ASSESSMENT OF WATER, SANITATION AND HYGIENE PRACTICES ASSOCIATED WITH DIARRHEA PREVALENCE AMONG HOUSEHOLDS' MEMBERS IN FLOOD PRONE AREAS: A CROSS-SECTIONAL STUDY ALONG KILOMBERO VALLEY

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By

Robert Octavian Kibongolo

A dissertation Submitted in partial Fulfillment of the Requirements for the

Degree of Master of Public Health of

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CERTIFICATION

The undersigned certifies that, he has read and hereby recommends for acceptance by the Muhimbili University of Health and Allied Sciences a dissertation entitled ***"Assessment of water, sanitation and hygiene practices associated with diarrhea prevalence among households' members in flood prone areas: A Cross-Sectional Study along Kilombero Valley",*** in (partial) fulfillment of the requirements for the degree of Master of Public Health of Muhimbili University of Health and Allied Sciences.

_____

L.M.B RONGO, PhD

(Supervisor)

Date _____

DECLARATION AND COPYRIGHT

I, **Robert Octavian Kibongolo**, 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 similar or any other degree award.

Signature: _____ Date: _____

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DEDICATION

This dissertation is dedicated to my beloved parents Mr. and Mrs. Octavian J. Kibongolo who took tireless care and encouragement throughout my study period.

ABSTRACT

Introduction: The prevalence of diarrhea at household level in flood prone areas are largely associated with inadequate or poor water, sanitation and hygiene practices such as use of untreated drinking water, use of unimproved sanitation facilities and inadequate hand washing practices. Residents in flood prone areas experience flooding incidences which eventually alters their hygienic status due to limited safe water sources and sanitation facilities. The study aimed at assessing water, sanitation and hygiene practices associated with diarrhea prevalence among households' members in flood prone areas of Kilombero Valley.

Methods: Cross sectional study was conducted early of August, 2017 in the flood prone areas of Kilombero Valley involving household interviews. About 384 heads of households were interviewed in order to determine the prevalence of diarrhea and the associated WASH practices.

Results: The prevalence of diarrhea was 30.6%. WASH characteristics showed that between 6% and 57% of households responded to use improved water supply, Household Water Treatment, improved sanitation and good hygiene condition. Treating drinking water (AOR=2.729, 95%CI 1.169-6.370, p=0.020), Sanitation status (AOR=6.749, 95%CI 1.602-28.434, p=0.009) and use of pit latrine without slab (AOR=8.213, 95%CI 2.070-32.587, p=0.003) increased the risk of diarrhea. Also, use of good storage facilities (AOR=0.272, 95% CI 0.099-0.742, p=0.011), and handwashing after using toilet (AOR=0.513, 95% CI 0.229-0.881, p=0.015) were associated with reduced risk of diarrhea.

Conclusion: The study reveals that, households' members in flood prone areas are at high risk of diarrhea associated with poor WASH practices. The intervention programmes enhancing use of effective household treated drinking water, improved sanitation facilities and handwashing status should be undertaken in order to reduce the burden of diarrhea disease in flood prone areas of Kilombero Valley.

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ACRONYMS/ ABBREVIATIONS

AOR	Adjusted Odds Ratio
CBOs	Community Based Organizations
NGOs	Non-Governmental Organizations
OR	Odd ratio
POU	Point of Use
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

OPERATIONAL DEFINITIONS OF TERMS

Diarrhea refers to loss of watery stool at least three times a day

Household include people who live together and share the same pot

Water sources: These are places from which water for domestic purposes can be obtained. Therefore, an unimproved (poor) water source is water from dam or pond, or stagnant water from a river, stream or rainwater tank. An improved water source is defined by the WHO/UNICEF Joint Monitoring Program to be water piped into the residence, from human powered drills or from water tower.

Sanitation: Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and feces. The UNESCO defines sanitation as 'Maintaining clean, hygienic circumstances that help avoid disease through services such as waste collection and waste water removal'. In this context the households with unimproved (poor) sanitation status have no latrine or toilet facilities. Households with (good) sanitation status have pour/ flush latrine, or ventilated improved pit latrine.

Hygiene: Hygiene is the practice of keeping oneself and one's surroundings clean, especially in order to prevent illness or the spread of disease. Poor hygiene practice includes having no handwashing and bathing facilities or detergents in the house, or washing hands with water but no soap or other detergents. Good hygiene practice includes the use of hand washing and bathing facilities, with the availability of soap and the detergents in the house.

Flood prone areas: Flood prone areas refer to areas in which a large amount of water is likely to temporarily cover an area of land that is usually dry.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Diarrhea remains one of the leading causes of morbidity and mortality worldwide, despite of the improved health technologies, management and increased use of Oral Rehydration Therapy (ORT). Globally diarrheal disease kills an estimated 1.5 million people each year (1). Studies (2) revealed that most of diarrheal diseases in Low and Middle Income Countries (LMIC) are associated with poor WASH**.** It has been estimated that in 2012, a total of 842,000 deaths per year were caused by inadequate WASH (502, 000 deaths are attributed to unsafe and insufficient drinking-water while 280, 000 deaths result from inadequate sanitation, and another 297, 000 are due to inadequate handwashing). This represents over half (58%) of diarrhea disease or an estimated 1.5% of the total disease burden. Diarrheal deaths among children under-five have been reduced more than half (i.e. from 1.5 million in 1990 to 622 000 in 2012. Currently, inadequate WASH accounts for 361 000 of these deaths, or over 1000 child deaths per day. The current global burdens of disease estimate of the impact of inadequate WASH which is about 58% of total diarrheal deaths (2). This is attributed to a number of factors including the fall in global diarrheal deaths from 2.2 million in 2000 to 1.5 million in 2012 and the use of a far more conservative counterfactual, which retains a significant risk of diarrheal illness (2–4)**.**

The transmission of diarrhea occurs mainly through ingestion of contaminated food or drinking water which contains bacterial and viral pathogens that threaten human health and are largely facilitated by both environmental and climatic factors (2,5). The wide variety of bacteria, viral and protozoa pathogens excreted in the feaces of humans and animal are known to cause diarrhea. Among the most important of these are E.coli, Salmonella sp; Shigella sp; Campylobacter jejuni, Vibrio cholera, Rotavirus, Norovirus, Giardia lamblia, Cryptosporidium sp; and Entamoeba Histolytica (6).

The explored environmental factors which results into diarrhea incidences include unhygienic handling and storage of foods, poor handwashing practices, poor disposal of wastes, open

defecation, lack of safe water sources for domestic purposes continue to be the health threats among the household members (7). Likewise, climatic hazards particularly flood found to play a great role in the occurrence of diarrhea disease in flood prone areas. This due to the fact that, flooding tend to distort the existing water and sanitation systems which eventually alters the hygienic practices in that area (8). The provision of quality water and good sanitation in flood prone areas is a problem faced by many developing countries. Some of these problems include lack of sanitation infrastructures, indiscriminate disposal of solid wastes and open defecation. The resultant effects of open defecation include pollution of groundwater, contamination of agricultural products and spread of disease such as diarrhea.

Intervention for the prevention and control of diarrheal diseases not only include enhanced water quality but also steps to improve sanitation, increase the quality and improve access to water supply, and promote hand washing and other hygiene practices within domestic and community settings (9). Health authorities generally accept that microbiologically safe water plays an important role in preventing outbreaks of waterborne diseases (10).

Accordingly, the most widely accepted guidelines for water quality allow no detectable level of harmful pathogens at the point of distribution. However, an estimated 1.1 billion people lack access to improved water supplies while 2.5 billion lack access to improved sanitation. In settings that are not served by reliable water treatment and distribution systems, diarrheal disease is often endemic (10). According to global water, sanitation and hygiene (11) facts sheet, water, sanitation and hygiene have the potential to prevent at least 9.1% of the global disease burden and 6.3% of all deaths. Studies (2) reveal that diarrhea can be prevented with proven, cost effective measures such as water purification, improved sanitation and hand washing. Point of use treatment and household water treatment and storage (HWTS) involve disinfecting the microbial organisms. Hygiene practices that should be highly prioritized include hand wash with water and soap, or when not available use ash after contact with feaces and safe disposal of adults and children's feaces to prevent infection and contamination (i.e. clear scattered feaces, control open defecation and shallow trench latrines, repair toilet facilities and/or build temporary family or communal latrines) (12).

Tanzania is one of the developing countries which did not reach both National and International targets particularly National Strategy for Growth and the Reduction of Poverty II (Popularly abbreviated in Kiswahili as MKUKUTA) and Millennium Development Goals (MDGs, despite of the National WASH campaigns such as Community Led Total Sanitation (CLTS) and Maji Safi kwa Afya Bora (MSABI) (13) in Kilombero District focusing on the raised awareness on the use of improved water sources, sanitation facilities and hand washing with soap, yet still majority especially in rural areas use unimproved water sources, sanitary facilities and practice open defecation even close or within the water sources such as rivers, lakes and oceans. More than a half (61.4%) of the Tanzanian population has access to improved water sources and only 10% practice open defecation. The water supply coverage is estimated at 86% for urban Tanzania mainland areas and 47.8% for rural mainland areas. The sustained sanitation coverage in Tanzania is estimated at around 35.5% (14). Most people in rural areas especially along the river system depend on open water sources for various domestic purposes which present serious health risk.

Assessing water, sanitation and hygiene practice in flood prone areas that influence diarrhea prevalence enable in understanding to what extent the households' members are more vulnerable to health risks resulted by the emerging state of climate shift (15). However, the information on the extent of WASH practices that influencing the prevalence of diarrhea among households' members residing in flood prone areas are limited in rural areas of Tanzania. Therefore, this study aimed to assess WASH practices and diarrhea control among households' members in the flood prone areas along Kilombero Valley.

1.2 Problem Statement

Poor water, sanitation and hygiene and hygiene practices has resulted into increased waterborne diseases such as diarrhea in flood prone areas where water is becoming unsafe in most developing countries (12,16). This due to the fact that, the flood prone areas experience frequent flooding incidences which in turn tend to destroy water and sanitation systems in that area. However, some countries like Nepal and Bangladesh have played a great role in reducing the flood related health risk by ensuring safe and clean water as well as improving sanitary facilities and hygiene behavior. The increased diarrhea incidences in the flood prone areas are largely associated with inadequate or poor sanitary facilities, poor water supply, and poor hygiene status. Flooding usually causes the households to use contaminated drinking water sources due to disruption of unprotected water sources and sanitary facilities (17). Members of households in flood prone areas are more susceptible to diarrhea because they rely on unsecured and contaminated water sources and sanitary facilities which have been disrupted by flooding incidences.

If appropriate preventive measures are not well addressed, there is high possibility of increased morbidity and mortality caused by diarrhea infections in flood prone areas. Due to high risk of being exposed to diarrhea in the flood prone areas preventive measures on WASH practices at household level become more pronounced. In this case, the proven cost effective measures at household level in the flood prone areas include proper household water treatment and storage (HWTS), improved sanitation infrastructures as well as hygiene status such as hand washing practices which will reduce the vulnerability to emerging flood health problems (18,19).

Several studies (15,20,21) have addressed on the reasons for persistency of flood effects and adaptation measures as well as community vulnerability to flooding in urban areas. But there is no information that depicts the extent of WASH practices that influence the prevalence of diarrhea among households' members in the rural flood prone areas of Tanzania. Hence, this study entails to assess water, sanitation and hygiene practices associated with diarrhea prevalence among households' members in the flood prone areas along Kilombero Valley.

1.3 Conceptual Framework

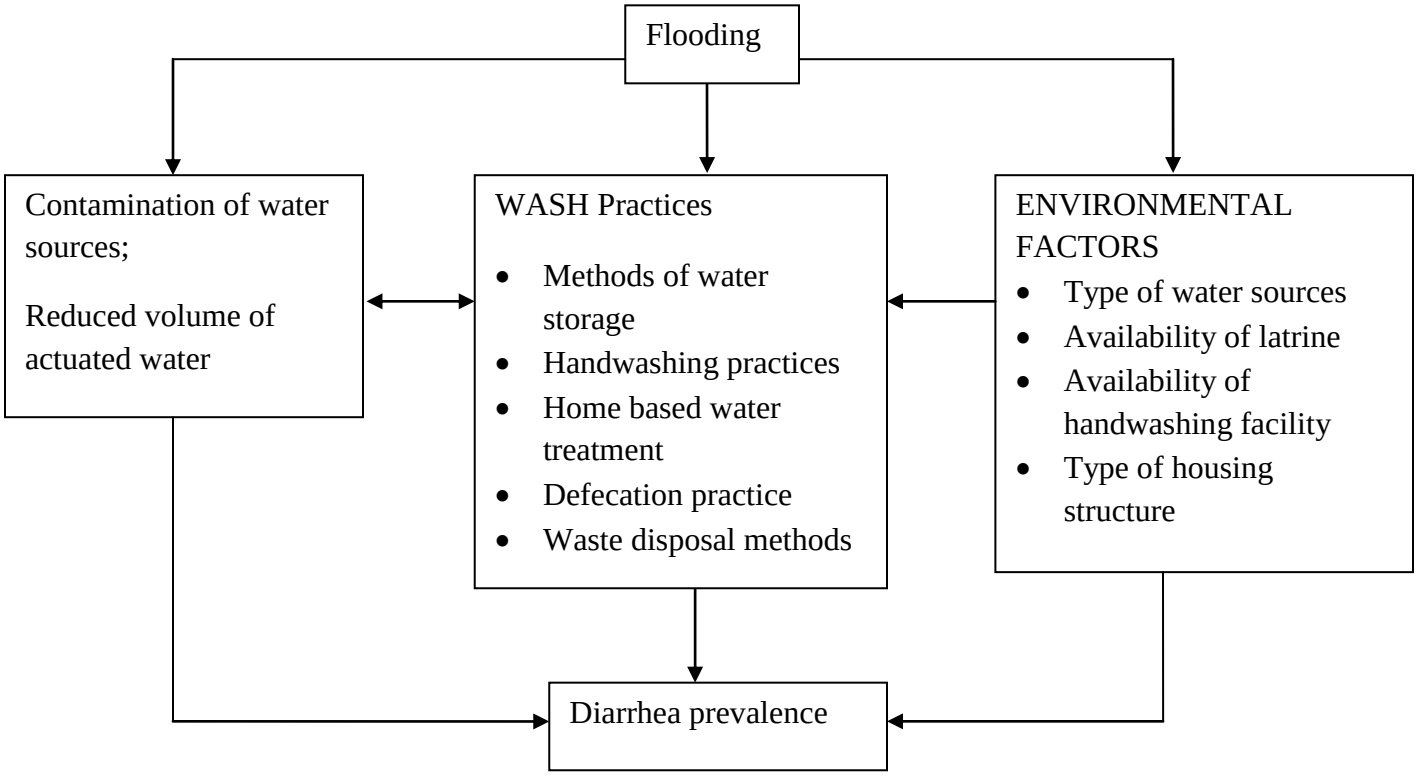

Figure 1: Conceptual framework on the relationship between WASH practices, occurrence of diarrhea diseases and the associated factors.

Different studies showed that, the emerging flooding incidences cause diarrhea due to the fact that, they have tendency of destroying the existing water supply and sanitation systems which eventually decrease water supply and sanitation in flood prone areas (22). This results into the increased use of unsafe water and unhygienic practices such as open defecation (23).

Water quality interventions particularly at the point of use (POU) treatment has been found to be the most effective in the control of diarrhea disease at household level (24). Proper drinking water purification and storage in the household is very important in preventing the occurrence of diarrhea in areas prone to flooding. Therefore, purification of drinking water at household level depends on the availability of energy sources or drugs such as Water Guard. The normal local

drinking water purification processes which can be used in the household level include boiling, using disinfectants such as chlorine, filtration through sand or cloth (25).

Poor sanitation facilities and open defecation are closely related to diarrhea prevalence in flood prone areas (26). The established unimproved toilets are usually disrupted during flood disasters which eventually lead to contamination of potential water sources such as rivers and unprotected shallow wells. The household which doesn't have waste management facilities may results into haphazard disposal of wastes. This tends to attract insects such as flies and cockroaches which are used for transmission of waterborne disease pathogens into the unprotected drinking water sources or food and as a result causing illness in the household. Hence, due to lack of clean water leads households' members to use contaminated water sources that could result into the outbreak of diarrheal diseases. In order to avoid the occurrence of diarrhea in the area, there should be improved sanitary facilities that satisfy the relevant condition of the area as well as presence of protected waste disposal sites.

A number of studies have attempted to examine the role of personal and domestic hygiene, although in many cases some of the "hygiene" measures or interventions could also impact on sanitation, and hygiene interventions may also interact with water quality (27). Hygiene practice is very important for ensuring personal health and safety. If not properly taken into consideration there is high probability of the household members to suffer from diarrheal diseases. The hygiene practices which should be taken daily by the household members include stool disposal and the removal of fecal matter from hands, good handwashing before preparing food, cooking, and eating (28). Hygiene interventions act by reducing contamination of hands, food, water and fomites (24).

1.4 Rationale of the research study:

Currently, the magnitude of diarrhea prevalence and the level of WASH practices in flood prone areas particularly along Kilombero Valley are unknown. Thus, this study assessed the extent of water, sanitation and hygiene practices associated with diarrheal prevalence among households' members in the flood prone areas of Kilombero Valley. The study will help community, households and local authority to develop sustainable strategies that will reduce health impacts of households' members in flood prone areas of Kilombero Valley.

1.5 Research Questions

1.5.1 Main question:

What are the water, sanitation and hygiene practices that associated with diarrhea prevalence among members of households in flood prone areas of Kilombero Valley?

1.5.2 Sub questions:

1. What is the prevalence of diarrhea among households' members in the flood prone areas along Kilombero Valley?
2. What is the level of households' WASH practices in flood prone areas along Kilombero Valley?
3. What is the association between water, sanitation, hygiene practices and diarrhea prevalence among households' members in flood prone areas along Kilombero Valley?

1.6 Research Objectives

1.6.1 Main Objective:

To determine water, sanitation and hygiene practices associated with diarrhea prevalence among members of households in the flood prone areas of Kilombero Valley

1.6.2 Specific Objectives:

1. To determine the prevalence diarrhea among members of households in the flood prone areas of Kilombero Valley.
2. To determine the level of WASH practices in the flood prone areas of Kilombero Valley.
3. To determine the association of WASH practices and diarrhea prevalence among members of households in flood prone areas of Kilombero Valley.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Diarrhea prevalence in flood prone areas.

The prevalence of diarrhea is largely influenced by poor water, sanitation and hygiene practices in flood prone areas. The most vulnerable group in the flood prone areas was children. Diarrhea prevalence in Indonesia showed that, the under 5 years age was 12.8% while between 5 and 14 years was 5.1% and above 14 years was 4% (7). This is due to the fact that, children are more susceptible to be in contact with contaminated materials such as soil, water and food.

The outbreaks of diarrheal diseases are mostly the results of exposure of a human body to contaminated water and limited water availability for drinking and sanitation purpose. Studies (29) have found that the households which resides in the downstream are more likely to suffer from diarrhea diseases because most of them depending on water from the contaminated rivers for various domestic purposes. Thus, diarrhea prevalence in the downstream settlements along Thamalakane River recorded to be 27-38% and 20-27% of the interviewed households during the early and late flood recession seasons respectively (29).

Flooding incidences can greatly increase the risk of diarrhea disease to epidemic levels since may result into increased destruction of water supply and sanitation facilities. This is due to the fact that, the households tend to use untreated drinking water, unimproved sanitation facilities, lack of soap for hand washing soap, lacked maternal education or relied on uncovered community wells for drinking water (30). Thus, following the severe floods in 2011, about 22% of children (0-59 months) has been increased at epidemic level in the three provinces of Cambodia, which is similar to diarrhea incidence that occurred in Bangladesh in August 2007 and Pakistan floods in 2010 that caused the accumulation of incidence for about 17% of medical consultations in the worst affected provinces (30).

In Tanzania, diarrhea is a major cause of morbidity and mortality among young children. Diarrheal diseases are frequently resulted from the consumption of contaminated water as well as poor hygienic practices in food preparation and disposal of excreta. About 12% of children less

than 5 years age had diarrhea in the 2 weeks before the survey. The prevalence of diarrhea was slightly higher in urban areas (14%) compared with rural areas (11%) (14). The study on the vulnerability of communities to flooding hazards which was conducted in Tandale and Kigogo Wards in Dar es Salaam, revealed that out of 95% of households interviewed, only 15% mentioned that they have been affected by diarrhea and cholera (21).

Studies (31–34) showed that, Kilombero Valley is endowed with abundant drainage channels and fertile land that attracted people to establish their settlements and economic activities in the flood prone areas which eventually increase their vulnerability to health emerging health problems during and after flooding incidence. According to Annual Report Health Sector Morogoro Region; diarrhea disease was observed to be the third ranked disease and has accounted for 13% for less than 5 years, while for the above 5 years is about 10% and they are associated with poor environmental sanitation and poor personal hygiene (35). The screening patients done between September 2014 and September 2015 in Kilombero District revealed that among 1007 patients only 101 (10%) found to have diarrhea (36).

2.2 The level of households' WASH Practices.

Water use practice particularly from their sources, handling, treatment and storage can cause diarrhea to the consumers. Households in flood prone suffer from insufficiency water sources for domestic purposes which eventually force them to use water from unimproved or unprotected drinking sources. Point of Use treatment and household water treatment and storage (HWTS) involve disinfecting water prior to use. Boiling has been found to be the most common used method in households today. Following water purification treatment is necessary inorder to prevent subsequent water contamination (19). Therefore, the sites which lack water supply there is high probability for the occurrence of diarrhea incidences (26). Different studies reported that most of households' members consume untreated water since they believe that water losses test or taste unpalatable after boiling; it takes time to boil and cool water for drinking while one is thirsty; boiling water for large family is tedious and also they believe that water is safe from pathogens (29). Despite of the access to improved sources of drinking water has increased from 57 to 61 percent respectively but there is disparity between urban and rural areas in Tanzania.

About 46.8 percent of households in urban of Tanzania mainland use untreated water for drinking while 68.6 percent use untreated water for drinking in rural areas (37). This disparity depicts that most of households in rural area more vulnerable to health problems particularly diarrheal diseases due to the fact that they consume untreated water from unprotected sources that can be easily contaminated with fecal matter. Usually potential surface water is contaminated as people lacking alternatives, wash, and bath and defecates in the open areas. Ground water becomes polluted by unregulated discharges of domestic and agricultural discharges of domestic and agricultural effluent into open water bodies and infiltrating soils. The communities residing within close proximity to water bodies and those relying on ground water are particularly vulnerable (38).

Sanitation practices involve the access and proper use of sanitary facilities as well as proper waste management. The access to improved sanitation lowers the residents at risk from poor environmental conditions. People living in the communities with high level of sanitation has low rate of growth stunting regardless of in home access to a flush toilet. People living close to contaminated wastewater had relatively high risk of diarrhea morbidity than those in water absent settings. The use of improved sanitation facilities has increased from 2 to 19 percent in 2004/5 to 2015/16 respectively, but still a number of people especially in rural areas of Tanzania do not have toilets that mean they defecate in the bush or fields (14).

Type of sanitation facilities appears to be closely related with diarrhea morbidity. Findings from other studies showed that, the households with pit latrines have high rates of diarrhea incidences compared to the households with flush toilets (26). Most of residents in flood prone areas use unimproved sanitary facilities in which during flood events can be disrupted and surface runoff drain the human feaces to the potential water sources. Different studies (18) revealed that extreme environmental conditions particularly flood can increase diarrhea rates by flushing pathogens into surface drinking water sources - pathogens that have accumulated in the environment due to improper disposal of feces. Humans can ingest these pathogens when they consume untreated drinking water. During wet periods, rainfall may regularly flush pathogens from the village environment and in the surface water directly, through runoff, and indirectly, through the mobilization of bacteria in soil. Latrines might concentrate pathogens and, if not

sealed, could overflow during a heavy rainfall event, increasing exposure to pathogens. Communities with higher open defecation rates might experience more dispersion of microbial contamination during regular rainfall events (15).

Haphazard disposal of solid waste in the household premise may play a major role in the occurrence of diarrhea diseases since they may pose odor that attract vectors in the area (20)**.** Improper households and community solid waste management can contribute to possible contamination of nearby water sources which are used for various domestic purposes and eventually if not properly treated tend cause diarrhea diseases among households. Literature found that, increased instances of flood coupled with lack of solid waste management could raise the spread and outbreak of diarrhea diseases (38).

Household liquid waste disposal is equally a problem in the neighborhoods. These open drains are a source of disease transmission point in the communities. Households that dispose liquid waste in their backyard could pre-dispose the majority of children who play around to diseases. The probability of humans coming into contact with household liquid waste is greater in the neighborhood because of the poor sanitary conditions (20). Therefore, poor sanitation in most flood prone areas is associated with poor drainage channels which cause water to rain water to disperse in the household premises particularly in ditches. This creates conducive environment for vector causing diseases.

Hygiene behaviors such as hand washing practices, eating habit and proper food preparation condition as well as proper wastes disposal such as human feaces, liquid wastes which if not well managed can initiate the occurrence of diseases. (26)**.** According to WHO (23), about a tremendous adverse impact of unsafe water in India despite of increased access and also that regardless of the initial water quality, widespread unhygienic practices during collection and limited access to sanitation facilities perpetuated transmission of diarrhea. Also, diarrhea diseases can spread from person to person aggregated by poor personal hygiene, through ingestion of contaminated food which is poorly managed or stored in unhygienic conditions. Both children and adults can be infected by waterborne diseases through direct contact with the medium such as water and soil. Though literature reveals that, there is no clear evidence that

water quality interventions are more effective in preventing diarrhea when combined with any of the additional interventions; hygiene promotion; separate vessel for water treatment or storage, or both; or improvements in sanitation or water supply. Hand washing with soap (HWWS) can interrupt the transmission path of diarrhea while soap is widely available in many parts of the developing world and is used for washing the body and clothes. Only 3% of people in Ghana, 6% in Peru and 31% in Senegal wash their hands after defecation (19).

2.3 The relationship of diarrhea prevalence and water, sanitation, hygiene practices

Different studies (19) found that, Point of Water use and safe storage of drinking water can reduce diarrhea diseases by 30 to 50%. This entails typical required treatment of drinking water which include filtration and disinfection (on a large or small scale) or boiling of water (on a small scale) (39). Studies (40) also found that, water often becomes contaminated before it is consumed even if it was collected from a protected source. The practice of boiling water which is the most cost effective purification method was also found to be the significant predictor of households' diarrheal encounters (29,30)

The use of improved pit latrine could prevent people from contamination of nearby water sources which act as potential domestic water sources. Therefore, the households with absence of pit latrine forces people to defecate in the nearby water sources which eventually may lead to occurrence of diarrhea diseases. Households with improved latrines were found to be 52% less likely to reported diarrhea incidences compared with unimproved pit latrines (41).

Proper waste management may play a great role in the prevention of diarrhea diseases in the flood prone areas. Proper solid wastes and child stool disposal practices tend to control microbial accumulation and protect human from being in contact with wastes. The proper waste disposals include burying of solid wastes or collecting them into the dustbin and finally send them to the nearby collection point (42).

Hygiene in the area prone to flooding is a crucial determinant of health outcome and this is done through raised awareness to the communities (19). The main promoted community hygiene programme include hand washing using soap before eating, after coming from the toilet,

drinking water purification and proper storage (20). Hand washing with soap, alone, has the highest impact on reducing disease transmission, including diarrhea, lowering the condition by about 47%. The studies found that, the instances of diarrhea were significantly reduced when hands were washed before cooking, if children were washed regularly and if the opening to the pit latrine was covered (43).

CHAPTER THREE

3.0 STUDY METHODOLOGY

3.1 Study area

The study was conducted in Kilombero Valley which is located in the Southern part of Tanzania and forms one of the four principal sub-basins of the Rufiji River Basin. It has an area of approximately 39,990 km². The basin of the Kilombero River is oriented from SW to NE and situated between Longitudes 34°33''E and 37°20''E and between Latitudes 7°39''S and 10°01''S as shown in figure 2.

Rainfall pattern is unimodal and very heavy and overall water levels in the Kilombero Valley tend to rise in November–April and fall smoothly from May onwards. Flood peaks tend to occur during March–April but can happen as early as January and as late as May and at that time accessibility can be very cumbersome. The annual rainfall ranges from 1,200 to 1,600 mm (44).

The Valley comprises a myriad of rivers and swampy, which make up the largest seasonally freshwater lowland floodplain in East Africa joining the Great Ruaha, Rufiji and Luwegu rivers. The Valley has attracted a number of people to establish their settlements due to its potential land fertility and availability of both permanent and temporary rivers. According to National Census of 2012, Kilombero District has a population of 407,880 with household size of 4.3 and is divided into 19 wards (45) Approximately 80% of people in the Valley are engaged in agricultural activities while few are involved in livestock keeping and others use the Kilombero River for fishing activities (46).

The Valley which is part of Rufiji Basin covers Kilombero and Ulanga District in Morogoro Region. The study was carried out in the flood prone areas of Kilombero Valley particularly in Kilombero District which administratively covered the areas of Ifakara Town Council and Kilombero District Council.

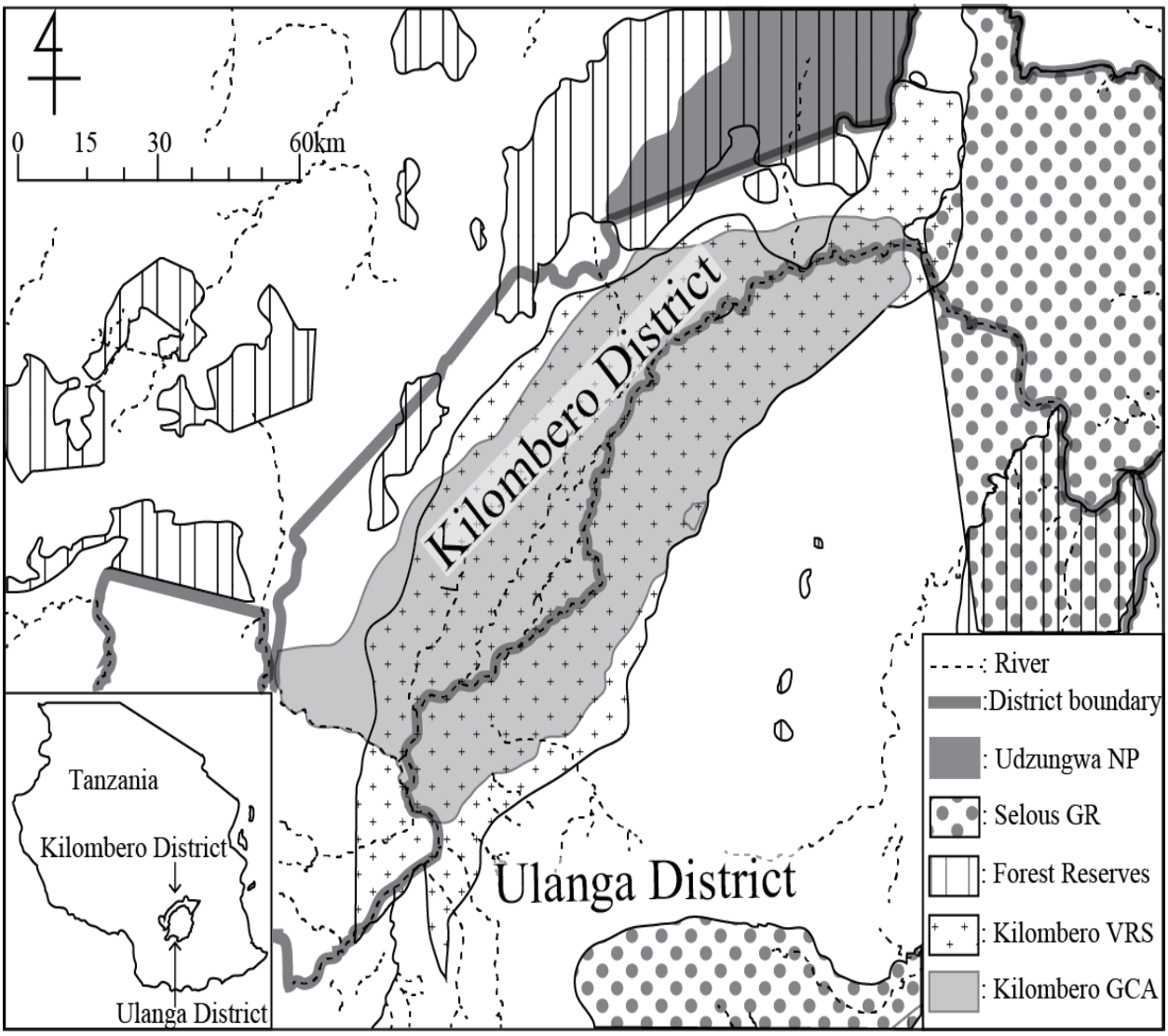

Figure 2: Map of Tanzania showing location of the Kilombero Valley Floodplain (46)**.**

3.2 Study population

The study population involved members of households who reside in the flood prone areas along Kilombero Valley specifically in Kilombero District.

3.3 Study design

The research was cross-sectional study design using quantitative methods for addressing the objectives.

3.4 Sample size

The sample size was calculated in order to obtain the heterogeneous characteristics of the sample. It was calculated based on the following formula;

$$n = \frac{z^2 p(1-p)}{\varepsilon^2}$$

Where;
n = Number of households

P = Proportion of households with diarrhea prevalence in flood prone areas. Since the proportion is not known, then 50% has been used

Z = The level of significant set up at the level of 95% confidence interval

Ɛ = Maximum likely error between the means which was estimated

$$n = \frac{z^2 p(1-p)}{\varepsilon^2}$$

$$= \frac{1.96^2 * 0.5\ (1-0.5)}{0.05^2}$$

Therefore, **n = 384**

Table 1 Wards, Villages and Sample size in project area

Ward	**No. of Villages/ Mitaa Selected**	**Sample Size**	**Percentage (%)**
Ifakara	3	72	18.75
Lumemo	3	72	18.75
Mofu	6	144	37.5
Mchombe	2	48	12.5
Utengule	2	48	12.5
Total	**16**	**384**	**100**

3.5 Inclusion and Exclusion Criteria

The study sample involved head of household who resided in the flood prone areas for 1 year and above.

Households in the selected villages who were not at risk of flooding were excluded in the study.

Respondents that were not able to release information due to any other reasons were excluded from the study.

3.6 Sampling techniques

The study involved multistage sampling techniques. Five (5) Wards that are situated in the flood prone areas were identified to constitute both urban and rural characteristics. Using simple random sampling the sixteen (16) Villages were selected from the selected wards. Then, 24 households were selected by using simple random sampling method in each village. The first household was identified after counting all households which are prone to flood with the assistance of Village Chairman. Then selected randomly one household from the total counted to be the first household to visit. After simple random selection of the first household to be interviewed then sampling interval between the selected household and the next was obtained by dividing the total number of households in the floodprone area and the sample size. Simple random sampling was used for the households with more than one heads of households in order to determine the head of household who will be included in the study. This method was done for all selected villages in order to exhaust the sample size of 384 households.

3.7 Data collection methods and tools

Primary data collection methods involved households' surveys and field observations. Household data were collected through interviewing heads of households or adult over 18 years using structured questionnaire adopted from the UNICEF Survey on Monitoring WASH practices at household level in Gaza in 2009 which was modified to fit the households resides in flood prone areas. The questionnaire addressed the following particulars; the first section assessed the demographic characteristics of respondents that are age, sex, marital status, children below 5 years, level of education and social economic status. The second section assessed the

household characteristics that are size of household, water sources, treatment and storage practices of household drinking water. The third section assessed the issues related to hygiene and sanitation like hand hygiene, toilet use and type (sharing of latrines between households)

In addition to that, participants were asked about the episode of diarrhea with the recall period of past three (3) months in the selected households. Information on the number of individual in the households was collected basing on their sex and ages. If households were observed to have the disease, then specific questions about diarrhea characteristics were asked about presence of mucus, blood and/or worms and the use of health care practices to treat diarrhea including administration of Oral rehydration solution and whether doctor was consulted. English version interview questions were translated into Swahili to obtain data from the study participants and to ensure that they understand the contents properly.

Visual inspections of environmental cleanliness, signs of damage and deterioration for water and sanitation facilities, e.g. cracks, dampness, etc. was also done in the field site.

3.8 Recruitment and training of research assistants

Four research assistants who had experience in Community health were recruited and trained on how to use research instruments and the easier way of collecting data from respondents. Also, they were trained in ethical issues.

3.9 Pre-testing of research tools

The Swahili version questionnaire was developed and pre-tested in the field to know if it is clear understood by the study participants. The research assistants used this opportunity to gain more interview skills. Moreover, the tools were tested to check whether they generate the intended data. Errors were noted in the pre-test exercise including the interview protocols which were then corrected before actual data collection.

3.10 Data Management

Filled questionnaires were checked for completeness at the end of each data collection day within the field so as to identify any missing data before leaving the field. At the end of each data collection day all field questionnaires were handled to the principal supervisor for safe storage.

3.11 Data processing and analysis

The collected data were checked and coded. Then data entry was done using Epi Info Version 3.5.1 and then exported to SPSS computer software version 20 prior for analysis. Univariate and multivariate logistic regression analysis was performed to determine factors that strongly affect the dependent variable and $p<0.05$ was used to interpret the significance of the statistical test.

3.12 Variables:

3.12.1 Dependent variable:

Diarrhea incidence

3.12.2 Independent variables:

Socio-demographic characteristics include;

Age, sex, education, monthly income, type of housing structure, family size and children under 5

Environmental factors and WASH practices include;

Water supply: - (drinking water sources, water purification practices, drinking water storage utensils);

Sanitation: - presence or absence of improved sanitary facilities, sharing of sanitary facilities, location of sanitary facilities in the household, Waste disposal;

Hygiene status which include availability of soap, presence or absence of functional handwashing station as well as awareness of handwashing practice

3.13 Ethical consideration

Ethical clearance was obtained from Muhimbili University of Health and Allied Sciences directorate of Research and Publications Committee as shown in appendix 5. Permission was granted from Kilombero District Executive Director, Ifakara Town Council Executive Director, Wards leaders and Village leaders. Confidentiality to all study participants was assured.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic characteristics of respondents

A total of 384 were interviewed in order to assess the Water, Sanitation and Hygiene Practices related to the control of diarrhea diseases in flood prone areas of Kilombero District.

More than a half (54.7%) of the respondents was females, while 45.3% were males. About (19.8%) of respondents were aged below 30 years; while almost more than half (54.4%) were between 31 and 50 years and 99 (25.8%) of respondents were above 51 years. Only 6.3% earned Tsh. 200,000/= and above while majority (93.8) were earning less than 200,000/= Tsh per month. About 11.5% of the total respondents did not have formal education. Majority had attained primary (78.6%) and 9.9% attained Secondary education and above. It was also found that about 68.8% of their houses are built with temporally building materials.

Table 2 Demographic and socio-economic characteristics of respondents (n = 384)

Variable	Categories	Frequency (n)	Percentage (%)
Age group	30 and below	76	19.8
	31-40	110	28.6
	41-50	99	25.8
	51 and above	99	25.8
Sex	Female	210	54.7
	Male	174	45.3
Education level:	None	44	11.5
	Primary	302	78.6
	Secondary and above	38	9.9
Marital status	Single	35	9.1
	Married	295	76.8
	Divorced	15	3.9
	Widowed/widower	39	10.1
Monthly income (TSh)	< 200,000	360	93.8
	≥ 200,000	24	6.3
Housing structure	Temporary	264	68.8
	Permanent	120	31.3

4.2 Reported diarrhea prevalence

Table 3 depicts the prevalence of diarrhea in the community. The results showed that about 30.6% reported diarrhea in three months period prior to data collection. With respect to age distribution, about 22.5% were children below five (5) years while 38.6% were within and above five (5) years.

Table 3 Prevalence of reported diarrhea in flood prone areas

Diarrhea prevalence	**Frequency (n)**	**%**
Below 5 years (n= 182)	41	22.5
5 and above years (n= 202)	78	38.6
Overall (n=384)	119	30.6

4.3 Levels of Water, Sanitation and Hygiene Practices

4.3.1 Household water sources, storage and treatment practice

The average water usage per household is about 101 Litres per day while the average daily water use per individual was 19 Litres. Most of them (76.8%) responded that only 30 minutes is used to acquire water for domestic purposes.

From Table 4, about 34.2% responded that they treat their drinking water. Boiling is the most treatment method used by 15.9% of respondents. The drinking water storage facilities were also assessed during the study period. The most widely used storage facility was bucket covered with a lid which accounts 68% of all facilities in the study area. Regarding the separation of drinking water storage facilities with other uses about 90.4% was always separating the storage facilities while others did not separate drinking water with water in other uses.

Table 4 Household water sources, status, treatment and storage

Variable	Categories	Freq (n)	Percentage (%)
Main water sources	Public taps/ stand pipes	144	37.5
	Tube well/ borehole	71	18.5
	Protected dug well	3	0.8
	Unprotected dug well	113	29.4
	Surface water	53	13.8
Water source status	Improved	218	56.8
	Unimproved	166	43.2
Time taken	Less than 30 min	295	76.8
	More than 30 min	89	23.2
HH water treatment	Yes	135	35.2
	No	249	64.8
Purification method	None	249	64.8
	Boiling	61	15.9
	Filter with cloth	14	3.6
	Let it stand and settle	41	10.7
	Use Chlorine (Water guard)	19	4.9
Drinking water storage facilities	Bucket with a lid	262	68.2
	Bucket without a lid	5	1.3
	Calabash	16	4.2
	Pot with a lid	101	26.3
Specifying drinking storage facilities	Always	347	90.0
	No	16	4.2
	Sometimes	21	5.5

4.3.2 Sanitation aspect

More than a half (51.3%) of households in the study area have access to unimproved toilet facilities while the remaining (48.7%) has access to improved toilet facilities. The most dominant toilet facility used by households include Pit latrine without slab (47.7%). The results depict that most (96.1%) of the toilet facilities are situated within 50 m from the houses. A distribution of households by their types of latrine shows that more than three quarters (77.3%), shared sanitation facilities that are they were used by more than one household while the remaining that

is 19% of toilets were used by only one household. About 3.6% still practice open defecation as shown in Table 5.

With regards to household's waste disposal practices it was observed that most of them (42.7%) collected refuse and burn immediately in the household's premise. Liquid waste was mainly (54.9%) thrown into the households' yards purposely for reducing dust into the surrounding or discharged directly into the garden.

Table 5 Sanitation status in flood prone areas of Kilombero District

Variable	Categories	n	%
Toilet facilities	Flush/ Pour flush to pit latrine	69	18.0
	Flush/ Pour flush to septic tank	10	2.6
	Pit latrine with slab	27	7.0
	Ventilated Improved Pit latrine	81	21.1
	Pit latrine without slab	183	47.7
	No facility/ Open defecation	14	3.6
Distance to toilet facilities	Less than 10m	104	27.1
	10m and above	266	69.3
Sharing of toilet facility	Only one household	73.0	19.0
	More than 1 household	297	77.3
Sanitation status	Improved	187	48.7
	Unimproved	197	51.3
Methods of solid waste disposal	Collected and burnt in the household premises	164	42.7
	Buried in the household premises	87	22.7
	Collected by companies to the dumpsite	42	10.9
	Uncollected/ dispersed in the household premise	91	23.7
Methods of liquid waste disposal	Discharged in the soak pit	133	34.6
	Throw on garden/ yards	211	54.9
	Throw on roads	40	10.4

4.3.3 Hygiene condition:

4.3.3.1 Handwashing at critical times

The most critical times to wash one's hand according to respondents were before eating (91.1%), before cooking/preparing meals (10.7%), after using latrines (65.6%). About 41.7% of

respondents regardless of gender, education level or whether they have latrines or not, reported that they have the habit of washing hands with water and soap.

4.3.3.2 Presence of handwashing station and soap.

Table 6 depicts hand washing practices with respect to their conditions. Only 6.3% of households had hand washing station/places. About 6.3% showed that there is soap in the handwashing station.

Table 6 Hygiene conditions in the flood prone areas of Kilombero Valley.

Variable	Categories	n	%
Handwashing critical conditions	After using toilet	252	65.6
	Before cooking/ preparing food	41	10.7
	After wakeup	18	4.7
	Before breast feeding	5	1.3
	Before and after meal	350	91.1
	After work	10	2.6
Hygiene condition	Good	24	6.3
	Bad	360	93.8
Hand washing with soap	Yes	160	41.7
	No	224	58.3
Hand washing facility (HWF)	Present	24	6.3
	Absent	360	93.8
Soap in the facility	Present	24	6.3
	Absent	360	93.8

4.4 Relationship between reported diarrhea and demographic and economic characteristics

Table 7 shows relationship between diarrhea and demographic and economic characteristics. There was no significance association between reported diarrhea and demographic and socio-economic characteristics of the study population and shown in Table 6 below.

Table 7 Relationship between reported diarrhea and demographic and socio-economic characteristics

Characteristics	n	OR	95%CI	p-value
Sex (n=384)				
Male	174	1.514	0.975-2.351	0.065
Female	210	1		
Marital status (n=384)				
Married	295	0.611	0.354-1.055	0.077
Not married	89	1		
Education (n=384)				
Primary and above	341	0.731	0.355-1.506	0.396
Not educated	43	1		
Family size (n=384)				
1-4	177	1.454	0.943-2.243	0.090
> 4	207	1		
Housing structure (n=384)				
Improved	120	1.153	0.720-1.847	0.553
Unimproved	264	1		
Average monthly income (n=384)				
200,000/= and above	24	2.377	0.794-1.259	0.122
Less than 200,000/=	360	1		
Presence of toilet facility (n=384)				
Present	370	1.684	0.571-4.966	0.345
Absent	14	1		

4.5 Bivariate analysis on the relationship between WASH practice and reported diarrhea

The study assessed the relationship between the current WASH practices and the three (3) months diarrhea prevalence. Table 8 shows the bivariate analysis on the relationship between diarrhea and WASH practices in flood prone areas of Kilombero District. Drinking water treatment practices particularly by boiling and let it stand and settle were significantly associated with diarrhea in the study area. It was found that the observed good storage facilities were significantly protective by 60% against diarrhea. Likewise, improved sanitation facilities were significantly protective by the protective effect of 43%. Ventilated Improved Pit latrine was found to be protective by 49% against diarrhea among households while Pit latrine without slab

was associated with diarrhea prevalence in the study area. Handwashing practice at critical conditions especially after using toilet was significantly protective by 40% against diarrhea. With regards to liquid waste disposal practice it was found that the throw of liquid wastes in household premises was significantly associated with diarrhea in the study area. Also it was found that the discharge of liquid waste into septic pit was protective by the protective factor of 41% to diarrhea. Other Water, Sanitation and Hygiene Practices did not show any significant association toward diarrhea diseases to residents in flood prone areas of Kilombero District.

Table 8 Relationship between reported diarrhea and WASH practices in flood prone areas of Kilombero Valley

Characteristics	Categories	n	OR	95%CI	p-value
Water source	Improved Unimproved	218 166	1.225 1	0.794-1.891	0.360
Treating drinking water	Yes No	135 249	3.108 1	1.885-5.206	0.000*
Boiling drinking water	Yes No	59 325	2.507 1	1.223-5.139	0.012*
Let it stand and settle	Yes No	41 343	2.904 1	1.187-7.105	0.020*
Drinking water storage facility	Good Bad	336 48	0.400 1	0.181-0.883	0.023*
Sanitation status	Improved Unimproved	187 197	0.569 1	0.367-0.880	0.011*
Pit latrine with slab	Yes No	27 357	0.461 1	0.210-1.014	0.054
Ventilated improved pit latrine	Yes No	81 303	0.512 1	0.309-0.850	0.010*
Pit latrine without slab	Yes No	183 201	1.921 1	1.233-2.991	0.004*
Pour/ Flush latrine to septic tank	Yes No	10 374	0.444 1	0.126-1.564	0.206
Pour/ flush latrine to pit	Yes No	69 315	1.486 1	0.819-2.697	0.154
Handwashing after using toilet	Yes No	252 132	0.596 1	0.371-0.959	0.033*
Handwashing before cooking	Yes No	41 343	0.977 1	0.487-1.959	0.947
Throw of waste water on garden/yard	Yes No	211 173	1.793 1	1.160-2.772	0.009*
Discharge in pits	Yes No	131 253	0.588 1	0.376-0.920	0.020*
Buried in the household premise	Yes No	87 297	1.013 1	0.605-1.698	0.961

Statistically significance at $p < 0.05$

4.6 Multivariate analysis

Table 9 shows predictor model for reported diarrhea by including all factors that had a $p < 0.05$ in bivariate analysis in order to establish the final model and adjust for confounding variables. The results revealed that treating drinking water and use of pit latrine without slab was significantly associated with the reported diarrhea in flood prone areas of Kilombero District. Improved drinking water storage and handwashing practice after using toilet were significantly found to be protective against diarrhea prevalence in flood prone areas of Kilombero District.

Table 9: Logistic model on the relationship between WASH practices and reported diarrhea in flood prone areas of Kilombero Valley.

Predictor variable	**Categories**	**n**	AOR	**95%CI**	**p-value**
Treating drinking water	Yes No	132 252	2.729 1	1.169-6.370	0.020*
Boiling drinking water	Yes No	59 325	1.336 1	0.467-3.823	0.589
Let it stand and settle	Yes No	41 343	1.314 1	0.408-4.232	0.647
Drinking water storage facility	Good Bad	336 48	0.272 1	0.099-0.742	0.011*
Sanitation status	Improved Unimproved	187 197	6.749 1	1.602-28.434	0.009*
Throw of liquid wastes on garden/yard	Yes No	211 173	1.375 1	0.638-2.964	0.416
Discharge in pits	Yes No	131 253	0.811 1	0.374-1.760	0.596
Handwashing after using toilet	Yes No	252 132	0.513 1	0.299-0.881	0.015*
Ventilated Improved Pit Latrine	Yes No	81 303	0.721 1	0.373-1.390	0.328
Pit latrine without slab	Yes No	183 201	8.213 1	2.070-32.587	0.003*

CHAPTER FIVE

5.0 DISCUSSION

5.1 Prevalence of Diarrhea

The prevalence of reported diarrhea within 3 months was found to be 30.6%. With respect to age distribution, about 22.5% were children under five (5) years while 38.6% were within and above five (5) years. The results for under five was found to be higher than that of Morogoro Region Prevalence rate of 8.5% as reported by Tanzania Demographic Health Survey (TDHS, 2015/16). The difference is due to recall period, sample size and focused study group. The diarrheal burden has been reported to be higher in refugee camp (54 %) and lower in slums (20 %) for the households that reported an instance of diarrhea in Kabul, Afghanistan (47).

5.2 Households WASH practices

The occurrence of diarrhea is sustained by the ongoing fecal contamination of water, food, water-collecting vessels, water and food, serving utensils, or the hands within the infected persons' personal, social, or house- hold contacts (48). However, they can be easily managed through cleanliness of utensils as well as hygiene of handler. Regardless of the water sources the manner in which the water is managed/ stored in the household remains critical if the contamination is to remain minimal (49). About 90% of the households had specific containers while the remaining 10% did not separate drinking water with water for other uses. This study found that more than half (56.8%) of households rely on improved water sources which are higher than the National Rural Mainland settings (47.8%) (14). The available evidence suggests that contamination of drinking water during storage in household vessels may contribute to disease transmission, and that improvements in the design of household water storage vessels coupled with point of use water treatment before storage can reduce this risk (24,25,50). This study found that, few (35.2%) responded that they purify their drinking water for various methods and most (15%) of them responded to use boiling as their most purification method in the study area. Boiling of drinking water at household level found to be the most cost effective method which tend to kill any illness causing microorganisms (51).

The most emerging communicable diseases in flood prone areas is mainly through contaminated water, mud and dust which contaminated due to poor sanitation and lack of hygiene practices as well as insufficient facilities to protect them from epidemic threats (12). Sanitation in the study area tends to be unhygienic with existing latrines poorly maintained. The most dominant toilet facility used was pit latrine without slab (47.7%). The sanitation situation is at alarming rate especially during wet season when water covers all homestead land. With regards to waste disposal methods it has been observed that most of households (42.7%) used to collect their refusal and then burnt in their premises. Also, liquid wastes are directly thrown on the household's yard in order to reduce dust or on the garden (54.9%). The state of water and sanitation situation in the households determines the risk of members of households contracting diarrheal disease in the event of flooding (49).

Hygiene behaviors such as hand washing practices, eating habit and proper food preparation condition as well as proper wastes disposal such as human feaces, liquid wastes which if not well managed can initiate the occurrence of diseases. (26)**.** According to WHO (23), about a tremendous adverse impact of unsafe water in India despite of increased access and also that regardless of the initial water quality, widespread unhygienic practices during collection and limited access to sanitation facilities perpetuated transmission of diarrhea. This study found that, the flood prone areas along Kilombero Valley have unhygienic status of about 93.8% which may contribute on the prevalence of diarrhea disease in flood prone areas. About 41.7% responded that they wash their hands with soap. Sustainable practice of hand washing after defecation and before handling food is an easy but effective measure in preventing transmission of pathogens. It blocks the third contamination pathway of fecal pathogens to humans (49). Also, lack of hand washing facility were associated with diarrhea (52). Therefore, it is imperative to ensure that those affected by floods have the tools, knowledge and understanding to prevent WASH related disease by involving them in the design and maintenance of the facilities (53).

5.3 Relationship between reported WASH practices and diarrhea prevalence.

The results particularly treating drinking water, sanitation status, improved storage facilities, liquid waste disposal methods mainly throwing in yards/gardens and discharge in pit as well as

handwashing after using toilet have significance association with diarrhea incidences. Although some of them lost their significance during multivariate analysis.

Despite of the fact that there is an increased use of improved water sources as compared to National Rural Mainland settings, there is no association with improved water sources for domestic purposes in flood prone areas of Kilombero Valley (i.e. OR=1.225, 95% CI 0.794-1.891, p=0.360). This indicates that the transport of water from the source increases the risk of diarrhea incidence. Studies (40) found that, water often becomes contaminated before it is consumed even if it was collected from a protected source. Ensuring safe water for domestic purposes, through water treatment at the point of use may reduce incidences of diarrhea (49).

Boiling of water for drinking purposes could also minimize the problem of diarrhea although water may be recontaminated during cooling and the practice may be economically and environmentally unsustainable to the communities under study. Therefore, the practice of boiling water which is the most cost effective purification method was also found to be the significant predictor of households' diarrheal encounters (29,30). This study reveals that, only 35% reported to treat their drinking water which depicts that majority of residents do not treat their drinking water which results into increased diarrhea incidence during and after flood occurrence. Inappropriate treatment of drinking water may cause recontamination of drinking water as it has been revealed in the results that there is association drinking water treatment and diarrhea incidence.

The findings of drinking water storage facilities are in line with other studies that unhygienic storage conditions may have possibly led to further decline of water quality in households and eventually increases the risk of diarrhea disease (29). However, proper storage of already prepared drinking water through washing of storage containers and safe clean drinking water may reduce risks of diarrhea in the population under study.

Due to economic constraints majority of households in rural settings are driven to use unimproved sanitation facilities such as pit latrine without slab. Findings from this study showed that majority of households with pit latrine without slab were at higher risk more than eight times in developing diarrhea compared to those used improved latrines such as Ventilated Improved

Pit (VIP) latrines. This is due to the fact that, they can be easily destructed during flood incidences and eventually increases the transmission of pathogens. The findings from the present study are similar to findings from other studies which reported an association between diarrhea and use of unimproved sanitation facilities (54)**.** In addition, it has been reported by other studies that about 15% to 70% of diarrhea worldwide could be reduced by ensuring hygienic sanitary facilities (49). Poor waste disposal methods may contribute to diarrhea prevalence in flood prone areas. Univariate analysis found that, throwing of wastewater in yards/ gardens has increased diarrhea incidences while discharge of wastewater into the pit played great role in protecting diarrhea to about 42.2%. Similarly, other studies (26,55) have also found significant association between inadequate disposal of solid waste, waste water and diarrhea incidences.

Handwashing with soap during critical conditions may play a great role in the control of diarrhea in flood prone areas. Findings from this study and other studies revealed that sustainable practice of hand washing after defecation and before handling food is an easy but effective measure in preventing transmission of pathogens to humans (49,52,56).

5.4 Study limitations

i. The cross-sectional design of the study could not allow for determination of a cause-effect relationship between diarrhea and WASH practices.

ii. Some of the information obtained through questionnaire relied on heads of household self-reporting which might have involved recall bias.

iii. The findings cannot be generalized to all communities in flood prone areas due to limited sample size.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The diarrhea prevalence in three months recall period was 30.6% which seem to be higher than of National Demographic and Health Survey data in 2015/16. This was due to differences in recall period, sample size and focused study groups.

WASH practices in flood prone areas of Kilombero Valley was found to be more than half (56.8%) for the use of improved water sources, 35.2% for household water treatment, 48.7% for improved sanitation status and 6.3% for good hygiene condition. This depict that there is low level of WASH practices due to the fact that, the key practices which play the great role in the control of diarrhea such as Household water treatment and handwashing with soap are inadequately implemented.

Also, the study findings show that, treating drinking water, use of improved sanitary facilities and use of pit latrine without slab (Unimproved) have greatly increased the risk of diarrhea incidences in flood prone areas while proper household drinking water storage and hand washing after using toilet found to reduce the risk of diarrhea in the area. This is due to the fact that some of them reported use of treated water while not in reality, drinking water may be recontaminated during cooling process, inadequate disinfecting dose, poor cleanliness of improved sanitation facilities may result into contamination of food or water sources and presence of dirty hand washing facilities. Therefore, this reveals that the households' members in the flood prone areas of Kilombero District are more likely to be affected by diarrhea incidence associated with WASH practices.

6.2 Recommendations

The following recommendations should be taken into consideration;

1. District government authorities and Non-Government Organizations should set interventions that promote the use of affordable improved sanitation facilities to the residents in flood prone areas.
2. District health office should establish health education programs to the communities in flood prone areas about handwashing practice to use soap at recommended times as well as other diarrhea preventive measures.
3. The government and NGOs intervention programmes should intensify the use of diarrhea preventive strategies at household level such as increased environmental cleanliness, improved food and personal hygiene as well as safe drinking water treatment and storage.

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APPENDICES:

Appendix 1: Informed consent form – English version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS

Title: Assessment of Water, Sanitation and Hygiene Practices associated with diarrhea prevalence among households' members in flood prone areas: A cross-sectional study of Kilombero Valley in Kilombero District, Morogoro Region, Tanzania

ID-NO ☐

Consent to participate in this study

Greeting! My name is ……I am working on this research project with the objective of assessing the association of Water, sanitation and hygiene practices and diarrhea control among households' members in flood prone areas: A case study of Kilombero Valley in Kilombero District, Morogoro Region, Tanzania. We plan to interview 384 head of household in this district. We are asking you to take part in this study because the information will be used purposely for this research only. Your opinion and experiences are important to us. You have been selected by chance.

We want you to understand the purpose of this study and your role, so you may decide if you want to join. If you join, we will ask you to sign this paper (or if you cannot read/ write, make your mark in front of a witness). Please ask us to explain any words or information that you may not understand.

Information about the research

If you participate we will interview you. We will ask you about your background. We will ask about the health status in your household and how you prepare and store your drinking water as well as sanitation and hygiene status. The interview will last about 20 min.

Possible risks we will do our best to protect your privacy and study records. Our interview will be private. However, it is possible that others will learn that you joined the research. Because of this, others may treat you unfairly.

The interview questions may cause you to feel some anxiety. You may refuse to answer any question. You may end the interview at any time.

Possible benefits this study has no direct benefits, but the results of this study will help to improve interventions against children's diarrhoea and water safety. We do not provide any incentive for water treatment, but the interview may advice you on you how you can safely store your water from contamination.

If you decide not to be in the research, you are free to decide if you want to take part in this research or not. Confidentiality

We will do our best to protect information about you and your part in this research. We will interview you in a private place. We will not write your name on the interview form.

You will not be named in any reports. Only the study staff and investigators will know your answers to the questions.

Compensation:

You will not receive any money by joining this study. Leaving the research study You may leave the research at any time. If you leave, it will not change the health care you receive here. If you choose to take part, you can change your mind at any time and withdraw. If so, please tell the research interviewer why you wish to leave.

Your rights as a participant: This research has been reviewed and approved by the Muhimbili University of Allied Health Sciences research and publication committee.

Whom to contact:

If you ever have questions about this study, you should contact the study Coordinator or the Principal Investigator Robert Kibongolo; Muhimbili University of Health and Allied Sciences

(MUHAS), P.O. Box 65011, Dar es Salaam Mobile No. 0716484280 questions about your rights as a participant, you may contact/call Dr. L. Rongo who is the supervisor of this study (Mobile: 0754 575 709).

Signature:

Do you agree?

Participant Agrees ☐

Participants disagree ☐

I ……. have read/understood the contents in this form. I agree to participate in this study.

Signature of participant. ……

Signature of witness (if participant cannot read) ……..

Signature of research assistant ……

Date of signed consent …….

Appendix 2: Fomu ya ridhaa

FOMU YA RIDHAA TOLEO LA KISWAHILI

CHUO KIKUU CHA AFYA NA TIBA MUHIMBILI

KURUGENZI YA UTAFITI: UTAFITI KUHUSU HALI YA MATUMIZI YA MAJI NA AFYA YA MAZINGIRA YASABABISHAYO MAAMBUKIZI YA UGONJWA WA KUHARISHA KWENYE KAYA KATIKA MAENEO YANAYOKABILIWA NA MAFURIKO KWENYE BONDE LA MTO KILOMBERO, WILAYA YA KILOMBERO, MKOA WA MOROGORO, TANZANIA.

Ridhaa ya kushiriki katika utafiti huu

Salamu! Mimi naitwa …….....Ninafanya utafiti kuhusu Hali ya matumizi ya maji, Usafi wa Mazingira na Maambukizi ya Ugonjwa wa kuharisha kwenye kaya zilizo katika maeneo yanayokabiliwa na mafuriko kwenye Bonde la Mto Kilombero, Wilaya ya Kilombero, Mkoa wa Morogoro, Tanzania**.** Tumepanga kufanya mahojiano na wakuu wa kaya wapatao 400 ambao tutawapata kwa njia isiyo ya upendeleo yaani bahati nasibu. Kwa njia hiyo ya bahati nasibu kaya yako imekuwa miongoni mwa kaya hizo hivyo tunakuomba ridhaa yako ya ushiriki katika mahojiano haya.

Tungependa uelewe malengo ya utafiti huu na umuhimu wa kushiriki utafiti huu ili uweze kuamua ama kukubali kushiriki au kukataa. Tutakuomba kutia sahihi kwenye fomu hii endapo utakubali kushiriki katika utafiti huu au kama hujui kuandika utaweka alama ya dole gumba mbele ya shahidi.

Maelezo kuhusu utafiti huu.

Endapo utakubali kushiriki tutakuuliza maswali yaliyopo katika dodoso hili. Tutakuuliza kuhusu taarifa binafsi pamoja na masuala ya kiafya ya familia kwa ujumla.Vilevile tutakuuliza namna unavyo andaa nakutunza maji yako ya kunywa katika kaya yako na pia afya na usafi wa mazingira.

Usiri:

Nakuhakikishia kuwa taarifa zote tutakazo chukua hazitawekwa bayana kwa mtu yoyote isipokuwa wanaofanya kwenye utafiti huu tu. Taarifa yetu itatumia majibu ya vipimo vyetu tu na si vinginevyo.

Faida ya utafiti huu:

Hakuna faida ya moja kwa moja utakayoipata kutokana na wewe kushiriki katika utafiti huu, isipokuwa matokeo ya utafiti huu yataisaidia Serikali kujua uhusiano uliopo kati ya hali ya matumizi ya maji, afya na usafi wa mazingira udhibiti wa maambukizi ya magonjwa ya kuharisha kwenye kaya zinazokabiliwa na mafuriko na hivyo kuandaa mikakati ya kuhimiza hali ya maji na usafi wa mazingira.

Madhara:

Hakuna wasiwasi wa madhara, yoyote yatokanayo na utafiti wetu. Una uhuru pia wa kukataa baadhi ya maswali pia kukataa kushiriki katika utafiti huu wakati wowote. Ni hiari yako kushiriki katika utafiti huu. Uamuzi wako wa kutokushiriki hautakuwa na madhara yoyote kwako ya kupata huduma zako unazostahiri. Wakati wowote unaweza kujitoa katika utafiti huu, hata baada ya kutoa ridhaa yako hapo awali. Kwa kujitoa kwako hakuna adhabu yoyote wala hutanyimwa haki yoyote unayostairi kupata katika jamii.

Mawasiliano:

Kama una swali lolote unaweza kuwasiliana na mimi Ndugu, Robert Kibongolo kwa kutumia anuani ya Chuo Kikuu Cha Afya na Tiba Muhimbili S.L.P. 65015, Dar es Salaam, Namba yangu ya simu ya kiganjani ni 0716 484280. Ukiwa na swali lolote kuhusu haki yako ya kushiriki utafiti huu unawezo kumpigia Dr. L. Rongo kwa simu namba 0754 575 709 ambaye ni msimamizi wa utafiti huu.

Sahihi:

Je utakubali?

Mhusika amekubali ☐

Mhusika amekataa ☐

Appendix 3: Questionnaire in English Version

MUHIMBILI UNIVERSITY OF ALLIED HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH AND SOCIAL SCIENCES

QUESTIONNAIRE FOR ASSESSMENT OF WATER, SANITATION AND HYGIENE PRACTICES ASSOCIATED WITH DIARRHEA PREVALENCE AMONG HOUSEHOLDS' MEMBERS IN FLOOD PRONE AREAS: A CASE STUDY OF KILOMBERO VALLEY, KILOMBERO DISTRICT, MOROGORO REGION, TANZANIA.

ID NO_____DATE OF INTERVIEW_____

INTERVIEWER NAME……..

VILLAGE_____WARD:_____

NO	QUESTIONS	CODING CATEGORIES		SKIP
DEMOGRAPHIC CHARACTERISTICS				
1	Status of the respondent in the household (Only one respondent)	Mother	1	
		Father	2	
		Grand father	3	
		Grand mother	4	
		Other	5	
2	Sex (Don't ask the respondent)	Male	1	
		Female	2	
3	Age of respondent (estimate allowed)	.....		
4	Marital status	Single	1	
		Married	2	
		Divorced	3	
		Widowed	4	
		Widower	5	

		Cohabiting		6	
5	Level of education (The highest level of education reached)	Primary		1	
		Secondary		2	
		College		3	
		Non		4	
6	Duration of residence in the area	…….years			
7	How many people live in your household?	……			
8	Does the household have children less than 5 years	Yes 1 No 2			
9	Household income per month	Less than 200,000/=Tsh 200,000/= to 500,000/= More than 500,000/=			
10	Does your household has		Yes	No	
		Electricity	1	2	
		Radio	1	2	
		Television	1	2	
		Mobile phone	1	2	
		Landline	1	2	
		Refrigerator	1	2	
11	What type of fuel does your household normally use for cooking?	Electricity	1		
		Gas	2		
		Paraffin	3		
		Charcoal	4		
		Firewood	5		
		Others	6		
12	House unit (FLOOR), record observation	Earth, sand, gung	1		
		Wood, planks, bamboo, palm	2		

		Parquet, polished wood	3	
		Vinyl or Asphalt strips	4	
		Ceramic tiles, Terrazzo	5	
		Cement	6	
		Carpet	7	
		Others	8	
12	Wall material, record observation.	Grass	1	
		Pole and mud	2	
		Sun dried bricks	3	
		Backed bricks	4	
		Wood timber Cement	5	
		Cement blocks	6	
		Stones	7	
		Others	8	
14	Roofing material	Grass/Thatch/Mud	1	
		Iron sheets	2	
		Tiles	3	
		Concrete	4	
		Asbestos	5	
		Others	6	
DRINKING WATER SOURCES, HANDLING AND STORAGE				
15	What is the main source of drinking water for members of your household	Piped water	1	
		Water from open well	2	
		Water from borehole	3	
		Surface water	4	
		Rain water	5	
		Water vendors	6	

		Other	7	
16	Who is providing water at the source	Authority	1	
		CBO/NGO	2	
		Private operator	3	
		Don't know	4	
17	How long does it take to go there, get water and come back	Less than 30 mins More than 30mins	1 2	
18	How much water do you get per day	……..litres/d		
19	Do you do anything to make water safer to drink?	Yes		If no skip to Qn. 20
		No		
20	What do you usually do to make the water safer to drink?	Boiling	1	
		Use of chlorine (water guard)	2	
		Use water filters (ceramic filters)	3	
		Solar disinfection	4	
		Let it stand and settle	5	
		Filter with cloth	6	
		Other	7	
21	Why do use this method for making water safer	Cheap	1	
		I don't know other option	2	
		The method is effective	3	
		Others	4	
		Don't know	5	
22	Why don't you treat your drinking water?	Availability	1	
		Cost	2	
		Bad taste and smelly of treated water	3	

		I believe water is safe from the source	4	
		I am used to drink untreated, nothing happen to us	5	
		Other	6	
		I don't know	7	
23	Do you store water for drinking separately from water for other domestic purposes	Always	1	
		Sometimes	2	
		No	3	
24	Which container do you store water for drinking (observe and write answers)	Bucket with a lid	1	
		Bucket without a lid	2	
		Small pan	3	
		Jerry cans	4	
		Others	5	
25	Do you use water for drinking for other purposes	Yes	1	
		No	2	
26	How do you draw water from your container	Use small pan	1	
		Pour water directly from container	2	
		Use cup	3	
		Others	4	
27	Do you enjoy the taste and smell of your cleaned drinking water	Yes		
		No		
		I don't know		
28	Who use water once it is treated	Father	1	
		Mother	2	
		Children	3	
		Guest	4	

		Elders	5	
		Other	6	
HOUSEHOLDS SANITATION AND HYGIENE PRACTICES				
29	When do you wash hands?	After using the toilet	1	
		Before meals	2	
		Before cooking/preparing food	3	
		Others	4	
30	Do you use soap?	Yes	1	
		No	2	
31	Is there a place for washing hands (observe)	Yes	1	
		No	2	
32	Is there a soap in a place they wash their hands (observe)	Yes	1	
		No	2	
33	What kind of toilet facility do members of household usually use	Flush/Pour flush to sewer	1	
		Flush/Pour flush to septic tank	2	
		Flush/Pour flush to pit latrine	3	
		Flush/Pour flush to elsewhere	4	
		Ventilated improved pit latrine	5	
		Pit latrine with slab	6	
		Pit latrine without slab/open pit	7	
		No facility/bush	8	
		Others	9	
34	How far is this toilet from where you	Less than 10 metres	1	

	live? [IF FEASIBLE, OBSERVE]	10 to 50 metres Over 50 metres	2 3	
		Don't know	4	
35	Was your latrine flooded in the past years	Yes…….	1	
		No….	2	
36	What did you do the last time the pit/septic tank was full?	Built a new pit or septic tank	1	
		Household emptied it	2	
		Private company emptied it	3	
		Government service emptied it	4	
		Other, specify.	5	
		Don't know	6	
37	Where does your household's domestic waste water discharge to (i.e. water from cooking, washing, cleaning, but not including toilet waste water)?	Septic system	1	
		Pour into toilet	2	
		Soak pit	3	
		Street drain	4	
		Throw on road	5	
		Throw on garden/yard	6	
		Pour into stream/ river	7	
		Other, specify	8	
		Don't know	9	

38	Where does the household's solid waste disposed?	Collected by the private companies to the dumpsite	1	
		Buried within the household's premise	2	
		Others, specify	3	
		Don't know	4	
INCIDENCE OF DIARRHEA AND CONTROL MEASURES				
39	Can you tell me, the biggest problem your family faces? (Don't read to respondents, write only answers)	Poor health	1	
		Insufficient food	2	
		Lack of money to meet the basic needs	3	
		Unemployment	4	
		Homeless	5	
		Lack of access to health services	6	
		Others	7	
40	What is the most frequent disease in your community (Do not read to the respondent).	Diarrhea	1	
		HIV/AIDS	2	
		Malaria	3	
		Trauma (Injuries)	4	
		Respiratory diseases	5	
		Anaemia	6	
		Skin diseases	7	
		Others	8	
		I don't know	9	
41	What causes diarrhoea? (Do not read to the respondent)	Drinking dirty water	1	
		Eating contaminated food	2	
		Flies/ insects	3	
		Poor hygiene	4	

		Weather	5	
		Spirit	6	
		Others	7	
		Don’t know	8	
42	Have any member of the household suffered from diarrhea?	Yes	1	
		No	2	
43	If yes, when did the most recent incident happen?	Last 3 months	1	
		Last 6 months	2	
		Last 9 months	3	
44	What was the age of that person?	…….. years		
45	How can you prevent diarrhoea? (Don’t read to respondent)	Wash hands more frequently	1	
		Cooking thoroughly	2	
		Cover prepared food	3	
		Cleanliness (dishes, utensils)	4	
		Weather	5	
		Others	6	
		Don’t know	7	

THANK YOU FOR YOUR TIME AND COOPERATION

Appendix 4: Dodoso la Utafiti

CHUO KIKUU CHA AFYA NA TIBA MUHIMBILI

KITIVO CHA SAYANSI YA AFYA YA JAMII

DODOSO LA UTAFITI WA HALI YA MATUMIZI YA MAJI, USAFI WA MAZINGIRA NA MAAMBUKIZI YA UGONJWA WA KUHARISHA KWENYE KAYA KATIKA MAENEO YANAYOKABILIWA NA MAFURIKO KWENYE BONDE LA MTO KILOMBERO, WILAYA YA KILOMBERO, MKOA WA MOROGORO, TANZANIA.

NAMBA_____ TAREHE YA MAHOJIANO_____

KIJIJI_____ KATA: _____

JINA LA MHOJAJI.....

Na	MASWALI	VIFUPISHO VYA MAJIBU		SKIP
	DEMOGRAPHIC CHARACTERISTICS			
1	Mhojiwa (Chagua inayohusika)	Mama	1	
		Baba	2	
		Babu	3	
		Bibi	4	
		Mwingine	5	
2	Jinsia ya mhojiwa	Me	1	
		Ke	2	
3	Umri wa mhojiwa (unaweza kukadiria)	Miaka.....		
4	Hali ya ndoa	Hajaoa/ hajaolewa	1	
		Ameoa/ ameolewa	2	
		Wameachana	3	
		Mjane	4	
		Mgane	5	

		Kimada	6	
5	Kiwango cha elimu	Shule ya msingi	1	
		Sekondari	2	
		Chuo	3	
		Hajasoma	4	
6	Muda mhojiwa alioishi kwenye kaya	……		
7	Unaishi na familia ya watu wangapi?	…… ……		12
8	Kaya yako ina watoto walio chini ya miaka 5	…… …….		13
9	Kipato cha kaya kwa mwezi (Tsh)	Chini ya 200,000/= 200,000-500,000/= Zaidi ya 500,000/=		
10	Je kwenye kaya yenu kuna:		Ndio	Hapana
		Umeme	1	2
		Redio	1	2
		TV	1	2
		Simu	1	2
		Simu ya mezani	1	2
		Friji	1	2
11	Ni aina gani ya chanzo cha nishati kinachotumika kupikia?	Umeme		1
		Gesi		2
		Mafuta ya taa		3
		Mkaa		4
		Kuni		5
		Nyinginezo		6
12	Hali ya nyumba (Sakafu), zungushia kinachohusika	Udongo		1
		Mbao ambazo hazina dawa		2

		Mbao zenye dawa	3	
		Vinyl au Asphalt strips	4	
		Vigae	5	
		Simenti	6	
		Zulia/ kapeti	7	
		Nyinginezo	8	
13	Ukuta	Vioo	1	
		Udongo	2	
		Matofali mabichi	3	
		Matofali yaliyochomwa	4	
		Mbao	5	
		Matofali ya sementi	6	
		Mawe	7	
		Nyinginezo	8	
14	Paa	Nyasi/ Makuti	1	
		Mabati	2	
		Vigae	3	
		Zege	4	
		Asbestos	5	
		Nyinginezo	6	
	HALI YA UPATIKANAJI WA MAJI NA UTIBUJI			
15	Chanzo chenu kikuu cha maji ya kunywa ni:	Maji ya bomba	1	
		Maji ya visima vifupi	2	
		Maji ya visima virefu	3	
		Maji ya mto	4	
		Maji ya mvua	5	
		Vioski	6	
		Nyinginezo	7	
16	Maji hayo yanamilikiwa na nani?	Serikali ya mtaa	1	

		Asasi zisizo za kiserikali	2	
		Mtu binafsi	3	
		Sijui	4	
17	Ni muda gani unatumia kupata maji hayo	Chini ya dk 30 Zaidi ya dk 30	1 2	
18	Kiasi gani cha maji unapata kwa siku	……		
19	Huwa unatakatisha maji ya kunywa?	Ndiyo	1	Kama hapana, nenda swali la 22
		Hapana	2	
20	Ni njia ipi unayoitumia kutakatisha maji ya kunywa?	Nachemsha	1	
		Natumia waterguard	2	
		Chujio maalum (ceramic filters)	3	
		Nguvu ya jua	4	
		Naacha yatulie	5	
		Nachuja na kitambaa	6	
		Nyinginezo	7	
21	Kwanini unatumia njia hiyo?	Ni nafuu	1	
		Hamna njia nyingine	2	
		Wanafamilia wanaipendelea	3	
		Sababu nyinginezo	4	
		Sijui	5	
22	Kwanini hautakatishi maji yako ya kunywa?	Hamna vitakatisho	1	
		Gharama	2	
		Maji yaliyotakatishwa sipendi ladha yake	3	
		Naamini maji ni salama	4	
		Nimekuwa nakunywa maji	5	

		yasiyo tibiwa bila matatizo		
		Sababu nyinginezo	6	
		Sijui	7	
23	Huwa unatunza maji yako ya kunywa tofauti na mengine	Ndio	1	
		Mara chache	2	
		Hapana	3	
24	Nionyeshe kifaa unachotumia kuhifadhia maji (angalia na zungushia jibu)	Ndoo yenye mfuniko	1	
		Ndoo isiyo na mfuniko	2	
		Sufuria	3	
		Madumu	4	
		Nyinginezo	5	
25	Huwa unatumia maji ya kunywa kwa shughuli nyingine?	Ndiyo		
		Hapana		
26	Huwa mnachukuaje maji ya kunywa kutoka kwenye chombo yalikohifadhiwa?	Bakuli	1	
		Tunamimina	2	
		Tunatumia kikombe	3	
		Nyinginezo	4	
27	Huwa mnafurahia ladha na harufu ya maji yenu yaliyotibiwa?	Ndyo	1	
		Hapana	2	
		Sijui	3	
28	Nani huwa anakunywa maji yaliyotibiwa?	Baba	1	
		Mama	2	
		Watoto	3	
		Mgeni	4	
		Watu wazima	5	
		Wengine	6	
HALI YA AFYA NA USAFI WA MAZINGIRA KWENYE KAYA.				
29	Ni wakati gani mnanawa mikono?	Baada ya kutoka chooni	1	
		Kabla na baada ya kula	2	

		Kabla ya kuanza kupika	3	
		Mengineyo	4	
30	Huwa mnatumia sabuni?	Ndiyo	1	
		Hapana	2	
31	Mna sehemu maalumu ya kunawa mikono? (angalia)	Ndiyo	1	
		Hapana	2	
32	Kuna sabuni sehemu ya kunawia mikono? (angalia)	Ndiyo	1	
		Hapana	2	
33	Mnatumia choo cha namna gani?	Kimeunganishwa kwenye mtandao wa maji taka	1	
		Kimeunganishwa kwenye makalo ya maji taka	2	
		Ni cha shimo na wanaflush	3	
		Wanaflush kwa kutapisha	4	
		Ni cha shimo chenye bomba la hewa	5	
		Ni cha shimo chenye cement slab/magogo	6	
		Ni shimo lisilo na slab	7	
		Hamna choo/ vichakani	8	
		Nyinginezo	9	
34	Ni umbali gani kati ya choo na kaya	Chini ya mita 10	1	
		Kati ya mita 10 na 50	2	
		Zaidi ya mita 10	3	
		Sifahamu	4	
35	Je, choo chako kimewahi kujaa kwa miaka iliyopita	Ndio…….	1	
		Hapana….	2	

36	Ulifanya nini pindi choo chako kilipojaa?	Nilijenga choo kingine	1	
		Kaya ilinyonya kinjesi	2	
		Kampuni ilinyonya kinyesi	3	
		Serikali ilinyonya kinyesi	4	
		Nyinginezo.	5	
		Sifahamu	6	
37	Majitaka yatokanayo na matumizi ya kaya yanamwagwa wapi?	Mfumo wa maji taka	1	
		Kwenye choo	2	
		Kwenye karo	3	
		Kwenye mtaro wa maji taka	4	
		Kwenye barabara	5	
		Kwenye bustani	6	
		Kwenye mto	7	
		Nyinginezo	8	
		Sifahamu	9	
38	Taka ngumu za kaya hutupwa wapi?	Kukusanywa na kampuni binafsi	1	
		Kufukiwa karibu na eneo la kaya	2	
		Nyinginezo	3	
		Sifahamu	4	
	MATUKIO YA MAGONJWA UZUIAJI KWENYE KAYA			
39	Ni tatizo lipi mnalokabiliana nalo? zungushia majibu	Afya mbaya	1	
		Upungufu wa chakula	2	

	usimsomee mhojiwa.	Ukosefu wa fedha za kujikimu kimaisha	3	
		Ukosefu wa ajira	4	
		Upweke	5	
		Ukosefu wa huduma za afya	6	
		Nyinginezo	7	
40	Ni ugonjwa upi unawasumbua mara kwa mara katika jamii yenu? zungushia majibu usimsomee mhojiwa.	Kuharisha		
		UKIMWI		
		Malaria		
		Ajali		
		Mgonjwa ya mfumo wa hewa		
		Anemia		
		Magonjwa ya ngozi		
		Nyinginezo		
		Sijui		
41	Kuharisha kunasababishwa na nini?, Usimsomee mhojiwa zungushia anachojibu	Unywaji wa maji yasiyo salama	1	
		Ulaji wa chakula kisicho salama	2	
		Nzi/ Wadudu	3	
		Uchafu	4	
		Hali ya hewa	5	
		Pepo wachafu	6	
		Nyinginezo	7	
		Sijui	8	
42	Je kuna mtu yeyote kwenye kaya yenu amewahi kupatwa na ugonjwa wa kuharisha?	Ndiyo	1	
		Hapana	2	
43	Kama, ndiyo ni wakati gani tukio hilo lilitokea?	Miezi mitatu iliyopita	1	
		Miezi 6 iliyopita	2	
		Miezi tisa iliyopita	3	

44	Mgonjwa alikuwa na umri gani?	Miaka……		
45	Unawezaje kuzuia magonjwa ya kuharisha? (Usimsomee, zungushia alichojibu)	Kunawa mikono kila mara kwa sabuni	1	
		Kupika chakula mpaka kiive vizuri	2	
		Kufunika chakula	3	
		Kuzingatia hali ya usafi (vyombo, nk)	4	
		Hali ya hewa	5	
		Nyinginezo	6	
		Sijui	7	

AHSANTE KWA MUDA WAKO NA USHIRIKIANO WAKO

Appendix 5: Ethical Clearance approval letter

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

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Ref. No. MU/ PGS/SAEC/Vol.X/ 1st August, 2017

Mr. Robert Kibongolo
Master of Public Health
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: ASSESSMENT OF WATER, SANITATION AND HYGIENE PRACTICE AND THE CONTROL OF DIARRHEA PREVALENCE AMONG HOUSEHOLDS IN FLOOD PRONE AREAS ALONG KILOMBERO RIVER VALLEY

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from 31st July, 2017 to 30th July, 2018. In case you do not complete data analysis and dissertation report writing by 30th July, 2018, you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. E. Balandya
DEPUTY DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Public Health and Social Sciences