University of Zambia
School of Medicine

Exploratory Study of Environmental Health Factors Associated with the Prevalence of Diarrhoea Diseases in Mtendere Township- Lusaka District Zambia

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MPH (Environmental Health)

Submitted in partial fulfillment of the requirements for the Degree in Masters of Public Health (Environmental Health) to The University of Zambia

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DECLARATION

I Florence Muleka Kabinga declare that this research document being presented for the Degree of Masters ofPublic Health (Environmental Health) has not been previously submitted either wholly or in part for other Degree at this or any other University nor is it being currently submitted for any other Degree.

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DEDICATION

This work is dedicated to God for enabling me to go through this programme; my husband, daughter Asa Mwale, sons: Joel and Mattaniah Mwale for their patience and support during the process of the study.

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ABBREVIATIONS

AMCO	:	African Ministers' Committee on Water
CSO	:	Central Statistical Office
EHP	:	Environmental Health Project
EIA	:	Environmental Impact Assessment
EU	:	European Union
FGDs	:	Focus Group Discussions
HIV/AIDS	:	Human Immuno Virus/Acquired Immune Deficiency Syndrome
MDGs	:	Millennium Development Goals
MEWD	:	Ministry of Energy and Water Development
MLGH	:	Ministry of Local Government and Housing
MOH	:	Ministry of Health
NGO	:	Non -Governmental Organisation
NWASCO	:	National Water and Sanitation Council
OD	:	Open Defecation
PHAST	:	Participatory Hygiene and Sanitation Transformation
SDGs	:	Sustainable Development Goals
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
USAID	:	United States of America International Development
WASH	:	Water Supply, Sanitation and Hygiene
WB	:	World Bank
WFD	:	Water Framework Directive
WHO	:	World Health Organisation
WSS	:	Water Supply and Sanitation
ZEMA	:	Zambia Environmental Management Agency

TABLE OF CONTENT

PAGE

List of Tables

List of figure

CHAPTER ONE

1.0 SUMMARY

Diarrhoea remains one of the diseases affecting children. The major transmission routes are inadequate water, sanitation and hygiene. Diarrheal diseases such as cholera and typhoid continued to be a public health problem and costs Zambia close to 946 billion Kwacha ($194 Million) due to poor sanitation.

Efforts made to increase coverage in water supply, sanitation and hygiene education have not reduced diarrheal diseases. The objective of this study was to establish environmental health factors associated with the prevalence of diarrhea diseases in Mtendere Township.

An analytical community-based cross-sectional study was conducted among 274 randomly selected household with a child aged between 6-59 months old and having lived in the area for more than six months. Both qualitative and quantitative data were collected for this study. A questionnaire, Focus Group Discussion Guide, observations and water sampling form were used to collect data. The dependable variable was diarrhea prevalence and the independent variables were sanitation, water storage, water quality, hand washing, residence, and knowledge on diarrhea.

Logistic regression was used to adjust odds ratios at 95% confidence interval. The prevalence of diarrhea among under five years of age in the study period was 37%. The most affected children were those between 12 to 24 months old. Drinking water was found to be more contaminated at household level than at the sources of water supply. The major factors associated with diarrhea are inadequate water, washinghands without soap, poverty and poor water storage. Therefore, this calls for concerted efforts by stakeholders to focus on supplying adequate safe water, water storage, hygiene and community development to reduce poverty at household level in order to reduce the problem of diarrhoea in Mtendere.

CHAPTER TWO

2.0 BACKGROUND

2.1 Introduction

Diarrhoea is passing of loose stool three or more times in a day. It is caused by ingestion of pathogens that are most commonly found in unsafe drinking-water, contaminated food or from unclean hands (Haller, 2008). Transmission of these pathogens is facilitated by inadequate water, sanitation and hygiene (Fewtrell et al., 2005, Brown et al., 2013). The disease is also common in the under five children especially the age range from 5 to 11 months old (Brown et al., 2013).Additionally, it is stipulated that the economic status of families is an important factor that leads to high prevalence of diarrhea (Joshi et al., 2011, Agustina et al., 2013).

In 2008, there were estimated 3-5 million cholera cases and 100 000-120 000 deaths as a result of the disease (Zuckerman et al., 2007) worldwide. It is estimated that the global incidence of typhoid fever is 21 million cases with 1-4% case fatality rate (Buckle et al., 2012).

Regions of south-central Asia and south-east Asia are considered high risk areas for typhoid with rates of >100/100,000 cases/year; the rest of Asia, Africa, Latin America and the Caribbean, experience medium incidence with rates of 10-100/100,000 cases/year while countries of Europe, North America and the rest of the developed world have low incidence with typhoid fever rates of <10/100,000 cases/year (Gonzalez-Escobedo, 2013)

Diarrhoea cases are attributed to mainly environmental factors, originating from poor excreta management (Prüss-Üstün et al., 2008). However, it is worth noting that 36% of diarrhea cases can be averted through basic sanitation interventions and with sanitation and hygiene combined 45% of these cases can be prevented (Prüss-Üstün et al., 2008).

The Joint Monitoring Programme for Water Supply and Sanitation (WHO, 2012) announced that MDG 7 whose targets among others was to "halve by 2015 the proportion of population without sustainable access to safe drinking water", was met in the water sector in 2010 five years ahead of schedule. However, human activities makes the safe water became polluted due to open defecation and poor sewage treatment (Kar, 2012). This may be the case in Zambia and as a

result diarrhea prevalence increased from 72/1000 in 2009 to 96/1000 in 2014 as shown in table 1 below.

Table 1: Diarrhea Prevalence per 1000 population by Province from 2009 to 2014

Province	Diarrhoea prevalence per year					
	2009	**2010**	**2011**	**2012**	**2013**	**2014**
Southern	96	99	102	103	105	105
Central	74	88	94	113	125	126
Copperbelt	79	86	89	116	121	118
Eastern	69	83	84	83	106	107
Luapula	77	60	82	94	94	109
Lusaka	53	62	74	73	73	79
North-western	78	92	99	124	119	130
Northern	36	61	68	68	66	64
Western	79	82	79	122	129	127
Zambia	**72**	**79**	**86**	**90**	**94**	**96**

Source: (MoH, 2013, MoH, 2014)

2.2 Diarrhoea Prevalence

Diarrhea is caused by poor sanitation and this costs Zambia close to 946 billion Kwacha ($194 Million) (WSP, 2012). In a British medical journal a reader's vote favored the introduction of clean water and improvement to sewerage systems as the most important medical milestone from the 1840s, surpassing anesthesia, antibiotics and vaccines (Brown et al., 2013). In one study a 22% prevalence of diarrhoea among the under-five children was observed in peri-urban compounds of Lusaka District (Peletz et al., 2011).

Some studies indicate that environmental and climatic factors may encourage the spread of cholera in African countries. An article based on the 632 reports had shown that 66% of cholera cases and 87.6% of fatality occurred in sub-Saharan Africa (Nkoko, 2011, Bompangue et al., 2008). A recent study in Zambia showed some evidence that increase in

atmospheric temperature is associated with the prevalence of non-bloody diarrhoea in children under-five years of age (Mudenda et al., 2014).

2.3 Water, Sanitation and Hygiene

The main aim of sanitation is to break the transmission route of pathogens that originate from feces (Cairncross et al., 2010b). This can be achieved through implementation of complex methods such as sewerage systems and simpler systems like Ventilated Improved Latrines and septic tanks. UNICEF and WHO in the joint Monitoring Programme classified the following as 'Improved' sanitation that is likely to be hygienic: a connection to sewerage system, septic tanks, pour flush toilets, ventilated improved latrine and pit latrine with a concrete slab (WHO, 2012). It is therefore clear that having improved sanitation facilities is likely to be protective against acquiring diarrhoea (Pfadenhauer and Rehfuess, 2015). In 2008, an estimated 565 million people in sub Saharan Africa did not have access to improved sanitation and out of these 231 million were reported practicing open defecation (Hickling and Hutton, 2013).

Adequate water supply is essential for prevention of diarrhoea (Howard and Bartram, 2003). The minimum quantity of water per person per day that is essential for personal hygiene and health is 150 to 200 litres for Urban population and 40 litres per capita per day for rural areas (Park, 2007). In emergency conditions such as a refugee camp the guideline for provision of water is a minimum of 15 to 20 litres/person/ day. It has also been documented that level of access to water portrays different levels of health risk and that less water puts people at more health risk(Howard and Bartram, 2003).

The quality of water for drinking is a powerful environmental determinant of health, and as such water safety is a foundation for prevention and control of water borne diseases (WHO, 2014). It is estimated that 10% of improved sources may be high risk, containing more than 100 *E.coli* or total coliform per 100ml and that drinking water is found to be more often contaminated in rural areas (41%) than in urban areas (12%) (Bain et al., 2012, Bain et al., 2014). This is attributed to access to unsafe water sources that fail to meet the standard for water quality of zero faecal coliform in 100 milliliters of water (WHO, 1993). Additionally, according to a study conducted in Ndola on water quality awareness and barriers to safe water provisions in informal settings

showed that even when people were knowledgeable on how water is contaminated, they did not protect their water sources from contamination (Liddle et al., 2014).

Safe water supply interventions have been shown to reduce the burden of diarrhoea by 25% to 27%, (Fewtrell et al., 2005Cairncross et al., 2010a); while sanitation can achieve a risk reduction of diarrhea from 22% to 48% (Waddington et al., 2009); and hand washing can contribute to reduction of diarrhea by 42-48% (Greene et al., 2012).

In Zambia a study conducted in Mtendere on the quality of drinking water in basic schools showed that three out of the four schools had access to contaminated water containing 10 to 100 feacal coliform per 100 milliliters (Tembo, 2013). Another study on effects of siting boreholes and septic tanks on ground water quality in Saint Bonaventure township in Lusaka also showed that 33% of the boreholes were contaminated with microbes indicative of pathogens (Banda, 2014). Equally, a study conducted in Luapula on community water supply and self-supply models for sustainable water supply indicated that 50% of water samples from hand dug wells were unsatisfactory containing from 30 feacal coliform (FC) to more than 100 feacal coliform; per 100 milliliters while the risk of borehole contamination was less than that of hand dug wells and scope holes (Kumamaru, 2011). Another study in South Africa showed that storage of water at household level was susceptible to contamination when the source of water was far from the household (Nala et al., 2000).

2.3.1 Water storage

In Zambia, a protective effect of treating water at household level using a filter combined with safe storage for people living with HIV/AIDS was found to be highly effective in improving drinking water quality and showed a protective effect against diarrhea (Peletz et al., 2012).
It has been documented that a combination of household water treatment, safe storage and promotion of positive hygiene behaviors leads to an even greater reduction in disease transmission (WHO, 2014).

2.3.2 Hand washing

Effective hand washing plays a major role in breaking the transmission route of pathogen through handling food and direct touch of the mouth. A study in Tanzania reported an

association between contamination of hands and storage of drinking water at household level in Bagamoyo (Mattioli et al., 2014). Another study showed the presence of hand washing facilities being positively associated with hand washing among households housing under-five children in Eastern Ethiopia (Mengistie et al., 2013).

2.3.3 Food hygiene

Diarrhoea transmission can be facilitated by poor handling of food at household level especially among people of low socio-economic status (Agustina et al., 2013). A study shows that children whose mothers prepared food on the ground had higher risk of developing diarrhoea than those whose mothers prepared food on a table (Takanashi et al., 2009). However, this was disputed by a systematic study that found no association of diarrhoea with kitchen hygiene in developing nations (Stenberg et al., 2008).

2.4 Conceptual Framework

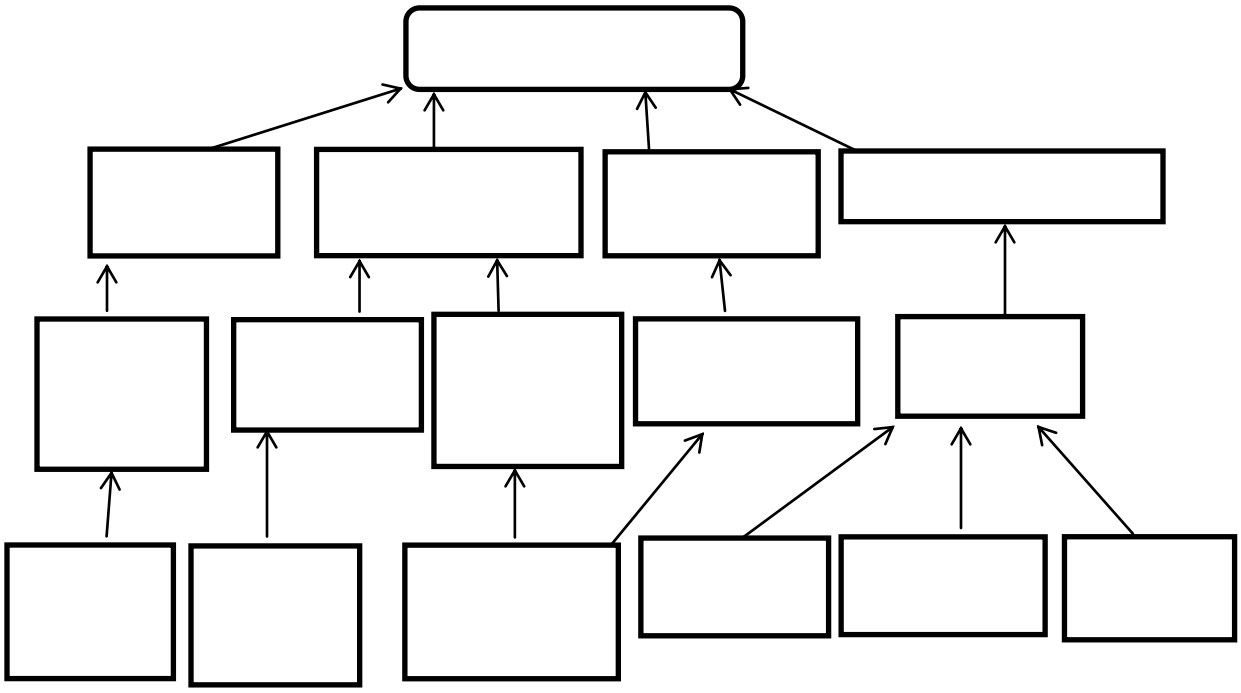


Figure 2: Conceptual framework for environmental factors associated with diarrhoea

Source: (Author)

Diarrhoea could be as a result of poor hygiene, unsafe drinking water, inadequate water supply and poor food safety as seen from figure 2.

2.5 Statement of the Problem

Poor hygiene, inadequate access to water and sanitation contributes to 88% of the deaths that result from diarrheal diseases worldwide (Oloke and Olugboye, 2014, Galan et al., 2013, Kar, 2012). This results in two under five children dying every minute in developing countries (Mara, 2003) . In southern Africa, little progress was made towards the sanitation goal and an impressive 89 percent access to water has been attained though this has not translated into safe water and health benefits and inequalities to service access across social, economic and geographical sectors exists (Ziegelhöfer, 2012,Gutierrez, 2007, McGranahan, 2013, WHO, 2014). This may be embedded in power, poverty, inequality, poor governance and implementation of policies and strategies (Konteh, 2009).

Although the country attained the goal on water supply coverage of 78% and sanitation coverage increased to 53% in the urban areas, diarrhea was the third leading cause of morbidity in the under five children showing a high incidence of 257/1000 in 2012 and diarrhea in all ages increased from 72/1000 in 2009 to 96/1000 population in 2012: (MoH, 2013, MoH, 2014). This could be attributed to unsafe water, inadequate sanitation and poor hygiene practices.

CHAPTER THREE

3.0 STUDY FOCUS

3.1 Justification of the Study

The increased access to water coverage in the urban areas of Zambia has not culminated into decrease of diarrheal diseases. Instead Ministry of Health reported an increase in the incidence of diarrhoea non-bloody from 79/1000 population in 2011 to 96/1000 population in 2012 (MoH, 2013). Efforts by the Ministry of Health and partners in water supply, household water treatment, refuse disposal and hygiene education including promotion of hand washing as means of preventing diarrheal diseases in both rural and urban areas has not yielded much results. To the contrary, frequent water related disease outbreaks such as typhoid, cholera and dysentery have continued to be experienced. It is therefore cardinal to find out why diarrhoea has not reduced despite putting up water and sanitation interventions. Therefore the study is necessitated by the gaps and the desire to search for effective interventions to prevention and control of diarrhoea in our community. The study may serve as a baseline for interventions in water and sanitation in Mtendere by the Millennium Challenge Account project indented to start in 2016.

3.2 Study Objectives

3.2.1 General Objective

To establish environmental health factors associated with the prevalence of diarrhea diseases in under five children in Mtendere township.

3.2.2 Specific Objectives

1. To determine the prevalence of diarrhoea in the under five children in Mtendere township.
2. Identify demographic factors associated with diarrhoea in under five children in Mtendere compound.
3. Identify water and sanitation risk factors related to diarrhea diseases in under five children at household level in Mtendere Compound in Lusaka.

4. Assess sanitation and hygiene practices at household level in Mtendere area of Lusaka District.

3.3 Question

What are the Environmental Health risk factors associated with the prevalence of diarrhea in the under five children at household level in Mtendere area of Lusaka District?

3.4 Definition of terms

The following definitions apply to this study:

Adequate sanitation facilities: refers to facilities that are not shared between households and those which separate human excreta from human contact.

Adequate water: means each individual accessing more than 150 litres per person per day in the urban/peri-urban and 40 litres in the rural areas.

Environmental health factors: refers to water quality, water quantity, food safety, and hygiene and sanitation aspects of human health determined by the physical, chemical, biological, social and psychosocial factors in the environment.

Hygiene: refers to practice of washing hands with soap before meals and after using the toilet, covering left over food, storing water in closed containers and keeping the house and general surroundings clean.

Poverty: means any households that earn less than a minimum wage of ZM 525 per month.

Safe water: means water free from faecal coliform.

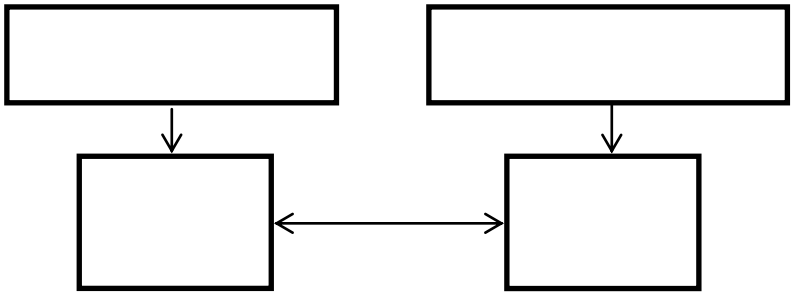
CHAPTER FOUR

4 METHODOLOGY

4.1 Study Design

The study holds a pragmatism paradigm that has both qualitative and quantitative methods. This philosophy is encouraged to be used in mixed methods for guiding desire for production of socially useful knowledge in research (Feilzer, 2010). Pragmatism philosophy strongly advocates for the use of scientific methods with an emphasis in the importance of the valid knowledge in social research (Denzin K., 2006). In this light a concurrent Triangulation design to fill the gaps of qualitative and quantitative research in a cross sectional study was applied. The qualitative design was exploratory while the quantitative method was an analytical cross-sectional study. The qualitative and quantitative data collection was done at the same time, data analysis was carried out separately as illustrated in figure 5. Thereafter, the findings were interpreted with linkages to both qualitative and quantitative results.

Figure 3: Concurrent Triangulation Design



Source: Adapted from (Kumamaru, 2011)

4.2 Study Variables

The study used the following variables and measurements in table 2.

Table 2: Variables and scale of measurement

Variable	Indicator	Scale of measurement	
Dependent Variable			
Diarrhoea	Child 6 - 59 months passing watery stool three times a day in the last two weeks	Yes: No:	Categorical Binary
Independent Variables			
Adequate Sanitation	HH with Toilet	Yes No	Categorical Binary
Water Quality	Drinking water free from pathogens (total and feacal)	Yes No	Binary
Food safety	Food preparation is an enclosed place	Yes No	Binary
Solid waste	Presence of waste in the surrounding	Yes No	Binary
Demography	Age	Months	Continuous
	Sex	Male Female	Categorical
Poverty	Income	< K525= low. +K525= high	Categorical
Water Quantity	<40lt/person/day 40-79lt/person/day >80lt/person/day	Inadequate Moderate adequate	Categorical
Hand washing	Water and soap present within the toilet	Present (1) Absent (0)	Categorical
Safe water storage	• Closed container with small mouth lid • Large mouth container	Safe (1) Unsafe (0)	Categorical

4.3 Study Area, sampling Frame and sample size

The study was carried out in Mtendere area in Lusaka province which is situated in the central part of Zambia. Lusaka province has a total population of 2,566,758 (CSO, 2013). Lusaka district has a surface area of 360 square kilometres and is located on the Southern part of the Central African plateau. The study area has a population of 81,308 and is situated in the central eastern area of Lusaka district. The area was selected purposively due to the intervention on water and sanitation to be carried out under the Millennium Development Account project. Therefore, the study will serve as a baseline for future studies to evaluate the impact of the water and sanitation project as stated.

The sampling frame was a list of households with a child 6-59 months old in Mtendere Township with a representative that has lived in the area for more than 6 months. Respondents included any care giver or guardian of child aged 6-59 months who has lived in the same area for the past 6 months and above the age of 18 years old. To estimate statistical significance and make association with minimal error the sample size was determined using a pertinent formula for simple random sample selection. The sample size was estimated assuming the 22% prevalence of diarrhea disease in the peri-urban areas of Lusaka (Peletz et al., 2011).

The formula is given below:-

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

Where;

n is the sample size, Z is the prevalence to be detected, and ε is precision (error)

$$n = \frac{1.96^2 \times 0.22 \times 0.78}{(0.05)^2} = 263.6$$

$n = 264$

A minimum sample size of **264** adjusted for none response at 10% (291) households was selected to determine both exposures and outcome at the same time.

Mtendere has a population of 81, 308 with approximately 13,551 households. It is divided in 3 sections/strata namely Mtendere main, Kalikiliki and Mtendere East. All the three sections/strata were included in the study. A proportionate allocation of sample sizes to each stratum was undertaken. Thus, for example, a stratum with the biggest number of households had the largest sample size. This approach ensured attaining an overall representative sample. Thereafter, a systematic simple random sampling technique was applied to select households that had at least one under-five child. The first household from each stratum was randomly picked and thereafter, a sampling interval was used to pick the rest of the sample households in the area.

The sampling interval was derived for each stratum using the following formula:

$$k = \frac{N}{n}$$

Where *k* = sampling interval,

n = sample size

N = population size

The calculated sampling intervals had taken into consideration the proportion of under-five children in Mtendere estimated at 20%. Therefore the (*k)* intervals for each stratum were as follows:

- Mtendere main: 20% X 55094 =9182/258 =7
- Kalikiliki compound: 20% 13823 = 2765/64 = 43
- Mtendere east: 20% X 12391 = 2478/57 = 43

Therefore, a sampling interval for Mtendere main was every seventh house until 258 respondents were concluded; the interval for Kalikiliki and Mtendere East areas was every 43rd house until their sample proportions had been accomplished. Furthermore, if no child was found, the next

house was selected. Equally if one refused to participate, the next house was selected. However if a participant was not found on a particular day, a follow up visit was made for that household.

Table 3: Sample size allocation

Zone	Population	Sample (sampling interval)	Water samples *(Source and household drinking water)*2*
Mtendere main	55, 094 (.68)	269 (every 7th House)	269
Kalikiliki	13, 823 (.17)	64 (every 43th house)	64
Mtendere East	12,391 (.15)	57 (Every 43rd house)	57
Total	**81,308**	**379**	**291**

Design effects for surveys at household level are usually less than 2 (range 1.0-3.2), therefore this study will use the value of 1.0 which entail that the sample size will be **291**.

Equally water samples were collected from each section using the same methods above. Each household was linked to the water source sampled and each household selected had a water sample collected from stored drinking water. All households with children within the age range of 6-59 months who have lived in Mtendere for the period of 6 months and above were included in the study. However, all households with children within the age range of 6-59 months who had lived in Mtendere for less than 6 months and children with chronic illness (diarrhea) or known to be on treatment for a long time or malnourished were excluded. Additionally, the study also excluded any potential respondent who declined to participate in the study.

4.4 Data collection

The study was conducted between November 2015 and January 2016 after ethical clearance from relevant authorities. We defined diarrhoea was defined as passing of loose stool more than three times in a day in the past two weeks. An analytical community-based cross-sectional study was conducted among 274 randomly selected households with a child aged between 6-59 months old that had lived in the area for more than six months in Mtendere. Data was collected using questionnaires, Focus Group Discussion guide, observations and water sampling forms. Chi square test was used to ascertain the significance of findings at p-value of <0.05. We used a

multivariate logistic regression model to adjust odds ratios at 95% confidence interval for significant. The quantitative part of the study was done using a structured questionnaire. All the data collection tools were pre-tested to determine the quality of data to be collection. The pre-test was done in Kanyama Township which has similar population characteristics. The pre-test helped to make corrections pertaining to the logical flow of sentences and determine the length of the interview.

4.5 Water sampling and analysis

Water from supply sources and stored water at the point of use were collected for analysis to ascertain its quality. Water samples were collected by trained Environmental Health staff in sterile 250mls bottles and transported in a cool box on ice pack to the University of Zambia Laboratory for microbiological tests within 3 hours. The results were checked using the WHO standard for drinking water. The sampling of water was aseptic. The process involved sterilizing the mouth of the taps with a flame for 5 minute, running the water for a minute before collecting the water sample at source. For stored water the sampling involved collecting water using the vessels normally used to draw water aseptically as in the procedure for taps. The microbiological analysis was done using the filtration membrane method for feacal and total coliform using the WHO standard of zero feacal coliform and 10 total coliforms in 100millimeters of water respectively.

4.6 Data Processing and Analysis

To ensure data quality and completeness, the study ensured that data was validated and checked for completeness on a daily basis. Stata Version 12 (Stata Corporation, TX, USA) and MS Excel were used to analyze the data. The Pearson's chi-squared test was used for comparison of proportions between groups. The relationship between study variables and diarrhea was examined using logistic regression. Selection for logistic regression model was considered at level $P < 0.05$. Thereafter, a backward selection process was employed to get the final logistic regression model. The method was used to remove variables one at a time beginning with the largest p-value and continuing until all remaining effects were significant at a specified level and removing more terms had results in poorer fit model.

Descriptive summaries have been reported as frequencies and proportions (prevalence), in bar charts and tables. The study used single and multiple logistic regression models to assess the association between diarrhea and other covariates in the study. Univariate logistic regression modeling was used to identify significant predictors of diarrhea before inclusion in a multivariable analysis. All the potential covariates were included in logistic analysis to estimate the adjusted OR at 95% CI. Thereafter, a multiple logistic regression model was used to account for effect of potential confounding and effect modification factors.Additionally all the significant categorical covariates such as sanitation, sex, poverty, hand washing, water storage were analysed using chi-square test to verify the significance at 95% confidence interval.

4.7 Qualitative methods

The qualitative part of the study was done using Focus Group Discussion (FGD) in Mtendere**.** A FGD guide consisting open-ended questions (probing questions) to inquire on the existing sanitation, personal hygiene hand washing facilities and hygiene practices aspirations for improvement was used to collect qualitative data. The FGD guide was adapted from the Environmental Health Project (EHP). The FGD data collection guide was pretested in a different area (Kanyama compound) other than the study place. Additionally, each participant in the FDGs was requested to participate voluntarily. Eight and ten groups of care givers or mothers to children eligible in this study were grouped in each FGD to collect data stated above. Convenient sampling was employed to select individuals who participated in the Focus Group Discussion. Women who were available in the area and were willing to participate were included for the study. 18 women participated in the FGDs, the first group from Mutendere Main comprised 8 women, and Kalikiliki FDG had 10 participants. The information collected reached a saturation level in the second focus group discussion, which necessitated the exclusion of one stratum in Mtendere East.

Equally an observation guide was used to collect data pertaining to type of sanitation, condition of sanitary facilities, presence of hand washing facilities and practices.The guide was also used to ascertain or confirm any reported practices from the Focus Group Discussions. Data analysis was done manually using tables and a problem solving analysis tree. Tables were used to derive common themes from the different questions and groups. Thereafter the data was refined into analytical themes for interpretation and discussions.

4.8 Integration of Results

The finding from the quantitative analysis has been integrated in interpretation in the discussion section. Similar values found both qualitative and quantitative have been reported as such and the differences of results have been recommended for further research using other methodologies in future.

4.9 Ethical Consideration

The study was expected to bring discomfort due ;to invasion of privacy at household level as the researcher conducted interview and collected samples for water analysis. For this reason consent was sought from individual respondents before data collection was carried out. All contaminated water was treated with chlorine and health education given for prevention of water and food borne diseases. Permission for conducting the study was sought from the relevant authorities namely the Ministries of Health and Community Development Mother and Child Health. The study protocol was also submitted for ethical clearance at the ERES Converge Ethics Committee. Operational ethical approval was sought from the Lusaka District Health Office. Permission was also sought from the National Research Authority before data collection.

During data collection informed consent was obtained from participants and a detailed explanation was given about the study to ensure voluntary participation. Privacy and confidentiality was maintained in order to protect rights and dignity of people through avoidance of use of names on the questionnaires.

4.10 Significance of the Study

The study has established a higher prevalence of diarrhea among the 6 to 59 months associated to poverty, inadequate hand washing and storage of water in large mouth containers. The results can be used for advocacy for resource allocation in targeted interventions for improvement of water quality at household level; improvement of hygiene practices in hand washing and water storage for prevention of diarrhoea.

CHAPTER FIVE

5.0 RESULTS

5.1 Demographic and social-economic characteristics of respondents and children under five in Mtendere compound

The study was conducted between November 2015 and January 2016. A total of 274 (100%) care givers for under five children in Mtendere compound participated in the study. Most respondents were from Mtendere main 152 followed by Kalikiliki 62 and Mtendere East 60 Almost all respondents were female (95.97%) as shown in table 4.

Table 4: Demographic and social-economic characteristics of respondents and children under five in Mtendere compound

Variable	Frequency	
	n	%
Age of respondent (Years)(n=273)		
18 – 35	214	78.39
36 – 55	53	19.41
56+	7	2.20
Age of Child (Months) (n=274)		
6 – 12	53	19.34
13 – 24	85	31.02
25 – 36	80	29.20
37 – 59	56	20.44
Sex of Respondent (n=273)		
Male	11	4
Female	262	95.97
Sex of child		
Male	129	47.25
Female	144	52.75
No. of people Living in a household (n=274)		
1– 3	56	20.44
4 – 6	158	57.66
7+	60	21.90
Source of income (n=274)		
Employed	175	63.87
Self-employed	96	35.04
None	3	1.09
Income (K) (n=272)		
< K525	48	17.65

526 – 1000	92	33.82
1001– 2500	97	35.66
2501+	35	12.87
Residential address (n=273)		
Mtendere main	151	55.31
Kalikiliki	62	22.71
Mtendere East	60	21.98

Table 4 shows that the majority of the respondents were between 18 – 35 years followed by those between 36 – 55 years. 57% of the households had between 4 – 6 people living in them. The majority (64%) of households had at least one member reported to be employed. The majority of the households (69%) earned income from 526 to 2500 Kwacha, 18 % earned less than the legal basic salary of K525 and only 13% of Household earned more than 2500 kwacha. Among the children that participated 130 (47%) were male and 144 (53%) female.

5.2 Prevalence of diarrhea in the under five children in Mtendere

Table five shows that 101 out of 273 children were reported to have had diarrhoea two weeks prior to the interview, providing a prevalence of 37%.

Table 5: Diarrhoea prevalence among under five children in Mtendere

Diarrhoea in previous 2 weeks (273)	**Frequency**	**proportion**
	n	**%**
Present	101	63
Absent	172	37
Total	**273**	**100**

Children in the age group 13-24 months had the highest prevalence of diarrhea (36.63%) followed by the age groups 26 - 36 months (32.67%) while those aged between 6-12 were third highest (16.83%) and the least were older children aged between 37-59 months (13.86%) as shown in table 10.

5.3 Water, sanitation and hygiene risk factors associated with child diarrhea in Mtendere

5.3.1 Drinking water sources in Mtendere

The majority of residents had access to a tap water source in Mtendere (61%), 17% had access to borehole water and 22% were still accessing water from hand dug wells as shown in figure 5.

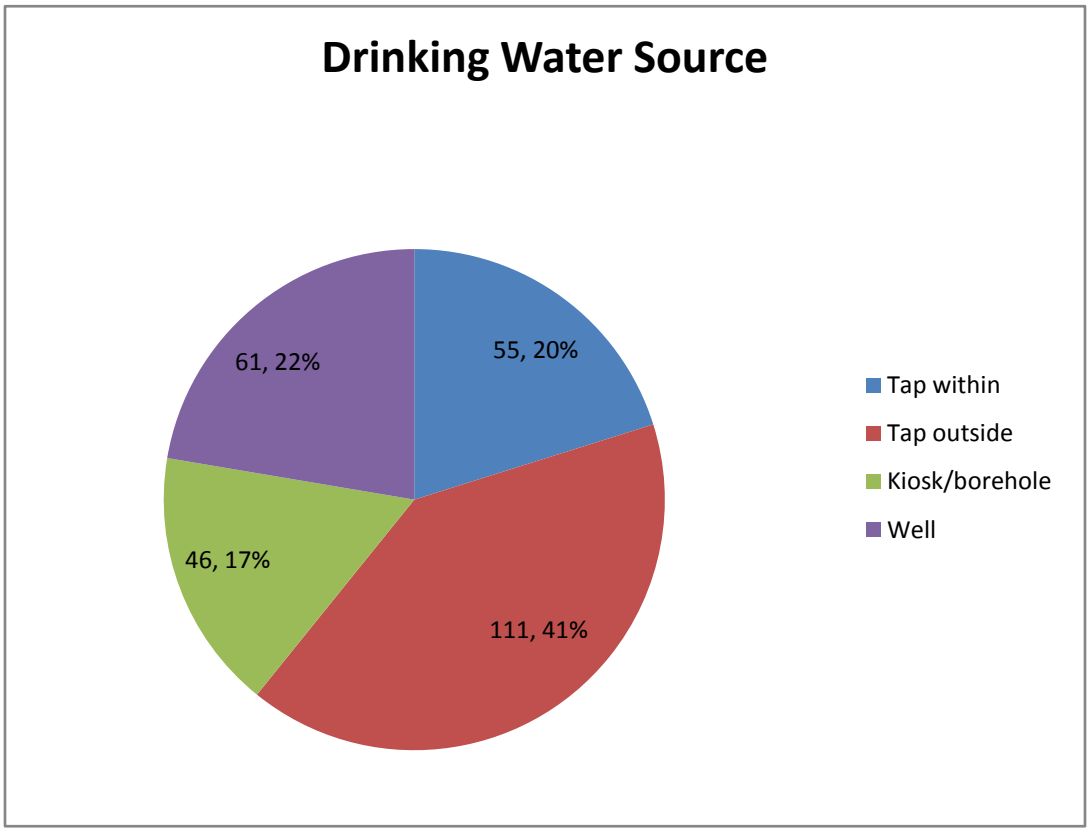


Figure 5: Drinking water sources in Mtendere

5.3.2 Water quantity and diarrhea

Among the residence in the study population the majority 203 (74%) had access to between 6-39 liters per person per day as seen in figure 4. Children who had access to less than 40 litres per person per day had a high number of diarrhoea 75 (75%).

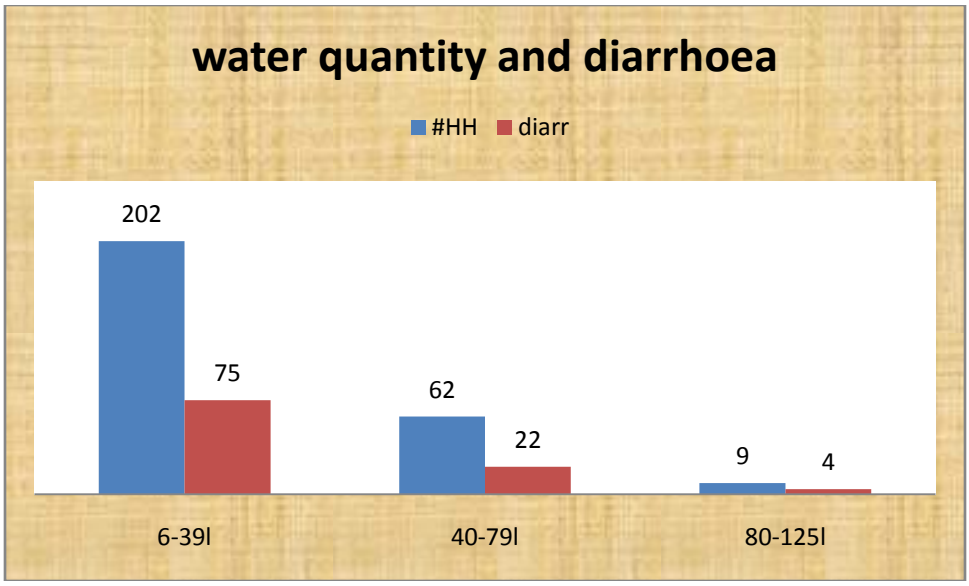


Figure 4: Water Quantity and diarrhea in under five children in Mtendere

5.3.3 Microbiological quality of water in Mtendere

Water samples (271) were collected for microbiological analysis. Results for total and feacal coliform analysis are shown in tables 6 to 9.

Table 6:Total Coliform in stored water at Household level

No	Total Coliforms(TC) in 100ml of Water	Number of samples	Proportion (%)
1	0 – 10	67	24.7
2	≥ 11	204	75.3
Total		271	100

Water quality at household level was poor with 75.36% of the water showing contamination as shown in table 6.

Tale 7: Feacal coliform contamination in stored water at Household level in Mtendere

No	Number of feacal *coliform* found in 100ml of Water	Number of samples	Proportion (%)
1	0	63	23.7
2	≥ 1	203	76.3

Total		266	100

Table 7 shows that 76.3% of the water at household level was contaminated with feacal coliform.

Tale 8: Total coliform contamination of water at source in Mtendere

No	Number of Coliform found in 100ml of Water	Number of samples	Proportion (%)
1	0 -10	189	70.3
2	≥ 1	80	29.7
Total		269	100

Table 8 shows that 29.7% drinking water sources in Mtendere were contaminated.

Tale 9: Feacal coliform contamination in water at source in Mtendere

No	Number of feacal coliform found in 100ml of Water	Number of samples	Proportion (%)
1	0	189	70
2	≥ 1	80	30
Total		269	100

Table 9 shows that 30% of the water sources were contaminated with faecal coliforms.

5.4 Bivariate analysis for demographic, socio-economic and environmental health factors associated with diarrhea in under five children in Mtendere

Table 10 shows variables of the study population in relation to diarrhea.

Table 10: Bivariate analysis for demographic and environmental factors association with diarrhea

Variable	No diarrhea		Diarrhea		P-value*
	n	%	n	%	
Age (months) (n=273)					
6-12	36	20.93	17	16.8	
13-24	47	27.3	37	36.6	0.01
25-36	47	27.3	33	32.67	
37-59	42	24.4	14	13.86	
People living in a household (n=273)					
1-3	30	17.4	26	25.74	0.131
4-6	99	57.56	58	57.4	
7+	43	25	17	16.83	
Residence (n=273)					
Mtendere Main	110	63.95	41	40.59	0.001
Mtendere East	30	17.4	30	29.70	
Kalikiliki	32	18.60	30	29.70	
Presence of toilet facility (n=273)					
Not Present	30	17.44	15	14.85	0.578
Present	142	82.56	86	85.15	
Hand washing with soap (n=272)					
Soap present	100	58.14	34	34	<0.001
Soap absent	72	41.86	66	66	

Hand washing (child) (273)					
Once and more	119	69.19	56	55.45	0.022
None	53	30.81	45	44.55	
Hand washing method (272)					
Pouring	77	45.03	25	24.75	0.001
Basin	94	54.97	76	75.25	
Income category (n=271)					
<525	26	15.29	22	21.78	0.01
526-1000	49	28.82	43	42.57	
1001-2500	68	40.0	29	28.71	
2501+	27	15.88	7	6.93	
Water source (n=273)					
Tap water outside premise	80	46.5	31	30.69	0.003
Tap water within premise	39	22.67	16	20.15	
Borehole water	21	12.21	25	24.75	
Hand dug well	32	18.60	29	28.71	
Water storage (n=273)					
Open container with large mouth	85	49.42	77	76.24	<0.001
Closed container with small mouth	87	50.58	24	23.76	
Water Quality (TC: n 267; FC: 269)					
Total coliform <10	134	79.79	70	70.71	0.092
Total coliform >=10	34	20.24	29	29.29	
Feacal coliform >=1	131	77.06	71	71.72	0.329
Feacal coliform <1	39	22.94	28	28.28	

* = Chi Square Test

The bivariate analysis in table 10 shows that the presence of soap for hand washing was strongly associated with a reduction of diarrhoea with a p-value <0.001.The number of times a child washes hands indicates an association to diarrhoea at p-value of 0.022. Table 10 also shows that hand washing method was strongly associated with diarrhoea (p-value = 0.001).Similarly, income status indicates an association with diarrhoea at p-value of 0.002.The microbial quality of water had no association with diarrhoea p-value = 0.329). Residence of the household shows a strong association with diarrhoea at p-value of 0.001. Equally water storage shows a strong link with diarrhoea p<0.001. Having a toilet facility was not associated with Diarrhoea (p-value=578). The presence of faecal coliform was not statistically supportive of any association with Diarrhoea (p=0.329).

5.5 Logistic Regression Analysis of Factors Associated with Diarrhea in under five children in Mtendere

After the bivariate analysis the significant variables at p-value less than 0.05 were subjected to multivariate logistic regression analysis; age of child, residence, hand washing with soap, number of times the child had its hand washed, hand washing method, income, water source and water storage. A backward selection method was applied to the variables in a logistic regression model by removing variables with a larger p-Value, the final model then included hand washing with soap, income and water storage which were independently associated with diarrhea as shown in table 11. In the final analysis the household that had soap present for hand washing had on average 61% reduced odds for diarrhea after adjusting for income and water storage and was statistically significant (OR =0.39, 95% , p-value <0.01).

The odds of diarrhoea if households had earnings of less than K1000 were 60% in comparison to the households earning higher income. The odds of diarrhoea in the children whose households had stored water in closed containers with a small mouth had on average 70% reduced odds of diarrhoea adjusting for income and hand washing. Table 11indicates that children from households that earned more than 2500 Kwacha were 69% less likely to have reported diarrhoea after adjusting for water storage and hand washing with soap (OR=0.31, 95%, p-value 0.045).

Table 11: Multivariate Logistic regression analysis of factors associated with diarrhea in under five children in in relation to hand washing with soap, income levels and water storage in Mtendere compound

Variable	Unadjusted Odds Ratio (95% CI) Bivariate	Adjusted Odds Ratio (95% CI) Multivariate	P-Value* (Chi-square)
Hand washing (soap)			
Soap absent	1	1	
Soap present	0.37 (0.22 – 0.61)	0.39 (0.28 – 0.82)	0.008
Income			
<525	1	1	
526-1000	1.03 (.51-2.0)	0.72 (0.34 – 1.54	0.40
1001-2500	0.50 (.24-1.03)	0.51(.23-1.11)	0.092
2501+	0.30 (0.11-0.83)	0.31 (0.10-0.97)	0.045
Water storage			
Open container with large mouth	1	1	
Closed container with small mouth	0.30 (0.17 – 0.52)	0.39 (0.21 – 0.71)	0.002

* = Chi Square Test

CHAPTER SIX

6.0 QUALITATIVE RUSULTS

Focus group discussions (FGD) were held in Mtendere main and Kaliliki areas to assess sanitation and hygiene practices at household level. A total of 18 people participated in the two discussions. The findings are summarised in figure 6.

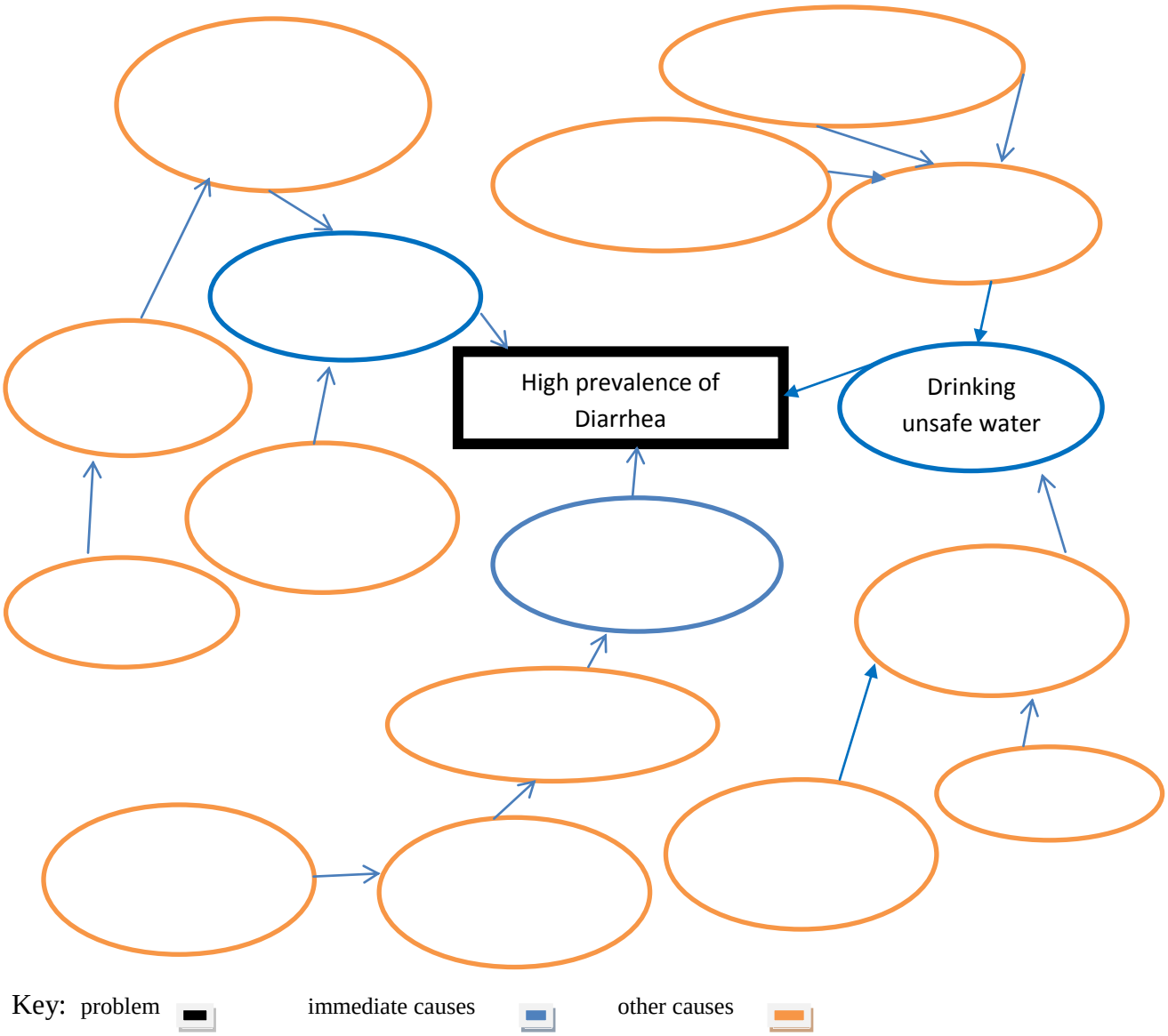


Figure 6: Problem solving Analysis for the Prevalence of Diarrhea in Mtendere Compound

Both focus group discussions indicated that the prevalence of diarrhoea in Mtendere was mainly due to drinking unsafe water from contaminated boreholes and shallow wells. Water from

unsafe sources is not treated due to inadequate knowledge, lack of chlorine on the market and inadequate funds to buy energy for boiling water. Furthermore, poor water storage practices and handling at household level was seen as contributing factors to the high diarrhoea prevalence in the area.

In addition, poor hand washing practices such as hand washing in a basin was still common among the participants. This practice was seen to be common due to inadequate knowledge on diarrhoea and water supply.

6.1 Knowledge on Diarrhea

Diarrhea was reported in both focus group discussions as one of the major illnesses affecting the community. The most common illnesses in order of their priority were diarrhoea malaria, flue and skin infections.

Almost all participants had knowledge on what diarrhea was. Most participants in Mtendere defined diarrhea as 'passing loose stool more frequently' (in Nyanja: kuyenda ku toilet pafupi pafupi). The participants in Kalikiliki defined diarrhea in the same way though a few people did not know what causes diarrhea as seen in the sentiments from one participant below:

> *….. We usually think of teething when a child has diarrhea, but even after the teething period children continue to have diarrhea. I am not sure what causes diarrhea in children besides teething (Participant, FGD2)*

However, the majority of the communities were knowledgeable about the causes of diarrhea highlighting the following as Causes of diarrhea:

- Not keeping food safe and not covering it from flies
- Drinking un treated water
- Dirty water from broken down pipes
- Poor drainage, , , lack of sanitary facilities and
- overcrowding

When the community was asked on what they could do to prevention diarrhea, majority of the participants were also able to show some knowledge on prevention of diarrhea. In a discussion in Mtendere main most of the residents indicated the following as ways of preventing diarrhea:

- Clean surroundings,
- Cleaning plates and
- Keeping food from flies.
- Boiling water,
- Using a clean toilet.
- Washing hands before eating and after using the toilet

6.4 Barrier to hygiene behaviors

a) Hand Washing

In discussion this component, majority indicated that hand washing with soap was not done by many people due to forgetfulness and drunkenness. One participant said the following:

....hand washing with soap is not common in the community. To be truthful, very few people wash hands with soap after using the toilet or even before eating. I usually wash hands with soap when I have eaten fish in order to remove the smell of fish (Participant, FDG2)

Another said the following:

..... Some people are ever drug hence forget to wash hands after using the toilet. (Participant, FGD2)

Inadequate hygiene education for children was highlighted by most participants as the reason why children did not wash hands at critical points. One of the participants had this to say;

...most children are not taught the importance of washing hands after using the toilet. This is why you find that children do not wash hands most times, and they are the ones that are affected by diarrhea.

b) Treating water

In both discussions participants said that boiling water was not being practiced by the majority. Some of the reasons were laziness, no funds to buy charcoal and lack of chlorine on the market**.**

...we usually have no power in this place. Boiling water on a brazier is not an alternative because it is costly to use charcoal as well. The other problem is that the chlorine we used to buy for treating water is no longer on the market. This makes us drink water without treating. (Participant, FGD1)

Another participant indicated the following:

...We still drink water even if a fly fell in it; even when you find rat droppings on food or in water you just remove the droppings and eat or drink. We do this because water is not

adequate and it is expensive. We pay 30 Ngwee for a 20 liter container; and sometimes we do not draw water because we do not have money on that day.

c) Sanitation

A number of people were reported as having no adequate sanitation in the area and reasons why some of them did not have proper sanitation varied as follows:

- Some people did not have toilets because of no space to dig holes for toilet construction in their vicinity,
- Some participants indicated that most people shared toilets with 15 households sharing one toilets
- Some residents indicated that most toilets were damaged during the rainy seasons due to flooding as a result of temporal and poor structured toilet
- Some group members indicated that lack of garbage collection services in their places led to accumulation solid waste and as a result flies were too many and come back to sit on their food at home.
- Some participants in Kalikiliki area were aware of the risks of flies getting on food and poor sanitation as a cause of typhoid, cholera and diarrhea.

One participant indicated that flies can bring diseases from rotten stuffs at dump sites:

> *…most of the homes near dump sites complain of flies, we don't have a system for collecting garbage and as a result the dirty accumulates and many flies enter our homes. (Participant, FGD2)*

The Desired or ideal toilet options were discussed and the majority of the participants indicated that they wanted to have either a flush toilet or an improved pit latrine. Some specifically indicated a toilet made from cement blocks with door, concrete floor and a roof. Similarly others indicated that they desired to have well-constructed and clean toilet.

The reasons as to why most of the people did not have their ideal toilet facility were mostly due to lack of adequate space to construct a toilet, inadequate funds and inadequate water for flush toilets. A participant from Mtendere Main indicated the following:

> *…..Land lords don't care to build better toilets: a few toilets that were built full and this allow flies pick germs from the toilets and come unto our food. (Participant, FDG1)*

d) Water sources

The major sources of water reported in both FGDs were piped water from Lusaka Water and Sewerage Company, community water kiosks and shallow wells. Qualification on usage of water from shallow wells was made that it mainly used for cleaning plates, bathing and washing clothes and not for drinking purpose.

.....tap water is mainly safe than shallow wells and boreholes, but we have a lot of leakages in the line and this introduces germs to our water. It becomes dirty when there are leakages in the pipes or when water at home is not cared for. (Participant, FDG2)

e) Treatment of water,

The discussions also highlighted that very few people treated their water at home. Reasons for this behavior were mainly due to negligence, poverty and lack of chlorine on the market. Some of the people who did not treat their water at home indicated that they trusted that the water from the tap was clean and safe for human consumption

CHAPTER SEVEN

7.0 DISCUSSION OF FINDINGS

This study was set to find out environmental health factors associated with diarrhoea in the age range from 6 to 59 months residing in Mtendere area. The major environmentsl health factors associated with diarrhoea in Mtendere are: inadequate water, poor water storage, inadequate hand washing and poverty. The study found a higher prevalence of diarrhoea (37%) than that reported by Ministry of health (25.7%)in 2012 and a previous researcher (22%) (Peletz et al., 2011). The higher prevalence therefore, could have been due to the El Niño event the country had experienced in the 2015-2016 period because increased ambient temperature facilitates microbial growth. Similar findings in some studies shows that increase in atmospheric temperature was associated with an increase in diarrhea by hundred to two hundred percentages of diarrhea prevalence (Mudenda et al., 2014) especially during El Niño periods (Bennett et al., 2012, Sari Kovats, 2000). During the same period, Lusaka experienced an outbreak of cholera recording close to a thousand cases by end of May 2016. This could have been triggered by the El Nino effects as indicated in an earlier study that showed an increase in cholera cases with a one degree Celsius(1^0c) rise in temperature during a similar event in 2006 (Fernández et al., 2009). Furthermore, the study shows that the most affected age group was one between 13-24 months children, followed by those between 25- 36 months old. In another study a much younger age group was more affected (Peletz et al., 2011). However, similar result show that during El Niño periods the mean age for children affected by diarrhea is increased (Checkley et al., 2000). Reasons for this variation in the age group affected by diarrhea are beyond the scope of this study and may be a new avenue for further study.

It has been shown in most studies that hands can directly or indirectly through food handling transmits the pathogens that cause diarrhoea. Therefore hand washing with soap is critical to reduction of the transmission of fecal-oral diseases. This study has shown that washing hands with soap reduces diarrhea by 61% (p-value <0.01). This finding agrees with studies that showed a reduction of diarrhea by 42-48% through hand washing (Greene et al., 2012, Brown et al., 2013). Equally, the focus group discussions findings indicates that although some participants reported the practice of washing hands; the method of washing hands mostly used was a

common basin as opposed to running water or pouring method. This was highlighted by a participant from Kalikiliki who said the following:

> *....hand washing with soap is not common in the community. To be truthful, very few people wash hands with soap after using the toilet or even before eating. I usually wash hands with soap when I have eaten fish in order to remove the smell of fish (Participant, FDG2)*

It is clear from the findings that hand washing with soap is an effective practice for reducing diarrheal diseases at household level in Mtendere area. It is therefore important to enrich the messages for hand washing to include methods of washing and the importance of using soap for washing hands. Special focus should be on hygiene education for children as they are not usually taught the importance of hand washing.

The study found that children whose households had stored water in closed containers with a small mouth had reported less diarrhoea compared to those who stored water in large mouth containers (p=0.002). Similar results agree that safe storage of water in jerry cans (small mouth container) reduces poor handling of water and improves quality of water, and therefore can have a protective effect against diarrhea (Quick et al., 2002). The practice of water storage at household level shows that most people store their water in buckets that have a large opening, and water is drawn from it using a cup for drinking or washing hands. This practice compromises with water quality through poor handling. This could explanation why 70% of the households had contaminated water for drinking. This alarming result need to be attended to urgently as may be the reason why the prevalence rate of diarrhea in the under five children is equally high in the area.

On the other handpoverty is one of the determinants of health and may be the major reason for ill health in most communities. Diarrhoea remains a disease that affects mostly poor countries and as such it is among the diseases coined as ‘diseases of poverty’(Kaler, 2008). This study shows that children from households that earned more than 2500 Kwacha ($250) had 69% reduced odds of diarrhea after adjusting for water storage and hand washing with soap. The results are similar

to a study which showed that diarrhea is higher in low income communities due to inadequate safe water and sanitation (Nala, et al, 2000). Some scholars argue that diarrheal diseases do not only affect the poor in the developing countries, but also those in developed countries alike (Keusch et al., 2006), while others agree with this study that a strong relationship between poverty and the extent of diarrheal episodes for children under five years exists (Keusch et al., 2006).Similar findings in the focus group discussions showed that most people who were willing to practice good hygiene had barriers among which poverty was eminent. Some participants indicated that they could not wash their hands due to inadequate water as a result of high cost of buying water which was on average costing 30ngwe per 20 liter container. To extrapolate the cost, a family of 6 people consuming a minimum of 80litres per capita per day needed K216 per month. Some families in this study were earning less than K 525 (18%). The cost of water in this respect is therefore beyond their incomes. The cost of water in Mtendere excludes some people from better health as shown in table 10.

Therefore interventions to reduce child diarrhea should be multi-faceted, affordable and accessible to the poorest of the poor. This calls for changes in health service programming and poverty reduction strategies. Furthermore, priority should be given to prevention of diarrhea at household level in the environment of adequate finance for basic necessities.

WHO indicates that access to safe water is a foundation for prevention and control of diarrhea (WH0, 2014). Zambia has recorded some improvements in the coverage of water. However, water quality is compromised due to erratic water supply, poor handling of water during transportation, storage and use. In Mtendere 70% of the water stored for drinking was contaminated while 30% of the water sources were not meeting the WHO standards. This study shows that water quality deteriorated further to 70% from the initial 30% while at household level. This implies that 40% of the sampled water was re-contaminated at home as a result of poor handling during transportation, storage and use. This translates to an increase of water contamination from the water source to stored water at household level by 133 % (70/40). This finding is in agreement with a study that showed that safe storage of water was an important practice for prevention of recontamination from poor handling (Brown et al., 2013). This therefore means that more child diarrhoea cases were reported by households that had poor water

results as shown in table 9. The water quality results from sources in Mtendere are similar to the findings by Banda et al (2014) who stated that 32.5% of water sources in Bonaventure, Lusaka were contaminated (Banda et al., 2014).

Similar findings from the focus group discussions showed that most people were aware of water quality from different sources. A participant from Mtendere had this to say:

> *.....tap water is safer than water from shallow wells and boreholes, but we have a lot of leakages in the line and this introduces germs to our water supply. It becomes dirty when there are leakages in the pipes or when water at home is not cared for t (participant, FGD 2).*

However, the practice of water treatment was reported to be low due to community trust of the water sources (such as tap and borehole water) and lack of chlorine for household to treat water. This means that households that have access to water perceived to be safe end up drinking contaminated water because of poor water handling. It is therefore, imperative to strengthen health promotion with a focus on water handling at household level as a priority to achieving the sustained development goals.

On the contrary, this study has not shown any association of poor water quality with diarrhea in the under five children. This could be due to either the design of the study or that other pathogens other than those that can be indicated through total and feacal coliform could be the cause of the diarrhea in the study area. This is supported by a study which showed similar results that high indicator bacteria counts were not associated with diarrhea. This may suggest that other pathogens such as rotavirus and cryptosporidium could be implicated (Gundry et al., 2004). Therefore, this implies that future studies should consider more specific methods of testing for causative agents other than indicative organisms.

7.3 Limitation of the study

The study was carried out to assess both exposure and outcome at the same time and this makes it difficult to tell the sequence of events; whether exposure would have occurred before, after or during the onset of the disease outcome, thereby making it impossible to infer causality.

However, the study has shown some useful associations and possible hypotheses for future research.

Since the study was carried out during a period when the country was experiencing an El Nino effect, the high ambient temperatures could have had an effect on the increased diarrhea prevalence. Therefore, reference to the findings of the study should be referenced in similar settings of the study.

7.2 Conclusion

The study has shown that diarrhoea is a public health problem among children under five years of age in Mtendere. The major factors associated with the prevalence of diarrhoea in the area are poor water quality as a result of storing water in large mouth containers, inadequate hand washing with soap, and poverty. Therefore, stakeholders should focus on adequate water and sanitation, water quality, water storage, hand washing with soap and community development to reduce poverty at household level in order to reduce the problem of diarrhoea in the area under the study. There is a dire need to improve service delivery in water and sanitation to enable the community to maintain positive behaviours for diarrheal prevention in the area.

7.3 Recommendations to Central Government

1. Ministry of Local Government and Housing to focus on water and sanitation improvement in order to effectively reduce diarrhoea cases in under five children in Mtendere compound.
2. Ministry of Health should strengthen a sustained health promotion programme for mothers and care givers with under five children using participatory methodologies with a focus on sanitation, hand washing and water storage.
3. Ministry of Health should strengthen a sustained water quality monitoring at household level.
4. Ministry of Community Development and Social Welfare to advocate for poverty reduction programmes that should promote income generation of not less K2500 ($250) per month per household for diarrhoea prevention to be a reality in under five children in Mtendere.

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ANNEX I: Questionnaire for Household Respondents

Respondent's identification number	
Date of interview	
Name of interviewer	
Starting time	
Ending time	
Sex of respondent: M ( ) F ( )	[ ]
Sex of child: M ( ) F ( )	[ ]

a. [Give your name and self-introduction to the possible respondent.]

b. I am talking to some families in this community in order to better understand children's health problems. We hope that what we learn will help us design better programs that respond to what you people say they need and want. Do you have one or more children under 5? [There may well be one or two additional questions to see if the respondent is "eligible" for an interview and what category of respondent–by area of residence,. If this person is not eligible, thank her and end the interview.]

c. [If eligible, explain how the discussion works]: • you can say anything you want as long as that is truly how you feel. • There is no right or wrong answer, only your ideas and opinions. However, be assured that I will NOT tell anyone what YOU as an individual say. Your name will not be used, and no one will be told about what any one person says. • Would you be willing to talk with me for about 30 minutes? You can continue with your tasks if you wish, and I will just follow you around. [If she declines to interview, ask why, try briefly to convince but do not pressure. Thank her and leave. If she is willing, continue.]

d. Do you have any questions?

e. Please answer a few introductory questions about yourself and your family. What is your youngest child's age?

Key: (introduce yourself; explain purpose of study, Get Informed Consent, Ensure Confidentiality)

Please tick where appropriate (√)
General information

1. How old are you?

   a) 18-35 years ( ) [ ]

Please tick where appropriate (√)

General information

1. How old are you?
   a) 18-35 years ( ) [ ]
   b) 36-55 years ( ) [ ]
   c) Above 55 years ( ) [ ]
2. How many people live in this house?
   a) 1-3 people ( ) [ ]
   b) 4-6 people ( ) [ ]
   c) 7 and above ( ) [ ]

3. What do you do for income generation?
   a) Employed ( ) [ ]
   b) Self-employed ( ) [ ]
   c) Nothing ( ) [ ]
4. If employed or self-employed; how much is your/husband's income per month?
   a) < K525 ( ) [ ]
   b) K525 - K1000 ( ) [ ]
   c) 1001- 2500 ( ) [ ]
   d) Above 2500 ( ) [ ]

5. How old is your child?
   a) 6- 12 months ( ) [ ]
   b) 13- 24 months ( ) [ ]
   c) 25- 36 months ( ) [ ]
   d) 37- 59 months ( ) [ ]

Diarrhoea

6. What are the three most common health problems in their order of priority that your child experiences?
   a) ----------
   b) ----------

c) ----------

7. Has your youngest child suffered from diarrhea in the past 2 weeks?

Yes ( ) [ ]

No ( ) [ ]

8. In your opinion, what causes diarrhoea?

a) Germs, ( )
b) poor sanitation, ( )
c) Not washing hands after using the toilet ( )
d) Flies ( )
e) Poor food hygiene ( )
f) Drinking unsafe water ( )
g) Others ----------( )

9. Do you believe it is possible to prevent diarrhea? Yes ( ) No ( ) [ ]

a) Treating drinking water ( )
b) Hand washing ( )
c) Keeping the surroundings clean ( )
d) Practicing good food hygiene ( )
e) Others ----------( )

10. Do you do anything to prevent diarrhea? Please explain.

a) Treating water for drinking ( )
b) Washing Hands ( )
c) Keeping the surroundings clean ( )
d) Practicing good food hygiene ( )
e) Others ---------- ( )

11. Are there other things that you would like to do to prevent diarrhea but do not for some reason?

a) Yes ( )
b) No ( )

12. [If yes, ask] Why don't you do these things?

Water

13. Where do you draw water for your family?

a) Municipal tap water (stand pipe outside the premises) ( ) [ ]

b) Municipal tap water (stand pipe within the premises) ( ) [ ]

c) Borehole water ( ) [ ]

d) Hand dug well ( ) [ ]

e) Stream water

a) How much water do you draw for the family per day?

Container	Volume	No. of trips	Total volume
1			
2			
3			
Total			[ ]

14. Do you have other sources of water for drinking? Yes ( ) No ( ) [ ]

15. [Is Yes] What is your alternative source?
    a) Shallow well ( ) [ ]
    b) Borehole ( ) [ ]
    c) Municipal water source ( ) [ ]
    d) Stream ( ) [ ]
    e) Other ---------- ( ) [ ]

16. Do you believe that the water available to your family is good to drink?

    a) Yes ( )

    b) No ( )

17. What can you do to make water good to drink? ----------

18. Where do you store water for drinking?

    a) Closed container with small mouth ( ) [ ]

    b) Open container with large mouth ( ) [ ]

19. How much time does it usually take each day to collect water? ----------

20. Do you feel that this is a little time or a lot of time? ----------

21. Do you pay for water? Yes ( ) No ( )

22. [If yes, ask:] How much do you pay each month? ---------- -----
23. Do you believe this is a fair amount? Yes ( ) No ( )
24. Would you pay to have more water available in or very near your home? Yes ( ) no ( )

25. [If no, ask] Why not? ----------

26. If yes, ask] How much would you pay each month? ----------

Hand Washing

27. When do you normally wash hands with soap?

a) Before eating: Yes ( ) No ( )
b) Before preparing food: Yes ( ) No ( )
c) Before eating or feeding a child: Yes ( ) No ( )
d) After using the toilet: Yes ( ) No ( )
e) After cleaning a baby's nappy: Yes ( ) No ( )

28. How many times today has your child's hands been washed?

a) Once and more ( ) [ ]
b) None ( ) [ ]

Please show me where you usually wash your hands. Please wash your hands the way you usually do. [Note if mother uses water and from where, uses soap or a substitute, rubs hands together at least 3 times, dries hands and how. Also look for a regular place for hand washing, presence of a washing basin or Tippy Tap, soap.]

Location	
Water from where	
Presence of (soap, ash)	
Number of times rub hands together	

Sanitation

29. Does your family have a toilet? Yes ( ) No ( ) [ ]

    [Yes: if water closet, pour flash, VIP or latrine with concrete slab].

30. [If yes, ask] Is the toilet shared with other families? Yes ( ) No ( )
31. **[**If no, ask] Why haven't you constructed a latrine?

a) No funds
b) No space for a latrine
c) Share with neighbors
d) Other ----------

Food safety

32. Where do you prepare food for the family?

    a) Enclosed place ( ) [ ]

    b) Outside in the open ( ) [ ]

Thank you for the responses to the questions.

Annex II: Focus Group Discussion Guide for Mothers/guardian of Children under 5

Introduce all of the research team present. Explain the purpose of the discussion, that there are no "correct" answers, that everyone should participate, and that each person's opinion is valuable, the time it will last, and that refreshments will be served.

Ask the group's permission to record the discussion in case the note taker doesn't catch everything, and promise that no one besides the researchers will listen to it.

Mention that all participants are mothers of children under 5 (and other common selection criteria).

Diarrhoea

1. What are the main illnesses that affect children under five years in this place? [Reach group consensus on the top 3 illnesses.]
2. What is diarrhea?
3. What do you think when your child gets diarrhea?
4. Can families like yours prevent diarrhoea in Children?
5. What are some of the barrier to prevention of diarrhoea in the community?

Water

6. Where does the water that you use at home come from?
7. Do you think all water is the same, or are there different types of water?
8. Can water be dirty?
9. Please describe what the water is like that your family drinks.
10. Are you satisfied with the water your family drinks
11. Can families like yours prevent diarrhea?

Sanitation

12. Some [a few] families around here always seem to put feces in a latrine.
    Do you think it is important for a family to have and use a latrine?
13. Would you like to have a latrine for your family? Please describe the kind of latrine you would like to have if you could.
14. What are the barriers to having the latrines we want to have?

Annex III: Information Sheet

The information sheet is for mothers/caregivers with children under five years of age that have been invited to participate in a study entitled "Exploratory study of environmental health factors associated with the prevalence of diarrhoea diseases in Mtendere compound - Lusaka District Zambia".

Introduction

Dear participant(s),

My names are Florence Muleka Kabinga. I am student at the University of Zambia undertaking a master's degree in public health. My research team and I are conducting a study in your area on environmental health factors associated with the prevalence of diarrhoea diseases in Mtendere compound. We are inviting you to take part in this study because we feel that you can help us with the information that we really need. You are free to any ask questions where you are not clear as we go through the information sheet and we will explain to you.

Purpose of the study

The main purpose of this study is to find out the environmental health factors associated with the prevalence of diarrhea diseases in Mtendere township. The study will also: -

- Determine the prevalence of diarrhoea in the under five children in Mtendere township.
- Identify demographic factors associated with diarrhoea in Mtendere area.
- Identify environmental risk factors related to diarrhea diseases at household level in Mtendere Township in Lusaka
- Assess sanitation and hygiene practices at household level in Mtendere area of Lusaka

Type of Research Intervention

The study will require your participation in an interview/FGD that may take about 30 – 50 minutes only.

Study Procedure

The study will involve asking questions about you and your family especially the under five year child that relates to diarrhea. Additionally water samples will be taken from the source and

storage container at home for testing at the laboratory. You have the right to take part in the study and to withdraw from the study at any point.
The benefits and hazards of the study will be explained to you before you make a decision.

Participant selection

You are being invited to take part in the study because we feel that your experience and knowledge as a mother/caregiver to children under five years of age will help us to gain an in-depth understanding of the issue diarrhea in the under-five children in Mtendere.

Voluntary participation

Your participation in this study is entirely voluntary. Therefore, you are free to either take part or not.

Risks

Risks in this study are quite minimal. We do not expect you to have problems. But in case you feel some information is personal or confidential, you are free to tell us. Your participation in this study will not affect your work in any way.

Benefits

Although the findings of this study may not immediately benefit you, it is anticipated that it will help regulatory institutions such as Ministry of Health, MCDMCH in decision making with regards to public health policy on diarrhoea diseases in children under- five years of age.

If you decide to participate and we find that your water sample has germs, we are going to give you a bottle of chlorine for treating your water. The other benefit is that you will be advised on the safe storage and treatment of water in the household.

Confidentiality

Be advised that anything you tell us is going to be treated as confidential and will not be personally attributed to you in any reports that result from this interview. All of our reports will be written in a manner that no individual comment can be attributed to a particular person. We

have thought of including you in this study because we believe you have the knowledge on diarrhoea in children.

Sharing of results

The information to be collected will not be shared with or given to anyone except among the research team and university of Zambia. The information will also be shared with you through the Ministry of Health.

Right to refuse or withdraw

You have the right to refuse to participate or to withdraw from the study at any time of the interview.

Who to contact

If you have any questions, you may ask me now or later. If you wish to ask questions later, you may contact the Principal Investigator on the following address:

Florence Muleka Kabinga
UNZA School of Medicine
Public Health Department
P.O Box 50110
LUSAKA.
Cell 0979425868

Or
The Head Public Health
UNZA School of Medicine
Public Health Department
P.O Box 50110
LUSAKA.
Cell 0977 453107

You may also contact

The Chairperson

ERES Converge IRB

33 Joseph Mwila Road, Roads Park,

Cell: 0955 155 633/ 0955 155 634
Email: eresconverge@yahoo.co.uk

Annex IV: Consent Form

The purpose of this study has been explained to me and I understand the purpose, benefits, risks and confindentiality of the study.

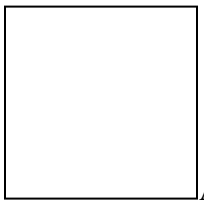
I further understand that if I agree to take part in the study , I have the right to withdraw at any time without having to give a reason and that taking part in this study is purely voluntary.

I …….. (Names) agree to take part in this study.

Signature…….. Date…… (Participant)

Witness……(Names)

Signature …… Date……

 Ask the participant to mark a "left thumb impression" in this box if the participant (or participant's parent) is unable to provide a signature above.

Person to contact for problems and queries.

Florence Muleka Kabinga
UNZA School of Medicine
Public Health Department
P.O Box 50110
Lusaka.
Cell 0977817899

You may also contact ERES Converge for more information on the purpose of the study in relation to your rights and privileges for participating in the study.

ERES Converge,

33 Joseph Mwila Road, Roads Park,

Cell: 0955 155 633/ 0955 155 634

Email: eresconverge@yahoo.co.uk

Annex V: PEPALA YA UTHENGA

Pepala ya uthenga ndi ya azimai/anthu opeleka cisamalo omwe ali ndi ana omwe asanakwanitse zaka zisanu zakubadwa omwe aitanidwa kuti atengeko mbali mu kafuku-fuku ocedwa ‘’ Kafuku-fuku wa zaumoyo zokhudza zacilengedwe z okhudzana ndi kufalikila kwa matenda otsekula m`mimba ya dailiya mkomboni ya Mtendere.mu mzinda wa Lusaka mdziko la Zambia’’.

Malonje

Kwa otengako mbali,

Ine dzina langa ndine Florence Muleka Kabinga. Ndine mphunzi pa sukulu lalikulu la University of Zambia ndipo ndi kucita maphunzilo yapamwamba ya masters degree yowona pa umoyo wa anthu m`malo okhalamo. Gulu langa la kafuku-fuku pamodzi ndi ine tikucita kafuku-fuku m`dela lanu owona pa za umoyo zokhudza zacilengedwe zokhudzana ndi kufalikila kwa matenda otsekula m`mimba ya dailiya mkomboni ya Mtendere. Tikukupemphani kuti mutengeko mbali mukafuku-fuku ameneyu kamba kakuti tikuganizila kuti inu mungatithandize pakutifotokozela zinthu zomwe tikufuna kudziwa. Ndinu omasuka kufunsa funso lili lonse ngati simunamvetsetse pomwe tikuwelenga pepala ya uthenga ndipo tizakumasulilani.

Colinga ca kafuku-fuku

Colinga ca kafuku-fuku ameneyu ndi kufuna kudziwa zinthu zacilengedwe zomwe zikhudzana ndi kufalikila kwa matenda yotsegula m`mimba ya dailiya mkomboni ya Mtendere. Kafuku-fuku ameneyu udzaonanso:-

- Kufuna kupeza kufalikila kwa matenda ya dailiya pakati pa ana omwe akalibe kukwanitsa zaka zisanu zakubadwa mkomboni ya Mtendere.
- Momwe unyinji wa anthu umabweletsela matenda ya dailiya mkomboni ya Mtendere.
- Pa kupeza zinthu zomwe zimapeleka ciopsyezo ku zacilengedwe mokhudzana ndi matenda ya dailiya pa nyumba mkomboni ya Mtendere mu mzinda wa Lusaka.
- Kuona za ukhondo pa nyumba mkomboni ya Mtendere mu mzinda wa Lusaka.

Mtundu wa kafuku-fuku

Kafuku-fuku ameneyu udzafuna kuti inu mutengeko mbali pa kufunsidwa mafunso/FGD ndipo zimenezi zidzatenda cabe phindi pakati pa 30 ndi 50.

Ndondomeko ya kafuku-fuku

Kafuku-fuku ameneyu udzakhala ofunsa mafunso yokhudza inu ndi banja lanu maka-maka ana omwe akalibe kukwanitsa zaka zisanu zakubadwa okhudzana ndi matenda ya dailiya. Kuphatikizapo pa izi madzi adzatengedwa kucokela komwe mutunga ndi momwe

musungila madzi pa nyumba kuti akapimidwe. Muli ndi ufulu otengako mbali mu kafuku-fuku ndiponso mulinso ndi ufulu oleka kutengako mbali nthawi iliyonse.

Phindu ndi ziwopsyezo za kafuku-fuku zidzafotokozedwa kwa inu mukalibe kupanga ganizo lilinso la kutengako mbali.

Kusankha munthu otengako mbali

Mwaitanidwa kutengako mbali mukafuku-fuku uyu kamba kakuti tili ndi cikhulupililo kuti kukhalitsa kwanu ngati mai/osamalira wa ana omwe akalibe kukwanitsa zaka zisanu zakubadwa kudzatithandiza kuti tidziwe zambili zokhudza matenda ya dailiya ku ana omwe akalibe kukwanitsa zaka zisanu zakubadwa m`komboni ya Mtendere.

Kutengako mbali modzipeleka

Kutengako mbali kwanu mu kafuku-fuku ameneyu ndi kodzipeleka painu nokha. Telo ndinu omasuka kutengako mbali kapena ayi.

Zowopsya

Zowopsya mu kafuku-fuku uyu ndi zocepa kwambili. Sitikuyembekezela kuti mudzakhala ndi zobvuta. Koma ngati mukuganiza kuti zomwe zomwe mudzalankhula ndi zacinsinsi kwa inu,muli omasuka kutidziwitsa. Kutengako mbali mu kafuku-fuku ameneyu sikuzasokoneza nchito yanu mwa njila iliyonse.

Phindu

Ngakhale kuti zotulukamo mu kafuku-fuku uyu sizizakuphindulilani mwa msanga,pali cikhulupililo cakuti zidzathandiza zigao zoyanganila monga cigao ca zaumoyo,MCDMCH kukonza njila ndi malamulo a zaumoyo owona pa matenda ya dailiya pakati pa ana omwe akalibe kukwanitsa zaka zisanu zakubadwa.

Ngati mwaganiza kuti mutengeko mbali mukafuku-fuku uyu ndipo ngati tapeza kuti madzi anu omwe tinatenga kuti tikapime ali ndi tudoyo,tidzakupatsani botolo ya mankhwala ophela tudoyo twa m`madzi a chlorine kuti muzithila ku madzi anu. Phindu ina ndi yakuti muzauzidwa momwe muyenela kusungila madzi anu ndi kuthila mankhwala ku madzi anu pa nyumba.

Conde dziwani kuti zonse zomwe inu muzatifotokoezla zidzakhala za cinsinsi ndipo sitizakamba kuti zinacokela kwa inu mu lipoloti lathu lili lonse lomwe tizalemba pambuyo pokambilana ndi inu. Malipoloti athu onse adzalembedwa m`njilayomwe sidzasonyeza munthu aliyense emwe tinakamba naye. Taganiza kuti tikhale ndi inu mu kafuku-fuku uyu kamba kakuti tikhulupilila kuti mudziwa za matenda ya dailiya ya ana.

Kugawana zotuluka za kafuku-fuku

Zonse zomwe tizapeza mu kafuku-fuku uyu sizidzagawidwa kwa munthu aliyense kucotselako cabe gulu la anthu omwe akucita kafuku-fuku ndi sukulu la University of Zambia. Zomwe tatenga mukafuku-fuku ameneyu zidzapelekedwanso kwa inu kudzela ku cigao ca za umoyo.

Ufulu wa kukana ndi kucokamo mu kafuku-fuku

Muli ndi ufulu wakukana kutengako mbali kapena kucokamo mu kafuku-fuku ameneyu nthawi ili yonse ya kukambilana kwathu.

Emwe mungaonane naye

Ngati muli ndi mafunso,mungathe kundifunsa tsopano kapena pambuyo pake. Ngati mufuna kufunsa mafunso pambuyo pake, mungathe kuonana ndi mkulu wa zofufuza pa keyala iyi:

Florence Muleka Kabinga

UNZA School of Medicine

Public Health Department

P.O Box 50110

LUSAKA

Cell 0979425868

Kapena

The Head Public Health

UNZA School of Medicine

Public Health Department

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

9th October, 2015

Ref. No. 2015-June-010

The Principal Investigator
Ms. Florence Muleka Kabinga
The University of Zambia
School of Medicine
Dept. of Public Health
P.O. Box 50110,
LUSAKA.

Dear Ms. Kabinga,

RE: EXPLORATORY STUDY OF ENVIRONMENTAL HEALTH FACTORS ASSOCIATED WITH THE PREVALENCE OF DIARRHOEA DISEASES IN MTENDERE TOWNSHIP – LUSAKA DISTRICT ZAMBIA.

Reference is made to your corrections. The IRB resolved to approve this study and your participation as principal investigator for a period of one year.

Review Type	**Ordinary**	Approval No. **2015-Jun-010**
Approval and Expiry Date	Approval Date: 9th October, 2015	Expiry Date: 8th October, 2016
Protocol Version and Date	Version-Nil	8th October, 2016
Information Sheet, Consent Forms and Dates	• English, Chinyanja.	8th October, 2016
Consent form ID and Date	Version-Nil	8th October, 2016
Recruitment Materials	Nil	8th October, 2016
Other Study Documents	Questionnaire, FGD Guides.	8th October, 2016
Number of participants approved for study	264	8th October, 2016

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

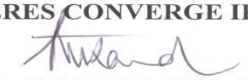
Conditions of Approval

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

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

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

Yours faithfully,
ERES CONVERGE IRB



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

ANNEX 7: National Health Research Authority

THE NATIONAL HEALTH RESEARCH AUTHORITY
C/O Ministry of Health
Ndeke House
P.O. Box 30205
LUSAKA

MH/101/23/10/1

In reply please quote:

No.....

29th October, 2015

Ms. Florence Kabinga
UNZA-School of Medicine
TROPGAN
P. O. Box 50398
Lusaka.

Dear Ms. Kabinga,

Re: Request for Authority to Conduct Research

The National Health Research Authority is in receipt of your request for authority to conduct research titled **"Exploratory study of environmental health factors associated with prevalence of diarrhoea in Mtendere Township - Lusaka District, Zambia".**

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

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

Yours sincerely,

Dr. I. Muteba
For/Director