimbazi since exposure occurs through inhalation, skin contacts, and sometimes by ingestion. Fuhrmann et al. (2014) proposed that farmers were at high risk of exposure to wastewater due to their daily activities about 75.9% followed by community members.

Martin and Griswold (2009) presented findings that human being frequently are exposed to heavy metals through human activities including agricultural and construction activities which can impose higher risks of exposure and health impacts to residents around the area through inhalation and skin contacts. About 65% of respondents who were small farmers exposed to wastewater through irrigation activities. Najem et al. (1994) describe existence of high level of exposure due to small irrigation. Industrial waste as a source of pollutants to river Msimbazi and years a person spent in occupation were direct associated with exposure status to residents nearby river Msimbazi.

Findings represent individuals exposed to wastewater from river Msimbazi with consideration of different factors including distance in proximity from river Msimbazi increases skin diseases, occupational for survival increases respiratory condition and source of pollutants increases reproductive problems among residents nearby river Msimbazi. (Fleisher et al, 2010) have found that population exposed to wastewater has been associated with an increased risk of infectious diseases including respiratory conditions, skin diseases, eye irritation and ear illnesses. Symptoms of skin infection

including skin irritation, black spots on the skin appear to be normal to residents nearby river Msimbazi.

Furthermore, individuals with respiratory diseases experienced pneumonia, asthma and wheezing more frequently than in the control group. Batanony and Shafie (2011) observe the existence of wastewater treatments plants workers suffered from adverse health effects including Asthma, wheezing and abdominal pain more frequently than in the comparison group who were not involved into treatment plants. On the other hand respondents with skin diseases experienced skin itching and rashes, black spots on the skin and scabies regularly than in the comparison group.

Moreover, residents nearby river Msimbazi have been affected with reproductive problems especially miscarriage, low birth weight, preterm birth and prolonged time to pregnancy much higher than in the comparison group. Reproductive effects including miscarriage, low birth weight were much higher around hazardous wastewater sites than in control areas (Vrijheid, 2000). Existence of heavy metals that pollutes river Msimbazi, level of education and ignorance on the use of personal protective equipments was associated into reproductive problems. Mwegoha and Kihampa (2010) described the fact that, these rivers have been reported to be highly polluted by toxic chemicals from industries which discharge wastewater untreated into receiving water along river Msimbazi valleys and residents near the area utilize untreated water without the use protective materials.

This study focused on three human health effects including skin diseases, respiratory diseases and reproductive problems but there other health effects mentioned by respondents that did not discussed on this study including gastrointestinal and cardiovascular diseases. Although, other variables were not significantly associated with skin diseases, respiratory conditions and reproductive problems, this study stand as a tool of reference for other future researchers who wish to venture on the same study.

## **CHAPTER SIX**

### **CONCLUSION AND RECOMMENDATIONS**

#### **6.1 Conclusion**

The findings revealed exposure to wastewater were significantly associated with skin diseases, respiratory conditions and reproductive problems. Factors such as source of pollutants that pollutes river Msimbazi ( $p=0.010$ ), years respondents spent in occupation ( $p=0.016$ ), ignorance on the use of apron ( $p=0.013$ ), ignorance on the use of overall ( $p=0.043$ ) and ignorance on the use of sunglasses ( $p=0.013$ ) were associated with exposures status among residents nearby river Msimbazi. From the findings variables like age in years ( $p=0.034$ ) and distance in proximity from river Msimbazi ( $p=0.005$ ) were significantly associated with skin diseases. Female respondents ( $p=0.005$ ), and respondents occupational for survival ( $p=0.048$ ) were significantly associated with respiratory conditions. Existence of source of pollutants that pollutes river Msimbazi ( $p=0.002$ ), respondents level of education ( $p=0.000$ ) and the use of sunglasses ( $p=0.023$ ) were significantly associated with reproductive problems.

#### **6.2 Limitations of the study**

During the accomplishment of this study, researchers encountered a number of limitations including time factor, funds, and reluctance of some respondents who refuse to respond on administered questionnaires, fear among respondents made information to be limited. On the other hand, researcher's security was a problem since Kigogo ward is well known for street thugs famous as "Panya road".

#### **6.3 Recommendations**

With considerations on research findings the following recommendations should be undertaken in order to restrain further health outcomes.

- I. More studies should be conducted on the human health effects of exposure to wastewater among residents nearby river Msimbazi, particularly on gastrointestinal and cardiovascular diseases.

- II. Health education on the effects of wastewater use should be promoted among residents nearby river Msimbazi in order to raise awareness on exposure factors as well as discovery of appropriate protection mechanisms.
- III. Law enforcement on industrial waste treatments in order to restrain further health outcomes.
- IV. Supply of clean and safe water should be promoted to minimize wastewater use. The responsible government should make sure there is adequate water supply in the area, the protection of the environment and the promotion of public health (Kandiah, 1994).
- V. Responsible authorities should make considerations on recommended findings in order to eliminate skin diseases, respiratory diseases and reproductive problems resulted from exposure to wastewater from river Msimbazi. WHO (1997) proposed that government must be prepared to establish and control wastewater reuse within a broader framework of a national effluent use of policy, which itself forms part of a national plan for water resources. Since wastewater use in Tanzania has increased to maximum level, there is a need for a government to establish relevant policy that will stand as a guideline for wastewater use in Tanzania.

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## APPENDIX 1

### ENGLISH QUESTIONNAIRE

Dear respondent

I am Mwalilei Gladson, a Master degree student at Mzumbe University. I am conducting a research on *Human health effects of exposure to wastewater among residents nearby river Msimbazi in Kigogo ward*. The productive goal of this research is for partial fulfillment of the requirement for award of the Master degree of Health Systems Management of Mzumbe University, I hereby request for your support in the achievement of this study. Any response provided in this research shall be kept as confidential.

| No. | Question   | Response  | Codes                      |
|-----|--|---|----------------------------|
|     | <b>BACKGROUND INFORMATION</b>  |   |                            |
| 1   | Your gender?   | Female<br>Male  | 1<br>2                     |
| 2   | Your age in years?   |   |                            |
| 3   | Your education status?   | Never went to school<br>Went to school  | 0<br>1                     |
| 4   | Your marital status?   | Single<br>Married<br>Living as married<br>Divorced<br>Widow   | 1<br>2<br>3<br>4<br>5      |
| 5   | How far is your residential proximity in kilometres from river Msimbazi? | Less than 0.5km<br>2 km   | 1<br>2                     |
| 6   | What is your specific occupation for daily survival?                     | None<br>Small farmer<br>Car washer<br>House construction technician<br>Industrial worker<br>Office worker<br>Other(specify) | 0<br>1<br>2<br>3<br>4<br>5 |
| 7   | What is the number of years in your occupation?                          |   |                            |
| 8   | What is your monthly family income in Tshs?                              |   |                            |

|    | <b>EXPOSURE FACTORS</b>   |  |                                 |
|----|---|--|---------------------------------|
| 9  | Are you exposed to wastewater from river Msimbazi?  | No<br>Yes  | 0<br>1                          |
| 10 | From your experience, what are the major pollutants that affect river Msimbazi water?               | Industrial waste<br>Urban waste<br>Other (specify)<br>_____  | 1<br>2<br>3                     |
| 11 | Are you aware on the importance of PPE?   | No<br>Yes  | 0<br>1                          |
| 12 | Does your activity (ies) involve the use of water from river Msimbazi?                              | No<br>Yes  | 0<br>1                          |
| 13 | Is it a major source of water in your daily activities?   | No<br>Yes  | 0<br>1                          |
| 14 | Which of the following you regular make the use of water from river Msimbazi?                       | None<br>Domestic use<br>Construction use<br>Small irrigation<br>Car washing<br>Other (specify)<br>_____            | 0<br>1<br>2<br>3<br>4<br>5      |
| 15 | For domestic use, which of the following you regular make the use of water from river Msimbazi?     | None<br>Bathing<br>House cleanness<br>Washing clothes and dishes.<br>Flushing toilets<br>Others (specify)<br>_____ | 0<br>1<br>2<br>3<br>4<br>5      |
| 16 | For construction use, which of the following you regular make the use of water from river Msimbazi? | None<br>Making bricks<br>House building<br>Plastering<br>Extracting sand<br>Painting<br>Other (specify)            | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 17 | For irrigation use, which of the following you regular make the use of water from river Msimbazi?   | None<br>Vegetable irrigation<br>Washing vegetables after harvesting<br>Other (specify)                             | 0<br>1<br>2<br>3                |
| 18 | Do you cover your chest with apron when your exposed to wastewater?                                 | No<br>Yes  | 0<br>1                          |
| 19 | Do you wear gloves when your exposed to wastewater?   | No<br>Yes  | 0<br>1                          |
| 20 | Do you wear gumboots when your exposed to wastewater?   | No<br>Yes  | 0<br>1                          |
| 21 | Do you cover your face with mask when your exposed to wastewater?                                   | No<br>Yes  | 0<br>1                          |

|    |  |  |                            |
|----|--|--|----------------------------|
| 22 | Do you cover your body with overall when your exposed to wastewater?                 | No<br>Yes  | 0<br>1                     |
| 23 | Do you cover your eyes with sunglasses when your exposed to wastewater?              | No<br>Yes  | 0<br>1                     |
|    | <b>Confounder factors</b>  |  |                            |
| 24 | Are you living close to city dump(s)?  | No<br>Yes  | 0<br>1                     |
| 25 | Are you working in industry?   | No<br>Yes  | 0<br>1                     |
| 26 | Which one among the following?   | None<br>Steel industry<br>Textiles industry<br>Paints industry<br>Cement industry<br>Other (specify) | 0<br>1<br>2<br>3<br>4<br>5 |
| 27 | Have you experienced any health effects from the industry?                           | No<br>Yes  | 0<br>1                     |
| 28 | Does your activity (ies) involve the use of pesticides?                              | No<br>Yes  | 0<br>1                     |
| 29 | Which of the following do you employ as protection when your exposed to pesticides?  | None<br>Apron<br>Mask<br>Gloves<br>Gumboots<br>Sunglasses  | 0<br>1<br>2<br>3<br>4<br>5 |
| 30 | Do you smoke tobacco?  | No<br>Yes  | 0<br>1                     |
| 31 | Do you take alcohol?   | No<br>Yes  | 0<br>1                     |
| 32 | Have you experienced any health problem resulted from the use of alcohol or tobacco? | No<br>Yes  | 0<br>1                     |
| 33 | Are you working in garage?   | No<br>Yes  | 0<br>1                     |
| 34 | Do you have any inherited health problem?  | No<br>Yes  | 0<br>1                     |
| 35 | Have you ever worked in petrol station or are you working in petrol station?         | No<br>Yes  | 0<br>1                     |
| 36 | Have you experienced occupational stress at work?                                    | No<br>Yes  | 0<br>1                     |
| 37 | Have you experienced health effects resulted from occupation tress at work?          | No<br>Yes  | 0<br>1                     |
|    | <b>Outcomes factors</b>  |  |                            |
| 38 | Are you aware on health effects resulted from wastewater use?                        | No<br>Yes  | 0<br>1                     |
| 39 | If yes, can you mention them?  | _____<br>_____<br>_____  |                            |

|    |   |  |                                 |
|----|---|--|---------------------------------|
| 40 | Do you have skin effects you perceive to have resulted from exposure to wastewater?                       | No<br>Yes  | 0<br>1                          |
| 41 | Do you have respiratory effects you perceive to have resulted from exposure to wastewater?                | No<br>Yes  | 0<br>1                          |
| 42 | Which among the following have you experienced?   | None<br>Skin effects<br>Respiratory effects<br>Reproductive effects  | 0<br>1<br>2<br>3                |
| 43 | Which of the following have you experienced with regards to skin effects?                                 | None<br>Skin rashes<br>Skin itching<br>Scabies<br>Black spots on the skin<br>Other (specify)<br>_____          | 0<br>1<br>2<br>3<br>4<br>5      |
| 44 | Which of the following have you experienced with regards to respiratory effects?                          | None<br>Persistent cough<br>Asthma<br>Wheezing<br>Pneumonia<br>Difficult breathing<br>Other (specify)<br>_____ | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 45 | Is there any member of your family who suffered from health effects resulted from exposure to wastewater? | No<br>Yes  | 0<br>1                          |
| 46 | Those effects are among of the skin effects respiratory effects, reproductive effects?                    | No<br>Yes  | 0<br>1                          |
| 47 | Which among of the following health effects have been experienced as major problem to Msimbazi residents? | None<br>Skin effects<br>Respiratory effects<br>Reproductive effects<br>Other (specify)                         | 0<br>1<br>2<br>3<br>4           |
|    | <b>Reproductive outcomes</b>  |  |                                 |
| 48 | Have you experienced reproductive effects as a result of exposure to wastewater?                          | No<br>Yes  | 0<br>1                          |

|    |  |   |                                 |
|----|--|---|---------------------------------|
| 49 | Which among the following have you experienced with regards to reproductive effects? | None<br>Menstrual disorder<br>Prolonged time to pregnancy<br>Preterm birth<br>Low birth weight (>2500g)<br>Miscarriage<br>Still birth<br>Other (specify)<br>_____ | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 50 | Have you experienced frequently miscarriage?   | No<br>Yes   | 0<br>1                          |
| 51 | Have you delivered a newborn with low birth weight (>2500)?                          | No<br>Yes   | 0<br>1                          |
| 52 | Have you experienced physical torture from your partner during the term of pregnant? | No<br>Yes   | 0<br>1                          |
| 53 | Were you involved in heavy duties during the term of pregnant?                       | No<br>Yes   | 0<br>1                          |
| 54 | At what age, did you get your first pregnancy?                                       | None<br>Below 20 years<br>Between 20 and 24 years<br>Above 24 years   | 0<br>1<br>2<br>3                |
| 55 | Are you taking contraceptives as your method for family?                             | No<br>Yes   | 0<br>1                          |
| 56 | Do you have monthly cycle problems?  | No<br>Yes   | 0<br>1                          |
| 57 | What have you experienced?   | None<br>Irregular monthly period<br>Missing of monthly period<br>Other (specify)<br>_____   | 0<br>1<br>2<br>3                |
| 58 | Have you experienced prolonged time to conception of pregnancy?                      | No<br>Yes   | 0<br>1                          |
| 59 | For how long does it take to conception of pregnancy?                                | None<br>Less than 5 years<br>More than 5 years  | 0<br>1<br>2                     |

**Thank you**

## Dodoso

Mimi Mwalilei Gladstone, mwanafunzi kutoka chuo kikuu Mzumbe. Nafanya utafiti juu ya *Madhara ya afya ya binadamu yatokanayo na matumizi ya majitaka kutoka miongoni mwa wakazi wanaoishi jirani na mto msimbazi*. Lengo kubwa la utafiti huu ni kutimiza tuzo ya Shahada ya Uzamili ya Menejimenti ya Mifumo ya Afya kutoka chuo kikuu Mzumbe. Naomba ushirikiano wako katika kujaza dodoso hili, ninaahidi taarifa zitakazotolewa zitakua za siri na hazitatolewa kinyume na malengo yaliyokusudiwa.

| Namba ya swali | Swali   | Jibu  | Namba ya Jibu                   |
|----------------|---|---|---------------------------------|
|                | <b>TAARIFA ZA MSINGI/ AWALI</b>   |   |                                 |
| 1              | Jinsia yako?  | Mwanamke<br>Mwanaume  | 1<br>2                          |
| 2              | Umri wako kwa miaka?  |   |                                 |
| 3              | Kiwango cha elimu yako?   | Hujasoma kabisa<br>Umepata elimu ya darasani  | 0<br>1                          |
| 4              | Hali ya ndoa yako?  | Hunandoa<br>Umefunga ndoa<br>Unaishi kwenye ndoa<br>Umeachika<br>Mjane  | 1<br>2<br>3<br>4<br>5           |
| 5              | Ni umbali gani yalipo makazi yako kutoka mto Msimbazi?                  | Viwanja pungufu ya 5 vya mpira<br>Viwanja 20 vya mpira  | 1<br>2                          |
| 6              | Unashughulika na kazi gani inayokuingizia kipato cha kila siku?         | Hakuna<br>Mkulima mdogo<br>Muosha magari<br>Fundi ujenzi<br>Mfanyakazi wa kiwandani<br>Mfanyakazi wa ofisini<br><u>Kama kuna ziada (zitaje)</u> | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 7              | Takribani miaka mingapi sasa unashughulika na kazi hiyo?                |   |                                 |
| 8              | Kwa mwezi unaingiza kiasi gani cha pesa kutoka kwenye kazi yako (Tshs)? |   |                                 |

|    | <b>VISABABISHI VYA TATIZO</b>  |  |                                 |
|----|--|--|---------------------------------|
| 9  | Je, wewe ni mtumiaji wa majitaka kutoka mto Msimbazi?  | Hapana<br>Ndiyo  | 0<br>1                          |
| 10 | Kwa uzoefu wako, unafikiri ni vichafuzi gani vinavyoathiri maji ya mto Msimbazi?                                       | Hakuna<br>Taka za viwandani<br>Taka za mji<br>Mabomba ya majitaka kutoka majumbani<br>Kama kuna ziada (zitaje)   | 0<br>1<br>2<br>3<br>4           |
| 11 | Unajua umuhimu wakutumia vifaa vya kujikinga na maji machafu?  | Hapana<br>Ndiyo  | 0<br>1                          |
| 12 | Shughuli zako zinahusisha matumizi ya maji kutoka mto Msimbazi?  | Hapana<br>Ndiyo  | 0<br>1                          |
| 13 | Mto Msimbazi ni chanzo kikubwa cha maji kwenye shughuli zako za kila siku?   | Hapana<br>Ndiyo  | 0<br>1                          |
| 14 | Kati ya shughuli zifuatazo, ni shughuli ipi unashughulika nayo ambayo inahusisha matumizi ya maji kutoka mto Msimbazi? | Hakuna<br>Matumizi ya nyumbani<br>Matumizi ya ujenzi<br>Umwagiliaji mdogo<br>Kuoshea magari<br>Kama kuna ziada (zitaje)  | 0<br>1<br>2<br>3<br>4<br>5      |
| 15 | Kwa matumizi ya nyumbani, ni shughuli ipi kati ya zifuatazo inahusisha matumizi ya maji kutoka mto Msimbazi?           | Hakuna<br>Kuogea<br>Kusafishia nyumba<br>Kuoshea vyombo<br>Kufulia nguo<br>Kufashia choo<br>Kama kuna ziada (zitaje)   | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 16 | Kwa matumizi ya ujenzi, ni shughuli ipi kati ya zifuatazo inahusisha matumizi ya maji kutoka mto Msimbazi?             | Hakuna<br>Kufyatulia matofali<br>Kujengea nyumba<br>Kufanyia nyumba plasta<br>Kuchimba mchanga mtoni<br>Kuchanganyia rangi ya kupaka kwenye nyumba<br>Kama kuna ziada (zitaje) | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 17 | Kwa matumizi ya umwagiliaji mdogo, shughuli ipi kati ya zifuatazo inahusisha matumizi ya maji kutoka mto msimbazi?     | Hakuna<br>Umwagiliaji wa mbogamboga<br>Kuoshea mbogamboga baada ya mavuno<br>Kama kuna ziada (zitaje)  | 0<br>1<br>2<br>3                |

|    |   |  |                            |
|----|---|--|----------------------------|
| 18 | Je, hua unavaa apron kuinga kifua chako wakati unatumia maji kutoka mto Msimbazi?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 19 | Je hua unavaa soski za mpira mikononi wakati unatumia maji kutoka mto Msimbazi?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 20 | Je, hua unavaa buti za mpira miguuni wakati unatumia maji kutoka mto Msimbazi?  | Hapana<br>Ndiyo  | 0<br>1                     |
| 21 | Je, hua unavaa maski ili kuinga uso wako wakati unatumia maji kutoka mto Msimbazi?  | Hapana<br>Ndiyo  | 0<br>1                     |
| 22 | Je, hua unavaa ovaroli kuinga sehemu ya mwili wako wakati unatumia maji kutoka mto Msimbazi?  | Hapana<br>Ndiyo  | 0<br>1                     |
| 23 | Je, hua unavaa miwani kuinga macho yako wakati unatumia maji kutoka mto Msimbazi?   | Hapana<br>Ndiyo  | 0<br>1                     |
|    | <b>VISABABISHI VINAVYOPELEKEA MADHARA YANAYOFANANA NA MATUMIZI YA MAJITAKA</b>  |  |                            |
| 24 | Unaishi karibu na dampo la kuchomea taka za jiji?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 25 | Je, wewe ni muajiriwa wa kiwandani?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 26 | Kama ni ndio, kipi kati ya hivi?  | Hakuna<br>Kiwanda cha chuma<br>Kiwanda cha nguo<br>Kiwanda cha rangi<br>Kiwanda cha saruji<br>Kama kuna ziada (zitaje) | 0<br>1<br>2<br>3<br>4<br>5 |
| 27 | Umeshawahi kupata madhara yoyote ya afya ukiwa unafanya kazi kiwandani?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 28 | Shughuli zako zinahusisha matumizi ya madawa ya kuulia wadudu?  | Hapana<br>Ndiyo  | 0<br>1                     |
| 29 | Unatumia vifaa vya kujikinga na madhara yatokanayo na madawa hayo (kama apron, mask, soksi za mpira, mabuti ya mpira, miwani, ovaroli)? | Hapana<br>Ndiyo  | 0<br>1                     |
| 30 | Je, unavuta sigara?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 31 | Je, unatumia kilevi?  | Hapana<br>Ndiyo  | 0<br>1                     |
| 32 | Je, umeshapata madhara ya kiafya kutokana na utumiaji wa kilevi au sigara?  | Hapana<br>Ndiyo  | 0<br>1                     |
| 33 | Unafanya kazi ya ufundi magari au gereji?   | Hapana<br>Ndiyo  | 0<br>1                     |
| 34 | Je, una magonjwa ya kurithi?  | Hapana<br>Ndiyo  | 0<br>1                     |



|    |   |   |                                 |
|----|---|---|---------------------------------|
| 35 | Je unafanya kazi au ulishawahi kufanya kazi kwenye kituo cha mafuta (petrol, diesel, nk)?                               | Hapana<br>Ndiyo   | 0<br>1                          |
| 36 | Ulishawahi kufanya kazi kwenye mazingira magumu?  | Hapana<br>Ndiyo   | 0<br>1                          |
| 37 | Ulipata madhara yoyote ya kiafya kutokana na mazingira magumu ya sehemu unayofanyia kazi?                               | Hapana<br>Ndiyo   | 0<br>1                          |
|    | <b>MATOKEO YA UTUMIAJI MAJITAKA</b>   |   |                                 |
| 38 | Je, unafahamu madhara yatokanayo na matumizi ya majitaka?   | Hapana<br>Ndiyo   | 0<br>1                          |
| 39 | Kama ni ndio, taja madhara unayoyafahamu?   | _____   |                                 |
| 40 | Je, umepata ugonjwa wa ngozi uliosababishwa na matumizi ya majitaka kutoka mto Msimbazi?                                | Hapana<br>Ndiyo   | 0<br>1                          |
| 41 | Je, umepata ugonjwa wa upumuaji uliosababishwa na matumizi ya majitaka kutoka mto Msimbazi?                             | Hakuna<br>Magonjwa ya ngozi<br>Magonjwa ya upumuaji<br>Madhara ya uzazi<br>Kama kuna ziada (zitaje)   | 0<br>1<br>2<br>3<br>4           |
| 42 | Je, umepata ugonjwa katika mfumo wa uzazi uliosababishwa na matumizi ya majitaka kutoka mto Msimbazi?                   | Hapana<br>Ndiyo   | 0<br>1                          |
| 43 | Ni ugonjwa upi wa ngozi ulioupata kati ya haya, ambao umesababishwa na matumizi ya majitaka kutoka mto Msimbazi?        | Hakuna<br>Vipele vidogovidogo kwenye ngozi<br>Ngozi kuwasha<br>Upele unaobabua ngozi<br>Mabaka meusi kwenye ngozi<br>Kama kuna ziada (zitaje) | 0<br>1<br>2<br>3<br>4<br>5      |
| 44 | Ni ugonjwa upi wa upumuaji ulioupata kati ya haya ambao umesababishwa na matumizi ya majitaka kutoka mto Msimbazi?      | Hakuna<br>Kikohozi kikavu na endelevu<br>Pumu<br>Kubanwa na kifua<br>Imonia<br>Kupumua kwa shida<br>Kama kuna ziada (zitaje)                  | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 45 | Je, kuna mtu yoyote kwenye familia yako ambaye amepata madhara ya kiafya baada ya kutumia majitaka kutoka mto Msimbazi? | Hapana<br>Ndiyo   | 0<br>1                          |
| 46 | Je, madhara hayo ni miongozi mwa magonjwa ya ngozi, upumuaji au madhara kwenye mfumo wa uzazi?                          | Hapana<br>Ndiyo   | 0<br>1                          |

|    |  |   |                                 |
|----|--|---|---------------------------------|
| 47 | Ni madhara yapi ya kiafya kati ya haya, yameonekana ni tatizo sana kwa kaya zilizopo karibu na mto Msimbazi? | Hakuna<br>Magonjwa ya ngozi<br>Magonjwa ya upumuaji<br>Madhara ya uzazi<br>Kama kuna ziada (zitaje)   | 0<br>1<br>2<br>3<br>4           |
|    | <b>Madhara ya uzazi</b>  |   |                                 |
| 48 | Ulishawahi kupata madhara ya uzazi baada ya kutumia majitaka kutoka mto Msimbazi?                            | Hapana<br>Ndiyo   | 0<br>1                          |
| 49 | Kama ni ndio, ni madhara yapi kati ya haya?  | Hakuna<br>Matatizo ya hedhi<br>Kukaa muda mrefu bila kushika mimba<br>Kujifungua mtoto kabla ya muda (njiti)<br>Kujifungua mtoto mwenye uzito mdogo (>2500g)<br>Kuharibika kwa mimba kujifungua mtoto mfu (aliyekufa)<br>Kama kuna ziada (zitaje) | 0<br>1<br>2<br>3<br>4<br>5<br>6 |
| 50 | Umekua ukipata matatizo ya mimba kuharibika mara kwa mara?   | Hapana<br>Ndiyo   | 0<br>1                          |
| 51 | Ulishawahi kujifungua mtoto mwenye uzito mdogo (>2500g)?   | Hapana<br>Ndiyo   | 0<br>1                          |
| 52 | Umeshawahi kupata kipigo kutoka kwa mwenza wako kipindi cha ujauzito wako?                                   | Hapana<br>Ndiyo   | 0<br>1                          |
| 53 | Ulikua unafanya kazi nzito kipindi cha ujauzito?   | Hapana<br>Ndiyo   | 0<br>1                          |
| 54 | Ulipata mimba ya kwanza ukiwa na umri gani?  | Hakuna<br>Pungufu ya miaka 20<br>Kati ya miaka 20 na 24<br>Zaidi ya miaka 24  | 0<br>1<br>2<br>3                |
| 55 | Unatumia uzazi wa mpango wa kisasa mfano vidonge, sindano?   | Hapana<br>Ndiyo   | 0<br>1                          |
| 56 | Umeshawahi kupata matatizo ya hedhi?   | Hapana<br>Ndiyo   | 0<br>1                          |
| 57 | Kama ni ndio, ni yapi ulishawahi kuyapata?   | Hakuna<br>Mabadiliko ya mzunguko wa hedhi<br>Kukosa hedhi kwa mwezi husika<br>Kama kuna ziada (zitaje)  | 0<br>1<br>2<br>3                |
| 58 | Ulishawahi kuhangaika kushika mimba kwa muda mrefu?  | Hapana<br>Ndiyo   | 0<br>1                          |
| 59 | Ni muda gani ilikusumbua kushika mimba?  | Hakuna<br>Pungufu ya miaka 5  | 0<br>1                          |

|  |  |                  |   |
|--|--|------------------|---|
|  |  | Zaidi ya miaka 5 | 2 |
|--|--|------------------|---|

**Asante**