

**HOUSEHOLD ENVIRONMENTAL HAZARDS AND BEHAVIORAL
PRACTICES INFLUENCING CHILDREN DIARRHEA INCIDENCES IN
HOMABAY COUNTY, KENYA**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
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OF PHILOSOPHY IN DISASTER MANAGEMENT AND
HUMANITARIAN ASSISTANCE OF MASINDE MULIRO UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

JULY, 2018

DECLARATION AND CERTIFICATION

DECLARATION BY THE CANDIDATE

This thesis is my original work prepared with no other than the indicated sources and support and has not been presented elsewhere for a degree or any other award.

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DEDICATION

This work is dedicated to all volunteers who are passionately serving humanity across the world.

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ABSTRACT

Diarrhea is a humanitarian issue of concern that remains a major cause of death among children below five years of age in developing countries especially the Sub-Saharan countries in Africa. The environmental risk factors for diarrhea development vary by context hence have crucial implications in designing appropriate intervention strategies to reduce the disease burden, and thus disasters in development and relief periods. In Kenya, maternal Health Seeking Behavior is at 49%, yet the requisite practices could reduce the number of child deaths and complications due to diarrhea. Utilization of Oral Rehydration Solution in Homabay County is far much below the global target of 90% while less than 1% are using zinc. The objective of the study was to establish the effect of household environmental hazards and caretakers' behavioral practices on diarrheal incidences among children below the age of five years. It also sought to evaluate the sustainability of strategic interventions employed to curb child diarrhea incidences. The study employed a cross sectional survey research design. Purposive sampling was used to select Homabay County while multistage random sampling was used to select households that participated in the study. Purposive sampling used to select key informants and FGD participants. Structured questionnaires, observational schedules and FGDs were used to collect data from households with care takers of children less than five years of age. A sample size of 432 households was used. Chi square, ANOVA and odds ratio (OR) at 95% confidence interval were used to analyze and determine the influence of the study variables. Quantitative data was presented in form of tables, graphs and charts while qualitative data was organized into themes, categories and sub-categories. The respondents were aware of the best ways to prevent diarrhea though the players in the sanitation industry had not built strong linkages with community members. There was a significant relationship ($r = -0.054$, $p = 0.337$) between kind of toilet facility and fecal coliforms in water. The odds ratio of the contaminated water having the risk of spreading diarrhea was high at 1.008. The odds ratio of the potential to have fecal contamination from the failure to clean and empty the water storage containers was 1.018 and it confirmed the potent risk of contamination from the practice. The study also established that there was a significant relationship between the incidences of diarrhea in children under five years and the numbers of persons living in the households ($r = 0.014$, $p = 0.804$). The study recommended that efforts should be made by the county governments to create enabling environment that enhance Public Private Partnerships in availing Sanitation and Hygiene related products in the market. The health sector should enhance healthcare service provision knowledge and skills on diarrhea treatment and management protocols.

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LIST OF ABBREVIATIONS AND ACRONYMS

CHMT	County Health Management Team
CHWs	Community Health Workers
CLTS	Community Led Total Sanitation
DPD	Diethyl Paraphenylene Diamine
DRR	Disaster Risk Reduction
FGD's	Focused group Discussion
IMR	Infant Mortality Rate
IEC	Information Education Communication
IMCI	Integrated Management of Childhood Illnesses
JMB	Joint Monitoring Programme
KDHS	Kenya Demographic and Health Survey
MDGs	Millennium Development Goals
ORS	Oral Rehydration Solution
PHOs	Public Health Officers
SDMHA	School of Disaster Management and Humanitarian Assistance
MMUST	Masinde Muliro University of Science and Technology
MOH	Ministry of Health
NACOSTI	National Commission of Science, Technology and Innovation
SBCC	Social Behavior Change Communication
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Scientists
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WSP	Water and Sanitation Program

OPERATIONALIZATION OF TERMS

Children: children in this study referred to any person who is 6-59 months.

Dehydration: Defined as the loss of water and dissolved salts from the body, occurring as a result of diarrhea.

Diarrhea: For purpose of this study, diarrhea will refer to under five child caregiver reported that the child had passage of three or more motions of loose stools in a day in the two weeks prior to the study.

Health seeking Behavior: Refers to any activity undertaken by mother/care takers who perceive their child to have diarrhea problem for purpose of finding an appropriate remedy.

Household: This is defined as a group of people living in the same house /compound or home sharing the same kitchen or meals together.

Mobility: in this it referred to number of children aged 6-59 months who had diarrhea

Mother/care taker: a person that is involved with provision of the child's care.

Prevalence: the percentage number of children who had two weeks before the time of the study.

Oral rehydration Salts (ORS) solution: This is the complete pre-packed sachet of salts containing the standard WHO/UNICEF recommended formula. When the salts are dissolved in water the product is oral rehydration solution.

Oral Rehydration Therapy: This is the administration of pre-packed Sackets of ORS by mouth to prevent or correct the dehydration that is usually a consequence of diarrhea.

Out of Pocket cost: Refers to the amount of money spent out of pocket for registration, investigation and medication

Quality of Care Refers to superiority of care that patients perceive from health care workers in terms of knowledge and skills to diagnose and treat them.

Rehydration: This is defined as the correction of dehydration

Sanitation: In this context it referred to collection and disposal of waste and included facilities in the disposal of waste.

Water treatment: Any activity undertaken by a house hold to make water more acceptable for a desired end use which includes drinking water so that the water does not pose any immediate or long-term health risk.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Over 10 million children die every year from preventable diseases, predominantly in poor countries (Fewtrell & Colford, 2005). Approximately 801,000 of these children are below the age of 5 years and on average, 2,200 children die every day due to diarrheal diseases (Walker *et al.*, 2013). Diarrheal diseases, together with pneumonia, are the leading cause of morbidity amongst children under-fives in a majority of developing countries (Fewtrell & Colford, 2005). A report by the United Nations Children's Fund (UNICEF) indicated that diarrhea generally causes children to be susceptible to malnutrition which makes them vulnerable to infection (Wolfheim, Marsh, Hammamy, & Young, 2012). As such, diarrheal diseases are a grave danger to children under 5 years and must be curbed.

During the mid 1970's, the World Bank actually discouraged research efforts geared towards evaluating the impact of environmental sanitation conditions on people in general and studies related to this area only began receiving adequate attention as from the early '80's (Ruger, 2005) and even then, in 1983, the International Journal of Epidemiology reported that most of the studies that had been published were replete with methodological flaws (BLUM & FEACHEM, 1983). For instance, a study done by (Snyder & Merson, 1982) led to one of the first attempts to uncover the global impact of diarrheal diseases and in the process showed the adverse effect that diarrheal diseases

had on children below the age of 5. The results of their study have since been determined to be flawed as they were founded upon average values obtained from very few studies and this failed to consider the epidemiological variations that are present from region to region.

The turning point in global efforts within this area of public health effectively took place in 1990 when the World Summit for Children made a global plea for the reduction in child mortality to less than 70 deaths for every 1000 live births by the year 2000 (United Nations Children's Fund, 1990) . This was necessitated by the high mortality rates at the time (Black, Morris, & Bryce, 2003). In 1990, the under-5- year mortality rate in sub-Saharan Africa was 180 deaths for every 1000 live births as compared to just 9 deaths for every 1000 live births in developed countries (UNICEF, 2010).

In 2002, nations around the world committed themselves towards the realization of a two-third reduction in child mortality rates by 2015 as part of the Millennium Development Goals (MDGs) for health (Travis *et al.*, 2004). In 2003, the Lancet Journal conducted a survey of all studies into the causes of under-5-year child mortality in developing countries and reported that the mortality statistics attributable to diarrhea varied from 15% to 44% in the studies (Black *et al.*, 2003).

An evaluation was conducted by UNICEF on diarrheal deaths amongst children in Sub-Saharan Africa in 2010 and the findings revealed that 430,000 children under the age of five died due to diarrheal diseases every year (UNICEF, 2010). The study also found that, in terms of the global spread of diarrhea, 3 out of the top 5 countries that were the most affected were from Africa namely, Nigeria, Ethiopia and the Democratic Republic of

Congo. Cholera, one of the worst diarrheal diseases, also disproportionately affects African children under the age of 5 (UNICEF, 2012).

Most studies on this subject are unanimous that socio-economic factors such as education and income levels are the most significant causative factor of childhood diarrhea in Africa. A study conducted by Yilgwan & Okolo (2012) in Jos, Nigeria revealed that 90% of the mothers of the children under 5 who had experienced a diarrheal episode either had no formal education or had only attained primary level of education, showing a strong link between education and diarrheal prevalence and morbidity. Another study by Root (2001) found that well-educated and more financially empowered mothers in Africa were better informed with regards to using healthcare services more effectively and avoiding contamination than uneducated women. Socio-economic factors have a bearing on other factors such as environmental and behavioral risk factors since an educated mother is better placed to know how to interact with their environment and attune their behavior in such a way that they do not expose themselves and their children to contaminants (Root, 2001). Previous studies such as those conducted by Mock, Sellers, Abdoh, & Franklin (1993); Manun'ebo (1994) and Okunribido *et al.*, (1998) failed to show any substantial relationship between socioeconomic factors such as education/ financial standing and childhood diarrheal morbidity. This therefore shows that this relationship needs further investigation.

The association between environmental factors and childhood diarrhea has also been tackled by different researchers. Study done by Woldemicael (2001) found that a majority of environmental factors are linked to one's socioeconomic status and residential area. A further study by Root (2001) done in Zimbabwe substantiated the

findings, revealing that children who lived in homes that used river water as their drinking water experienced diarrhea 33% times more than children who drunk borehole water.

Behavioral factors in Africa have also been addressed by, among others, the WHO and UNICEF Joint Monitoring Programme for Water Supply and Sanitation 2012 whereby behavior patterns such as open defecation and hand washing using soap are linked to the risk of exposure to diarrhea-causing organisms (UNICEF, 2012). African countries such as Niger, Nigeria and Burkina Faso are among the leading countries in terms of the global distribution open defecation cases (UNICEF, 2012) This finding is in tandem with an earlier study done by Child Health Research Project (1998) done in Gambia revealed there to be major contamination of gruels for children which caused diarrheal episodes.

Several studies have been done in East African countries although most focused on Ethiopia and Eritrea. Environmental factors were found to be prevalent most in a study conducted by Mitike (2001) to ascertain the prevalence of childhood diarrhea in North Gondar Zone, northwest Ethiopia, found that use of unprotected water sources strongly contributed towards diarrheal morbidity. In the same year, a cross-sectional study by Woldemicael (2001) in Eritrea found that the presence of some form of toilet facility corresponded to a 27% decrease in diarrhea risk. Prior to that, a study had been done by (National Health Development Network--Ethiopia, 2017) which found out that in places where children defecated out in the open, the prevalence of childhood diarrhea was much higher.

Behavioral factors have also been found to be significant in the two countries. According to the WHO and UNICEF Joint Monitoring Programme for Water Supply and Sanitation of 2012, Ethiopia accounted for 38% of the open defecation occurrences globally and this has resulted in an increase in diarrheal episodes in the country (UNICEF, 2012). This finding was in line with those of earlier studies. For instance, a bacteriological study by National Health Development Network--Ethiopia (1992) conducted on the contents of infant feeding bottles in Addis Ababa revealed that there were 2270 bacterial isolates showing that the infants and young children in the area ate contaminated food. A year later, Baltazar, Tiglao, and Tempongko (1993) undertook a case-control study and found that poor hygiene practices were major risk factors for under-five children diarrheal episodes.

Despite the multitude of studies done in African countries such as Egypt, Ghana, Gambia and Zimbabwe and East African countries such as Ethiopia and Eritrea on childhood diarrhea risk factors, very little research has been done in Kenya where diarrhea kills about 11,000 children under five years of age per year (WHO, 2013a). In Kenya, the linkage between the environmental factors and diarrheal morbidity in children under 5 years has not been sufficiently delved into. This represents a major knowledge gap in this area, a gap which the study sought to close.

Although accurate information on causes of death is lacking, the leading cause of under-five mortality in Kenya is pneumonia, malaria, measles and diarrheal disease, where diarrheal diseases kill more children than AIDS, malaria, and measles combined, making it the second leading cause of death among children under five (WHO, 2013).

The global survey by UNICEF ranks Kenya 10th in the world in the number of deaths of children under five years. A total of 106,000 Kenyans died in 2012 prior to their fifth birthday, (UNICEF, 2013). In its attempt to fill gaps identified in earlier studies with a view of providing framework for explaining the incidence of children diarrhea.

Current knowledge of socio-economic, household, environmental and behavioral risk factors, which promote the development of diarrhea among children under five years in Homabay county remains scanty despite child mortality being higher than the national average (UNICEF, 2013). The study sought to identify household environmental hazards and behavioral risk factors of children under five years diarrhea incidence, health seeking behaviors of care givers and evaluate sustainability of strategic interventions aimed at curbing diarrhea morbidity. The study is important since it sought to give insights in designing appropriate interventions that were initially not prioritized to militate against diarrhea.

1.2 Statement of the problem

Water supply and sanitation in Kenya have undergone significant reforms since the '90s, when it became clear that the government's ambitious long-term targets, set in the early '80s, would not be reached (WHO/UNICEF, 2014). Kenya has low sanitation coverage, where more than 43% of its rural population does not have access to basic sanitation. Low sanitation coverage and poor hygiene practices often leads to outbreaks of water borne diseases (Kenya National Bureau of Statistics (KNBS), 2008). Approximately 21 million Kenyans use unsanitary or shared latrines with a further 5.6 million practicing open defecation (OD) (KNBS, 2014).

Kenya is among the top fifteen countries globally with the greatest burden of diarrhea where a child dies in every fifteen minutes due to diarrhea (KNBS, 2014). Diarrheal diseases kill more children than AIDS, malaria and measles combined, making it the second leading cause of death among children under five years (Opisa, Odiere, Jura, Karanja, & Mwinzi, 2012).

In line with the SPHERE Standards on the prevention of water borne diseases, Nganga, Kariuki, & Kotut (2012) state that poor sanitation and unsafe water use is the leading risk factor causing high morbidity, as diarrhea is ranked third among the top ten causes of ill health in Homabay County (County Health Sector Strategic and Improvement Plan (CHSSIP) , 2014). The Kenya Demographic and Health Survey (KDHS) 2008-09 showed that compared to the 2003 KDHS, Under Five Mortality Rate improved to 73 from 115 per 1000 live births in Kenya (KNBS, 2014). However, under-five mortality rate in Homabay county is at 91/1000 live births much greater than the national average of 73/1000 live births despite the numerous interventions within the county (WHO, UNICEF, UNFPA, & WORLD BANK, 2014).

According to Water and Sanitation Program (WSP) (2014), Homabay County loses Ksh.920 million annually due to poor sanitation exacerbated by perennial seasonal floods in the low land areas of the county that leads to contamination of water sources hence increasing risk of water borne diseases through multiple channels (Marshall, 2011). Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD), has set out coverage target for diarrhea treatment to be 90%. However, only 37% of

children with diarrhea received Oral Rehydration Solution (ORS), with less than one percent receiving Zinc since it is not readily available in the county (KNBS, 2014).

The Kenya constitution recognizes and protects the right to water and sanitation whose responsibility lies to the county government (Constitution of Kenya, 2010). Article 43 (1) of this constitution provides that people have a right to clean and safe water in adequate quantities and a right to reasonable standards of sanitation. According to the social pillar of Vision 2030, only 48% of households use improved water sources and 22% use improved sanitation within the county thus, increasing health risks and mortality rate of children below five years contrary to the Sustainable Development Goal 3 (SDG 3) which targets to reduce the neonatal mortality to lower than 12 per 1000 live births and at least as low as 25 per 1000 live births for children below the age of 5 years by the year 2030 (Kenya Vision 2030, 2007).

In order to ensure that SDG 3 is achieved, there is need to ensure that 90% of households have access to hygienic, affordable facilities and access to safe drinking water (MICS, 2011; NWSS, 2007). Countrywide in 2015, seven counties were affected by a wave of cholera epidemics, with only Homabay County recording a resurgence of the epidemic. In the first wave, the region reported 377 cases and 5 deaths, while in the second wave, 111 cases with one death (UNICEF, 2015). Diarrheal disease spawns further problem in stretching the health budget both at individual household and the specific health facilities within the county yet it is preventable (Ministry of Health (MoH), 2015).

1.3 Research Objectives

The general objective of the study was to examine the household environmental hazards and behavioral practices influencing diarrhea incidences in children under five years of age in Homabay County. The specific objectives the study sought to address were:

- i. To examine the relationship between household environmental hazards and diarrhea in children under five years in Homabay County.
- ii. To determine household behavioral practices contributing to diarrhea among children less than five years of age in Homabay County
- iii. To explore health seeking behavior of caregivers of children with diarrhea in Homabay County.
- iv. Evaluate sustainability strategies of existing interventions aimed at curbing diarrhea morbidity and Mortality in Homabay County.

1.4 Research Questions

- i. Do what extent are household environmental risks associated with children under five years diarrhea morbidity in Homabay County?
- ii. What are the household behavioral practices attributed to diarrhea among children less than five years of age in Homabay County?
- iii. What are the health seeking behaviors of caregivers to children under five years of during the onset of diarrhea episodes in Homabay County?
- iv. What are the sustainability strategies of existing interventions employed to curb children under five years' diarrhea incidences in Homabay County?

1.5 Justification

Household environment is an important setting that has significant implications for the health and well-being of its members, specifically children under five years of age who are more vulnerable to small doses of pathogens due to their undeveloped immune systems. Approximately 23,000 Kenyans die from diarrheal diseases, which are ranked third in the country, as thousands lack access to safe drinking water and proper sanitation. With an estimated 70-80% of our local health issues point towards waterborne diseases, many of these diseases flourish during extreme weather events during floods and drought seasons (WHO, 2013b).

According to Ramesh, Blanchet, Ensink, and Roberts, (2015), during emergencies and Humanitarian response water and sanitation is a key concern because people can contract waterborne diseases. Hygiene is a pertinent health issue during such emergencies because children are exposed to contaminated and untreated water (Cronin *et al.*, 2008; Ramesh *et al.*, 2015; Dhanaseela & Ono, 2010). Additionally, health service delivery is often interrupted leading to slow or no appropriate and timely treatment (Allen, 2015). Therefore, this study aims to fill the knowledge gap since water, sanitation and hygiene intervention outcomes vary by context and interaction effects compounded with conflicting evidence on the effect of water and sanitation interventions on diarrheal diseases.

Furthermore, in the recent past, no study has been carried out in Homabay County looking into the three household environmental hazards aspects concurrently, including behavioral practices and sustainability aspects focusing on both risk assessment and risk

management as outlined in the Stockholm Framework. Therefore, the study will contribute to the achievement of Sustainable Development Goal 3 (SDG 3) which targets to reduce the neonatal mortality to lower than 12 per 1000 live births and at least as low as 25 per 1000 live births for children below the age of 5 years by the year 2030. It will also be of help to policy makers in the position of making legislations related to child mortality and morbidity as it will give understanding of regional differentials in child morbidity, especially the ones attributed to diarrhea incidences. It will also enable caregivers and households have sufficient knowledge on best mechanisms to manage diarrhea cases among children under five years of age. Lastly, the study will be stepping stone to further research since it will not have exhaustively looked into all determinants affecting children under five years diarrhea incidences.

1.6 Scope of the study

The study was limited to mothers and care givers of children under five years of age. It covered four sub counties namely Mbita, Karachuonyo, Rangwe and Ndhiwa in Homabay County. It also included key informants namely Sub county Public Health Officers, Private Pharmacies/Chemists, Sanitation products suppliers Community Health Extension Workers and Nurses in Charge in four Health Centers/Dispensaries

1.7 Summary

This thesis consists of eight chapters and each of them deals with different aspects related to the title of study. Chapter one is an introductory sector and an expansion of the purpose of the study to expose the gaps addressed in the study. The chapter is subdivided into five sections with the introduction building on the global view point of impact of

household environmental hazards and behavioral practices on children diarrhea incidences in Homabay County. In line with the topic, the turning point in the field of public health effectively occurred in 1990 when the World Summit for Children made a global plea for the diminution in child mortality to less than 70 deaths for every 1000 live deliveries by the year 2000. African countries (Niger, Nigeria and Burkina Faso) are among the leading countries in condition of the global distribution to out-of-doors defecation cases (UNICEF, 2012). But despite the multitude of studies done in African countries on childhood diarrhea hazard factors, very little research has been done in Kenya where diarrhea kill about 11,000 children under five years of age per year (WHO, 2013). The study sought to identify environmental hazards and behavioral risk factors of children under five years diarrhea incidence, health seeking behavior of care givers and evaluate sustainability of strategic interventions aimed at curbing diarrhea morbidity.

The statement of the problem exposes the knowledge gaps intended to be bridged by the findings of this study. It pointed out that the study area had increasing health hazard and mortality rate of children below five years divergent to the Sustainable Development Goal 3 (SDG 3) which objects to reduce the child mortality to lower than 12 per grand live births and at least as low as 25 per 1000 live births for children below the age of 5 years by the year 2030. Furthermore, there is shortage of data on date socio-economic, household, environmental and behavioral risk factors, which promote the development of diarrhea among children under five years in Homabay County. The third sphere points out the objectives and research questions that guided the study. It is then followed with justification, which describes Hygiene as a

pertinent health issue and during such emergencies children are exposed to contaminated and untreated water (Cronin *et al.*, 2008; Ramesh *et al.*, 2015; Dhanaseela and Ono, 2010). Extensively, in the contemporary past, no study has been carried out in the study area looking into the three household environmental hazards aspects concurrently, including behavioral practices and sustainability aspects centering on both risk assessment and risk management as outlined in the Stockholm Framework. The last sector; scope of the study pointing out four sub-counties Mbita, Rachuonyo, Rangwe and Ndhiwa in Homabay County. Additionally, the study was limited to mothers and care givers of children under 5 years of age. For further understanding of the various objectives that guided the study, the next chapter provides explores on existing literature to expose knowledge gaps. Lastly, it provides a conceptual framework employed to give direction to the study and show the relationship that exist between the variables of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section provides literature review for the study and is guided by the objectives formulated. It gives an overview diarrhea classification, causative agents, an in depth review looking into the linkage between diarrhea incidences and household environmental hazards, household behavioral practices and sustainability of various effective strategies employed by Ministry of Health and other development partners and stakeholders to curb children under five years diarrhea incidences.

2.2 Diarrhea Classification

According to WHO (2013) diarrhea is defined as the passing of loose or watery stool at least three times in a 24 hour period than it is normal for an individual. Globally, almost everyone has at one point been ill or affected by diarrhea (Kotloff *et al.*, 2013). It is estimated that diarrhea kills more than 760, 000 children under five years every year (WHO, 2013). Diarrhea occurs when there is an imbalance in the absorption and secretion properties of the intestinal tract. When the absorption of fluids decreases or secretion increases beyond its normal level, it results to diarrhea (Chiller *et al.*, 2006).

Boschi-Pinto, Velebit, and Shibuya, (2008) note that the definition of diarrhea varies from one individual to the other. In some individuals, even as little as one loose stool in 24 hours is regarded as diarrhea while others must pass at least three loose stools to be considered as diarrhea. The clinical features presented by different individuals with

diarrhea depends on the cause, duration, severity of the diarrhea and the general health of the patient (WHO, 2013; Navaneethan & Giannella, 2010).

Diarrhea often lasts for a few days depending on how fast the underlying cause is addressed. It usually causes dehydration in the body due to the excessive loss of body fluids. However, according to the WHO (2013) loose, but non watery stools, especially in breastfeeding babies is not considered as diarrhea therefore, not all loose stools are regarded as diarrhea unless it meets the threshold of three or more episodes of passing loose stools in a day. On the other hand, Boschi-Pinto, Velebit, & Shibuya (2008b) states that diarrhea in children may be defined as the excessive daily stool volume that is more than the 10g/Kg/day which is the upper limit in a day. Therefore, based on this study, it is possible to have diarrhea even when the stools involved are partially formed or not to have diarrhea even when an individual is passing loose stools.

2.2.1 Diarrhea Classification based on occurrence Mechanism

According to Husain, Seth, Dar, and Broor (1996) diarrhea can be classified into four general categories based on the mechanism in which it occurs. These include the osmotic diarrhea, oxidative diarrhea, motility disorder diarrhea and the secretory diarrhea. Osmotic diarrhea is associated with the retention of water in the bowel which originates from the non-absorbable water-soluble substances in the gastrointestinal tract (Shah, Yousafzai, Lakhani, Chotani, & Nowshad, 2003). The study points out that osmotic diarrhea results from an excessive intake of substances like hexitols, sorbitols and mannitol may result to slow absorption and rapid small intestine motility. Such type of diarrhea may also take place in infants if they take undiluted or highly concentrated formula. Chey, Jin, Lee, Sun, & Lee (2001). The severity of this form of diarrhea varies

directly with the amount of such sugars ingested and usually diminishes when the intake is reduced.

Motility disorder diarrhea is experienced as a result of abnormal intestinal contractions that result from an excessive number of high amplitude contractions on the intestinal walls that reduces the amount of time that the food substances remain in the large intestines to ensure maximum reabsorption of water hence causing diarrhea (Chey *et al.*, 2001). Changes of the small intestine motility may also occur, leading to diarrhea (Estrada-Garcia *et al.*, 2009). Secretory diarrhea on the other hand, refers to the type of diarrhea that is caused by an increase in the active secretion or inhibition of the absorption process in the gastrointestinal tract (Velázquez, Calzada, Bautista, & Gayosso, 2012). They indicated that this form of diarrhea induces little or no structural damage of the tissues. For instance, cholera toxins result in a secretory type of diarrhea since it stimulates the secretion of anions such as the chloride ions which interfere with the normal water absorption process in the body (Velázquez *et al.*, 2012) .

Lastly, oxidative diarrhea occurs when an individual's intestinal epithelium's barrier is compromised through the loss of epithelial cells or there is damage of the tight junction due to infection such as *E. coli*, *salmonella*, *Mycobacterium tuberculosis* and *Entamoeba histolytica* (Muhsen & Levine, 2012).

2.2.2 Classification of diarrhea based on clinical syndromes

Diarrhea may also be classified into four types based on the clinical syndromes and each of them presents a different pathogenesis. They include; acute watery diarrhea, persistent or prolonged diarrhea, dysentery, as well as the chronic diarrhea (WHO, 1995)

According to UNICEF (2012), acute watery diarrhea occurs when there is an abrupt onset of frequent, watery stools with no visible blood, lasting for less than two weeks. Acute watery diarrhea doesn't last long; hence it subsides within 72 hours of onset. It is usually characterized by the general body malaise, flatulence, nausea or sometimes vomiting and abdominal pain. It is commonly caused by viral, bacterial or parasitic infections, which may be as a result poor hygiene practices or food poisoning (Estrada-Garcia *et al.*, 2009). Various studies have revealed that the enteric pathogen causing acute watery diarrhea in both developing countries and developed countries are the same, but their proportions are different (Muhsen & Levine, 2012).

Another study by Pawlowski, Warren, and Guerrant (2009) indicated that bacterial pathogens are the main causative agent of the acute watery diarrhea in areas with poor hygienic conditions. Microorganisms such as the *Rotavirus*, *Shigella*, *E. coli*, *Vibrio cholera* and the *Salmonella species* are the main cause of this type of diarrhea in developing countries (Kotloff *et al.*, 2013). Acute diarrhea mostly results to dehydration, which is the most dangerous complication associated with this type of diarrhea. Dehydration occurs when there is excessive loss of body fluids and mineral salts from the body (Estrada-Garcia *et al.*, 2009). According to Kotloff *et al.* (2013) dehydration becomes more dangerous if the diarrhea is accompanied with vomiting, especially in young children and infants. Due to the rapid body water turnover, high body water

content and relatively larger body surface area to volume ratio in children, the condition of dehydration becomes more dangerous if it is not addressed quickly (UNICEF, 2013).

Dehydration in children may be classified as mild, moderate or severe dehydration (UNICEF/WHO, 2014). Patients who experience mild dehydration experience some thirst and dry mouth from time to time while those ones who have moderate to severe dehydration may present with orthostatic hypotension that is likely to lead to fainting upon standing that is caused by the decreased volume of blood, hence causing a drop in blood pressure upon standing (UNICEF, 2013). It also results to diminished urine output, kidney failure, confusion, and then acidosis and eventually may result into a coma (Kotloff *et al*, 2013).

WHO (2013) defines dysentery as the passing of loose or watery stools that contain visible red blood cells. It is usually regarded as bloody diarrhea and it is often caused by the *Shigella* species (a condition called bacillary dysentery) or by the *Entamoeba histolytica* that causes a condition called amoebic dysentery.

Amoebic dysentery is characterized by diarrheal episodes with visible blood and mucus in the stools, abdominal pain, fever and rectal pain. A study by Thapar & Sanderson (2004) indicated that in developing countries, dysentery is mostly caused by *Shigella flexneri*, *Shigella boydii* and *Shigella dysenteriae* while in developed countries the *Shigella sonnei* is the main causative agent of dysentery.

Research has shown that around 10% of diarrheal episodes in children under five years of age, have visible blood in the stool and this may result to about 15% of diarrhea related deaths in this age group (Kotloff *et al*, 2013). Another study by Levine *et al.*, (1973)

showed that *Shigella dysenteriae* tends to be more common in infants, children below five years, malnourished people and the elderly. The research also found out that mortality due to dysentery is highest in these groups due to their poor immune status.

Persistent diarrhea refers to the diarrheal episodes resulting from a presumed infectious etiology that have an unusually long duration that may last more than 14 days (Estrada-Garcia *et al.*, 2009). A study by Thapar & Sanderson (2004) indicated that about 10 % of diarrhea in children below five years from developing countries results to persistent diarrhea. In most cases, the diarrheal cases may start as watery diarrhea or dysentery, but continues for a prolonged period of time causing severe weight loss in many patients. Research has shown that this kind of diarrhea is responsible for causing about one-third to half of all diarrheal related deaths (Wang, Fang, & Pan, 2004).

According to Kotloff *et al.* (2012), the pathogenesis of persistent diarrhea is not known, though it is believed to be caused by a combination of infections such as entero aggressive *E. coli*, Enteropathogenic *E. coli* and the *Cryptosporidium* species that causes intolerance to food, delayed recovery of intestinal mucosal damage, immunodeficiency and inappropriate use of antibiotics.

Chronic diarrhea on the other hand, refers to the type of diarrhea that result from non-infectious cause, but is highly recurrent and long lasting. According to Carroccio *et al.* (2002) chronic diarrhea may be caused by gastrointestinal disease, may occur due to the underlying systemic disease or may be psychogenic in nature. The WHO (2013) report indicated that chronic diarrhea may be classified as inflammatory is caused by regional enteritis or ulcerative colitis. It is regarded as osmotic or malabsorption diarrhea if it is

caused by lactose intolerance. Similarly, chronic diarrhea may result from dysmotility diarrhea that is caused by conditions like irritable bowel syndrome or diabetic neuropathy. Chronic diarrhea may also result from prolonged use of laxatives leading to abuse. Lastly, it may be classified as secretory diarrhea if it results from prolonged use of medications, bowel resection or if there is an underlying mucosal disease.

2.2.3 Causes of Diarrhea

According to Byers, Guerrant, and Farr (2001) the causes of diarrhea among children and adults are diverse, though the majority of them result from infectious pathogens that get into the body through foods or water. However, some diarrhea results from the errors of metabolism, chemical irritation or organic disturbance.

2.2.4 Diarrhea as a result of parasitic infections

Parasitic infections are among the major causes of diarrhea in human beings. A study conducted in Northern Iran by Kia, Hosseini, Nilforoushan, Meamar, and Rezaeian (2008) indicated that parasitic infections cause about 20% of all diarrheal cases in children below the age of five years. Parasites that cause diarrhea include; *Giardia lamblia*, *Entamoeba histolytica*, *Cyclospora cayetanensis* and the *cryptosporidium*. Parasites enter the human body through food or water and settle in the digestive system where they cause an infection hence resulting to diarrhea (Fekadu, Taye, Teshome, & Asnake 2013).

2.2.5 Diarrhea as a result of bacterial infections

Bacterial infections cause a larger percentage of diarrheal cases globally, especially in developing countries, among the young children, infants and adults. Fekadu *et al.* (2013) assert that bacterial infections that lead to diarrheal diseases affect all age groups and regions worldwide, though the infections are high in developing countries and to a larger extent affect the individuals who have poor immunity and the immuno-compromised patients. According to the WHO (2013), bacterial infections that cause diarrhea in humans include *E. coli*, *Salmonella*, *Shigella*, *Campylobacter*, *Yersinia* and the *Clostridium difficile*.

2.2.6 Diarrhea caused by viral infections

According to Ozdemir, Delialioğlu, and Emekdaş (2010), viral infections are among the major causes of diarrhea among the children under five years. Infections associated with rotavirus are the most common cause of severe diarrheal cases in children and adults. Diarrheal diseases in human beings may also be caused by viruses such as *Norwalk viruses*, *enteric Adenoviruses*, *Caliciviruses* and the *Astroviruses* (Levy, Hubbard, Nelson, & Eisenberg, 2009).

2.3 Diarrhea incidences and Household Environmental Hazards

Globally, more than 5 million children from 0-14 years old die every year from diseases linked to the environmental conditions in which they live, learn and play. These places where children spend most of their time are unhealthy that they contribute to high morbidity and mortality among children especially in developing countries (Curtis & Cairncross, 2003). A number of studies indicate that most diseases and injuries are

contracted in the house and the immediate surroundings (Cairncross *et al.*, 2010; Waddington, 2009; Bartram and Cairncross, 2010). According to WHO (2010), over 40% of the global burden of disease attributed to environmental risk factors fall on children below the age of 5 years who account for 10% of the world's population. These children experience high rates of diarrheal mortality and are more vulnerable to smaller doses of pathogens than other members of the household due to their underdeveloped immune systems (WHO, 2013; Danquah, Awuah, Mensah, & Agyemang, 2014).

2.3.1 Diarrhea incidences and household water sources

WHO (2013) notes that poor access to water supply is a major issue in over 850 million people globally with over 2.5 billion limited by access to sanitation facilities. Prüss-Üstün, Bonjour, and Corvalán, (2008) asserted that globally the burden of disease and mortality rates could be reduced by about 9.1% and 6.3%, if only rapid success is attained in facilitating access to water, sanitation and hygiene facilities. According to Bartram and Cairncross (2010) unsafe drinking water is a major cause of diarrheal diseases and death in children under five years in most developing countries.

Similarly, in another study conducted by Fayehun (2010) on the household environmental hazards and child survival in sub-Saharan Africa indicated that almost 900 million people lack access to improved drinking water globally. A comparative study conducted in Egypt and Ghana found out that environmental factors such as availability and quality of water, availability of toilet facilities and housing conditions were strongly associated with childhood diarrheal morbidity (Regassa, Birke, Deboh, & Belachew, 2008). The source of drinking water greatly influences the health outcomes of both the mother and

child. Drinking water from improved sources is likely not to be contaminated while other sources such as open wells and surface water are likely to carry pathogens (WHO, 2010).

A research conducted in the Republic of Congo showed that children from households that obtain water from protected sources were less likely to have cases of diarrhea compared to those who get it from unprotected sources (Hunter, MacDonald, & Carter, 2010). The findings of the study were in agreement of other reports that found out that in developing countries there is a relationship between households source of drinking water and under five years child mortality. These reports also indicated that children under five in households relying on open well or surface water have higher risks of death than those with piped water or covered well (WHO, 2013; Rutstein, 2009).

Godana and Mengiste (2013) emphasizes that the use of water from unprotected sources contribute significantly to high diarrhea morbidity. A report from Ethiopia showed that the per-capita water consumption was lower in those households that had high diarrhea morbidity compared to those households that had lower diarrhea morbidity. Even though the households may be obtaining their water for domestic use from improved sources, the time used to access it was an important determinant of diarrhea among children below the age of 5 years (Hunter *et al.*, 2013). If the water sources are far away from the households, water may not be sufficient for the household and they may end up consuming unsafe water hence increasing diarrheal morbidity (Fayehun, 2010).

2.3.2 Diarrhea incidences and household sanitation

Approximately 2.7 billion people in the world live without proper sanitation and of these about 2 billion live in rural areas of developing countries (WHO, 2010). Poor sanitation and hygiene are responsible for 7% of deaths especially in developing countries (Leslie *et al.*, 2014; WHO, 2013; Prüss-Üstün *et al.*, 2008). Exposure to human waste increases the risk of diarrheal morbidity among children and adults (Joshi & Amadi, 2013). Latrines allow for proper disposal of human faeces and reduce transmission and ingestion of fecal-oral pathogens. Defecation in open places facilitates the transmission of diarrheal pathogens and also exposes individuals to high risk of intestinal parasitic infections (Cairncross *et al.*, 2010).

A study conducted by Johnston, Berg, Johnson, Tilley, and Hering (2011) found out that families that do not have an improved latrines have higher odds both of a child with a history of diarrhea in the previous 7 days. The findings concurred with another study conducted by Waddington, Snilstveit, White and Fewtrell (2009) in Mozambique that showed an association between lack of latrine and child mortality in Mozambique. Another study conducted by Buttenheim (2008) in South Asia showed that young children were allowed to defecate in the yard or land surrounding the household.

United Nation Millennium Development Goals (MDGs) aimed at reducing by a half the proportion of the population without access to basic sanitation and the reduction by two-thirds of under- five child mortality, between 1990 and 2015. A study conducted Sarfo, Awuah-Peasah, & Asamoah, (2013) on the Millennium Development Goal 4 and the knowledge of mothers on the prevention of diarrhea among children under five years in Ghana, found out that majority of the respondents did not have toilet facilities in their

homes. This was in agreement with a WHO/UNICEF (2010) report that majority of people in developing countries lack access to improved sanitation facilities and most people practice indiscriminate or open defecation. Children's stool tends to carry a higher pathogen load than adults and many of this children play around areas with this faeces. A qualitative study conducted in a dense settlement in Peru revealed several determinants of disposal of human fecal matter behavior which increased diarrhea morbidity including age, efforts required by the disposal method and availability of toilets or latrines (Capuno, Tan, & Fabella, 2015).

In developing countries, many households still do not have access to piped water hence they rely on springs and dug wells (WHO, 2010). These households are at a higher risk of being exposed to bacterial contamination especially during floods and typhoons (WHO, 2010; Bartram, 2010). USAID (2010) notes that most of these households are likely to have sub-standard toilet facilities which further expose children to diarrheal diseases. In some houses, house pipes may be leaky or water pump wells closer to septic tanks latrines or sewer-line hence contributing to high diarrhea morbidity. WHO/UNICEF (2010) reports that local governments of many developing nations often weakly enforce the building codes that enable households with flush toilets on the surface but still allow unsanitary septic tanks underneath.

According to Capuno *et al.* (2013) the greatest reduction of diarrhea is associated with pit latrines and flush toilets. They add that public toilets are unhygienic and unhealthy for children due to the presence of flies and dirty floors. Regassa (2008) asserts that children diarrheal morbidity is higher for households who share their toilets with more than five other households. Sharing of toilet creates unsanitary and unhygienic conditions

which provide a good environment for pathogenic organisms associated with diarrhea infection and increases the risk of transmitting the pathogens to other households (Alison, 2008).

Semba *et al.* (2011) also concurred with the study that sharing toilets with more than five households increased the risks by more than two fold. Another study conducted by Norman, Pedley, and Takkouche (2010) found out that neighborhood outdoor defecation increases the risk of infections from fecal pathogens in contaminated grounds. According to the WHO (2010) lack of excreta facility, the presence of excreta in environment, lack of latrines and absence of refuse disposal pit increased the risk of diarrheal morbidity all over the world. A research conducted in Ethiopia by Semba *et al.* (2011) found out that children from households where there were faeces around the pit hole were more likely to suffer from diarrhea diseases than those households where feces were not observed around the pit-hole. This indicates that the presence of latrine facilities does not contribute to the prevention of fecal pathogens but the proper utilization of the facility is what is important.

2.3.3 Diarrhea incidences and refuse handling

Refuse disposal is a very important factor that influences diarrhea morbidity among children below 5 years. According to Sankoh, Yan, and Protection (2013) open dumpsite approach in solid waste disposal is the most primitive stage of solid waste management practiced in many parts of the world. They point out that in many developing countries, the systems applied in waste disposal and management are outdated, unscientific and inefficient. With the increase in global population and the increasing demand for food

there has been a rise in the amount of waste from each household which is thrown into the municipal disposal sites (Nabegu, 2010). He adds that these wastes that are thrown to the dumpsite are poorly managed and thus end up becoming sources of environmental and health hazards especially to children below the age of 5 years living within the vicinity of such dumps.

WHO (2013) reported that in most developing countries, solid waste disposal sites are mostly on the outskirts of urban areas. These waste sites become sources of contamination to children below five years due to the incubation and proliferation of flies, rodents and mosquitoes. This opinion is shared by Rego, Moraes, and Dourado (2005) in their research that aimed at establishing the relationship between garbage disposal and diarrhea morbidity. Their findings indicated that open disposal of refuse around the houses and residential areas in general were a risk factor for diarrhea. This was attributed to the fact that inappropriate disposal of refuse provides breeding sites for insects, which may carry diarrhea pathogens from garbage to water and food hence thereby causing contamination which leads to diarrhea among children below 5 years.

2.3.4 Diarrhea incidences and floor types

According to WHO (2013), the type of materials used for flooring is a clear indicator of the economic situation of households and is also a source of disease causing pathogens. A study conducted in Sub-Saharan Africa by Fayehun (2010) examined the main flooring materials in households with children who are under five years. He found out that in average about 67% of children live in households with finished flooring materials such as tiles, cement or carpet while the rest lived in households with natural flooring made

of earth and sand that could have adverse effect on the health of under five years children especially those who are still at the stage of crawling.

2.3.5 Diarrhea incidences and food handling in the households

A research conducted by Gharaibeh, Okour, Okour, and Al-Ghazawi (2012) in Jordan valley indicated that there was a significant association between the prevalence of diarrhea in children under 5 years and the cooking area for the family. Families which had separate room for cooking recorded lower levels of diarrhea among children as opposed to those families who used the same room for cooking and sleeping. Although Forouzanfar *et al.* (2015) argue that environmental hygiene especially in the cooking area is the most important determinant of diarrhea; their findings show that diarrhea was high among children from families who cooked and slept in the same room. Another research by Mengistie, Berhane, and Worku (2013) concurred with earlier studies that the morbidity of diarrhea among the children under 5 years was significantly influenced by the location of the cooking area in the household. Their findings indicated that of the 750 respondents who had a separate room for cooking only 163 said they have ever had infantile diarrhea cases while 587 said they have never had such cases in the family. These findings were attributed to the children easily accessing the cooking area and eating food from the pot with dirty hands or picking left over foods from the ground hence increasing chances of getting diarrhea (Abdelhakeem *et al.*, 2011; Fayehun, 2010; WHO, 2010).

Many researchers globally have focused on the prevalence and risk factors that have led to high diarrheal morbidity and mortality in low and middle income countries over the

years. Majority of the studies in this area have not keenly explored the role of the household environmental condition in which children live and spend most of their time in increasing or reducing diarrhea morbidity. (Regassa, 2008) recommends that in order to significantly reduce the number of children dying from diarrhea and other related complications, special emphasis has to be given to the household environmental conditions which form the basis for this research.

2.3.6 Transmission mechanisms for diarrhea causing organisms

Most of the diarrhea causing organisms are transmitted through the fecal-oral route. This is main transmission mechanism for the infectious diarrheal agents such as parasites, bacteria and viruses (Valerie Curtis, Cairncross, & Yonli, 2000). They point out that transmission of the infective agents from the host to the new individual is achieved through the consumption of infected food or water, person-to-person contact or the direct fecal matter. Opisa *et al.* (2012) indicate that fecal-oral transmission occurs as a result of inadequate and insanitary disposal of infected human faeces leading to contamination of water sources and the ground. They emphasize that in many places globally, proper excreta disposal is a crucial aspect that must be considered in order to reduce the transmission of pathogenic agents that cause diarrhea. Research by Jensen, Jayasinghe, Hoek, Cairncross, and Dalsgaard (2004) that sought to establish the link between the safety of drinking water and childhood diarrhea indicated that water-borne-diarrhea occurs when the in house water storage facilities or its sources are contaminated. Poor excreta disposal in the area is usually influenced by lack of clean and adequate water supplies as well as low or no accessibility to sanitation facilities (Opisa *et al.*, 2012).

Diarrhea causative agents' transmission may occur in the public domain or the domestic domain. However, most of the transmission of diarrheal infection takes place in the domestic domain which involves the contamination of water at the storage level (Kontoyiannis *et al.*, 2010). According to Byers *et al.* (2001) diarrheal causative agents can be transmitted through four transmission routes which include; Human-to-human transmission via the environment, human-to-human transmission where the agents multiply in the environment, human-to-animal-to-human and the animal-to-human through the environment.

According to Debnath *et al.* (2014), infectious diarrhea caused by the fecal-oral transmission is usually spread when a susceptible individual ingests pathogens in food or water that is contaminated with the excreta from an infected individual. Wagner, Lanoix, and World Health Organization (1958) identified the major routes of transmission for the diarrheal disease causing agent and produced the 'f' diagram which has been applied until today. A study by O'REILLY *et al.* (2008) that investigated the impact of school based safe water and hygiene program concluded that in places where the fecal contamination is high in the domestic environment, the majority of the diarrheal diseases are transmitted through the human-to-human transmission with the environment playing an important role of being a medium of transmission or a medium of multiplication before the infective agents finally gets to the new host. Figure 2.1 shows fecal oral transmission mechanisms and protective barriers.

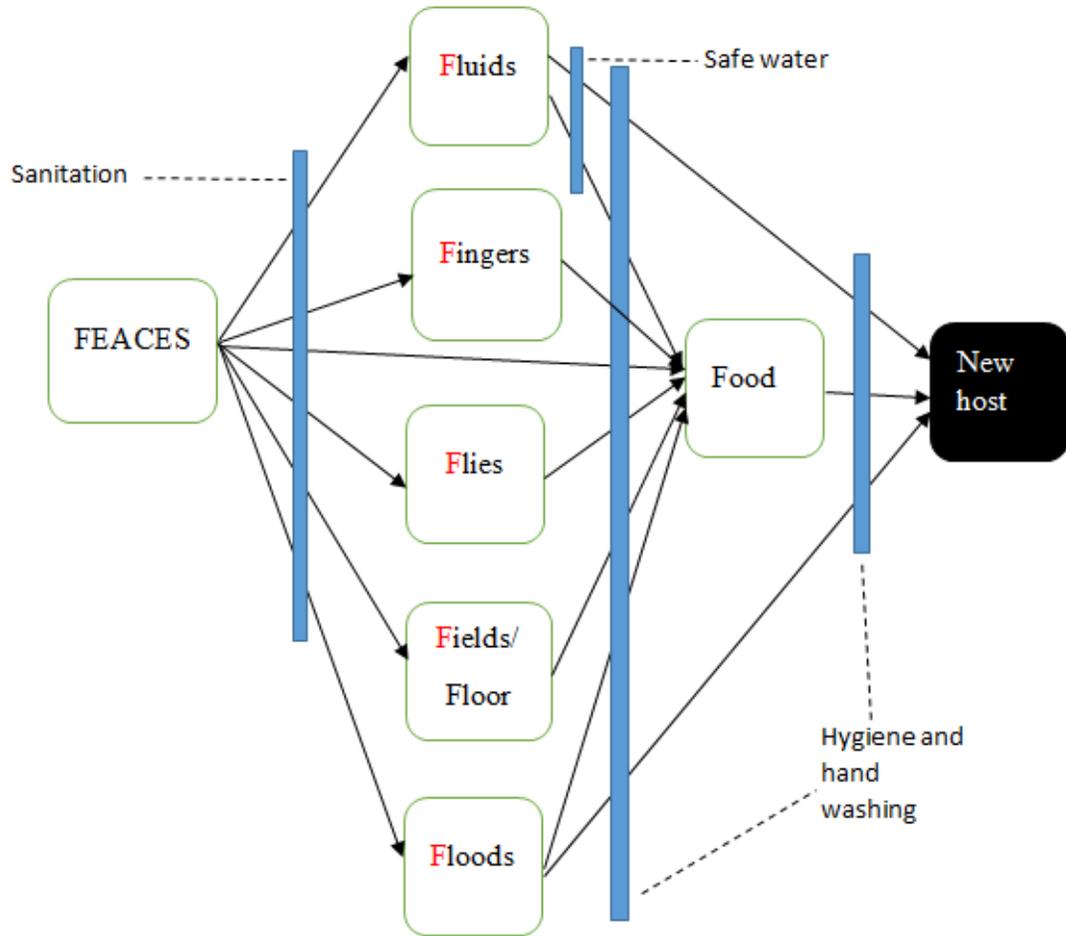


Figure 2.1 Fecal Oral Disease Transmission and Protective Barriers (Source: WEDC Poster 04, 2017).

2.4 Household Behavioral Practices and diarrhea Incidences

Diarrhea has been the leading cause of morbidity and mortality in children under 5 years old globally for many years. Black *et al.* (2003) established that the mortality rate in children is higher especially in the low and middle income countries such as sub Saharan Africa and South Asia where diarrhea is the major cause of deaths. Children under 5 years are more vulnerable to diarrheal diseases with highest morbidity and mortality in

the first 2 years of life (WHO, 2010). In most developing countries, the average annual occurrence of diarrhea cases for children less than five years is estimated to be 2.6 episodes. According to a report by WHO (2013) it is estimated that there are 100million episodes and 3.3 million deaths occurring each year among children under the age of five globally. In Africa 800, 000 children die each year from diarrhea and dehydration. In addition to high morbidity and mortality diarrhea predisposes children to malnutrition which makes them susceptible to other infections (Woldemichael, 2001).

Black *et al.* (2010) assert that the children's health is affected by environmental conditions as well as the social economic status of their family. A study conducted by WHO/UNICEF (2009) indicated that poor environmental conditions were strongly associated with the risk of diarrheal diseases. It was also established that maternal practices related to hygiene, breastfeeding, sanitary food preparation and appropriate weaning practices were potentially important determinants associated with diarrhea morbidity in children. However, Boadi and Kuitumen (1991); DSOUZA (2003); Schmidt, Cairncross, Barreto, Clasen, and Genser (2009) argued that exposure to diarrhea pathogens in developing countries is conditioned by factors such as age of the child, household economic status, the quality and quantity of water used for domestic purposes, level of education of the caregivers, availability of proper toilet facilities, good housing conditions, place of residence of the caregivers, proper feeding practices, personal and domestic hygiene.

2.4.1 Food contamination and diarrhea incidences

(Curtis & Cairncross, 2003) pointed out that diarrheal disease were mostly spread by person to person contact, ingestion of food and water contaminated by fecal matter or

direct contact with infected feces. Studies by (WHO 2013; Curtis 2011) shows that over 70% of diarrhea cases are attributed to ingestion of contaminated food and water. Danquah (2010) indicated that the most important risk factors were behaviors that encouraged human contact with fecal matter which included improper disposal of human waste and lack of hand washing after handling feces and before handling food. He added that hand contact with ready to eat food without washing represented a high risk of causing diarrhea diseases. In many low income countries, households lacked facilities for proper disposal of human waste and even where available they were not adopted for the use of children (UNICEF/WHO, 2009). This led to defecation all over the premises and hence increased the risk of handling excreta by mothers, caregivers and even children themselves. Evidence showed that children's faeces contained higher concentration of pathogens than those of adults due to their increased interaction with contaminated materials in their environment (Woldemichael, 2001).

A research conducted by Galiani, Gertler, and Orsola-Vidal (2012) that aimed at promoting hand washing intervention in Peru with an attempt to improve child healthcare showed that a 42% - 47% reduction in diarrhea can occur when the culture of hand washing with soap and water is introduced and sustained in the community. The study also established that hand washing promotion and intervention were estimated to have the potential to prevent more than one million deaths from diarrheal diseases in a year. Osoro, Ng'ang'a, Mutugi, and Wanzala (2014) established that in the year 2012, 38,800 children lost their lives to diarrhea and pneumonia in Kenya alone. In spite of many attempts by various organizations to promote hand

washing through modern communication channels in Kenya, the practice has not been fully embraced. African Population and Health Research Centre (2002) established that even though many people in Kenya wash their hands with water very few wash their hands with soap after visiting the toilet, changing diapers or before eating.

2.4.2 Breast feeding practices and diarrhea incidences

A study conducted by Lamberti, Fischer Walker, Noiman, Victora, and Black (2011) found out that lack of exclusive breastfeeding among infants 0-5 months of age and no breastfeeding among children 6-23 months of age are associated with increased diarrhea morbidity and mortality in most developing countries. The study found out that human milk glycans, which include oligosaccharides in their free and conjugated forms, are part of a natural immunological mechanism that accounts for the way in which human milk protects breastfed infants against diarrheal disease. In addition, a research conducted by Mhrshahi, Oddy, Peat, and Kabir (2008) in Chittagong, Bangladesh showed that breastfeeding reduces exposure to contaminated fluids and foods, and contributes to ensuring adequate nutrition and thus guarantees non-specific immunity.

Black *et al.* (2008) points out that in developing countries only 40-50% of infants less than two months and 25-31% of infants 2-5 months are exclusively breastfed and the proportion of infants 6-11 months of age receiving any breast milk is significantly low. In a system review on the benefits of breastfeeding on diarrhea and pneumonia mortality conducted by WHO (2013) found out that breastfeeding protects against diarrhea and respiratory infection in children under five years. It emphasized on the review conducted by Kramer *et al.* (2004) on the effect on the child health and growth of exclusive

breastfeeding for 6 months which showed that morbidity from gastro-intestinal diseases was lower among infants who were exclusively breastfed for 6 months in comparison to infants exclusively breastfed for at least 3-4 months. Another research conducted by Sunna (2012) on child feeding patterns and diarrhea concurred Kramer *et al.* (2004) that practicing exclusive breastfeeding was low among mothers and the occurrence of diarrhea was low among breastfed children.

Illness due to contaminated food is one of the major widespread health problems in the contemporary world (WHO, 2013). In the early stages of a child's life, breast milk is important in promoting good health. However, in subsequent months breast milk is supplemented with other foods to improve the nutritional status of a child. Lakkam, Wager, Wise, and Wein (2014) points out that the safety of food especially during weaning is one major concern that has posed a great threat to the health of children under the age of 5 years. The introduction of this supplementary food exposes these children to food-borne pathogens which increases the risk of diarrheal diseases. In addition weaned children begin to lose the protective effects of their mother's immunity and the immunological benefits of breast milk. Bener, Ehlayel, and Abdulrahman (2011) noted that inadequate breast feeding practice undermined the nutritional status of young children.

Masters, Kuwornu, and Sarpong (2011) found out that most mothers gave complimentary feeds to their children before the age of six months which was contrary to UNICEF recommendations that solid foods should be introduced to infants at the age of 6 months because by that age breast milk was not sufficient to maintain the child's growth

(UNICEF, 2010). The findings of the study agreed with those reported by Waswa, Jordan, Herrmann, Krawinkel, and Keding (2015) which all mothers had introduced their infant to food before six months. Children fed at the age of three months were exposed to diarrheal disease compared to those who were introduced to complementary feeding at six months. This was as a result of the child's digestive system not being fully developed and thus the exposure to ulceration and irritation of the gastrointestinal tract hence diarrheal incidences.

2.4.3 Household size and diarrhea incidences

According to a survey conducted by KNBS (2008) the mean Kenyan household size is 4.2 persons. The findings from the survey indicated that there was an association between the household size and the prevalence of diarrheal diseases. Household size was found to be significant determinant of the number of meals for children less than 5 years during food shortage. It was also established that households with more family members recorded a higher number of diarrheal cases compared to households with fewer members. This indicated that the higher the household size the more family resources were divided among many hence the adequacy of the meals and proper nutrients were limited (Lakkam *et al.*, 2014).

2.4.4 Water quality standards and diarrhea incidences

Bharti (2013) asserted that drinking unsafe water exposed young children to diarrheal diseases especially in low income countries. It was evident that without clean water maintaining hygiene was a huge problem. Water could be contaminated in many ways more especially at the source, during transport, in storage containers or improper

handling. According to UNICEF/WHO (2008) the national coverage of water and sanitation averages 48% and 42% respectively. The low coverage exposed a large percentage of people to preventable diseases that emanate from unsanitary environments especially children and this explained why diarrhea was among leading causes of death among young children.

A research conducted by Godana and Mengiste (2013) on the determinants of acute diarrhea among children found out the determinants of diarrhea to be sources of household water, availability of home based water treatment and consumption of left-over food stored at room temperature. Availability of home based drinking water was an independent predictor of diarrheal morbidity in the study. It was noted that children whose families used home-based drinking water treatment such as boiling were at a lower risk of getting diarrhea diseases compared to children from families where drinking water was not treated. Households that used unprotected water sources were likely to have a diarrhea cases in their homes (Curtis, 2011; Godana 2012). A study conducted by Bharti (2013) on knowledge attitude and practices regarding water handling and water quality assessment in a rural block of Haryana established that in majority of households 62.5% used well water for drinking and cooking purposes while piped water was used for washing clothes and bathing in two thirds of households.

In many developing countries, piped water was also found to be unsafe for drinking because of inadequately maintained pipes, low pressure, intermittent delivery, lack of chlorination and many others. A baseline study conducted by Quick *et al.* (1996) in a Bolivian community found out that households using the simple and inexpensive water quality intervention had improved water quality and fewer cases of diarrheal

diseases compared to those using traditional water handling practices. It was also noted that households that kept water in covered jerry cans had low rates of E.coli contamination compared to those that didn't. Another study by Kageni (2011) in Kenya concurred with these findings that there was an association between storage of drinking water and diarrhea cases among children under five years. The study established that most mothers stored their water in buckets which were usually not covered or lacked fitting covers and thus exposure to dust. More than half 62.7% of the mothers who stored their drinking water in buckets reported episodes of diarrhea. In addition she found out that children usually scooped water for drinking directly from the buckets using any cup or bowl thereby increasing the risk of diarrhea morbidity. Drinking water should be stored in separate container from other domestic water and the water should be scooped using clean containers in such a way that hands or other objects cannot contaminate it (Trevett & Carter, 2008; UN HABITAT, 2003; Kageni 2011).

2.5 Maternal Health seeking Behaviors during onset of diarrhea

Maternal health and health seeking behaviors of mothers have significant impacts on both life of the child and mother. A major factor that contributes towards these high infection rates is the health seeking behaviors of their caretakers. Several studies found that the failure to seek care or delays in seeking proper care for children resulted in significant numbers of child deaths in developing countries (Amarasiri de Silva, Wijekoon, Hornik, & Martines, 2001; D'Souza, 1999; Granich, Cantwell, Long, Maldonado, & Parsonnet, 1999). As such, an evaluation into the care-seeking behaviors of caretakers of under-five children was thus crucial in the prevention of diarrhea-related child deaths.

2.5.1 Awareness levels and health seeking behavior

Ignorance amongst caretakers is a significant contributing factor towards the diarrheal infection of children under the age of 5. In Pakistan, awareness on the importance of proper waste disposal and exclusive breastfeeding (only 2.2% were aware) was acutely low amongst caregivers (National Institute of Population Studies, 2009; Popkin *et al.*, 1990). Kenya, too, is plagued by a lack of knowledge whereby lack of knowledge concerning the symptoms of diarrheal infection was discovered to be a contributing factor towards the mortality rate of 86 children per day and in 2010, the Ministry of Health implemented guidelines that involved educating of parents on the requisite home-based care for under-fives to create awareness on the symptoms of dehydration after research revealed that approximately 30% of Kenyan children infected by diarrheal diseases did not receive any oral rehydration salts or fluids (IRIN, 2010).

Nevertheless, increased awareness and knowledge about the dangers and symptoms of diarrhea was not sufficient to reduce levels of diarrhea since it's brought about by a complexity of influences. It was increasingly acknowledged that vaccination was the best strategy to prevent infection in the first place, particularly with rotavirus diarrhea (Mwenda *et al.*, 2010; Nelson, Widdowson, Kilgore, & Steele, 2009; Parashar *et al.*, 2009; Steele *et al.*, 2009; Sanchez-Padilla *et al.*, 2009).

2.5.2 Residence and health seeking behavior

The area of residence was also very critical. Whether a caretaker lives in a rural or peri urban or urban setting seems to have a bearing on their care seeking behavior. Most studies show that urban caretakers have more positive health seeking behavior than rural

caretakers. In Ethiopia, research revealed that mothers who resided in urban set-ups were more likely to seek care from the health facilities than their rural counterparts which was in line with the findings of other studies (Malik, Hanafi, Ali, Ahmed, & Mohamed, 2006; Tessema, Asefa, & Ayele, 2002; Molyneux, Mung'ala-Odera, Harpham, & Snow, 1999).

In contrast, however, other studies showed that caretakers in urban areas did not always exhibit positive health seeking behaviors. A study undertaken in two urban slums in Nairobi between 2006 and 2010 showed that 55 per cent of the caretakers in these two slums took highly inappropriate care whilst 35 per cent took no action whatsoever (Mukiira, 2012). This seemed to show that it was not the mere setting that had an impact on care-seeking but other factors such as poverty levels since both rural and urban slum areas were characterised by poverty levels and lack of a proper health care infrastructure.

An analysis into where treatment was sought by caretakers during the onset of diarrhea on children was likewise crucial. In low-income peri-urban areas of Pakistan, the first place that caretakers chose to seek care for the children was a local licensed doctor (56.2%) (Bokhari *et al.*, 2013). In Ethiopia, 87.2 per cent of caretakers sought treatment from health facilities while a comparatively lower number of 72.7 per cent of caretakers in the rural region of Bahir Dar sought care from governmental and private health care facilities (Tessema *et al.*, 2002). Caretakers in Niger preferred health centres and health posts with less than 10 percent seeking care in a hospital (Page *et al.*, 2011). In Kenya's urban slum settlements, mothers preferred to give their sick children home treatments or over the counter products, only seeking health care after symptoms had exacerbated to dangerous levels (Mukiira, 2012; APHRC, 2002).

2.5.3 Education levels and health seeking behavior

The number of caretakers who actually sought care varied. In Pakistan, where diarrhea was attributed for 16% of all child mortality cases, 80.3 per cent of care takers took their sick children for care. Mothers with no formal education were the primary respondents comprising 84.9 per cent (Quadri *et al.*, 2013). This showed that, contrary to popular belief, education level had little effect on seeking health care. In Niger, 70.4% of caretakers sought care in same type of health facility (Page *et al.*, 2011).

Not every county reported such high figures of health care seeking. In Ethiopia, for instance, the access to and use of health care centres was low. This was due to the fact that only 63% of families resided within 10 km of health facilities and since most could not afford transport, this distance was too far. Only 43 percent of the population sought care at health facilities or any type of illness with 54 per cent only seeking health facilities during child immunization according to the Ethiopian Demographic and Health Survey of 2005 (Snow, 2005; Tessema *et al.*, 2002). In Kenya's informal settlements, only 25% of the caretakers sought treatment in a health facility, primarily preferring home remedies.

The motivation for seeking treatment differed from country to country. The prevailing wisdom was that the education levels of the caretakers had an impact on their care-seeking behaviors but in a study conducted in Niger in 2009, no relationship was discovered between the level of education and the consultations at a health facility. Instead, care seeking was pegged on the number of children in a household whereby the more children in a household, the higher the care-seeking behavior and vice versa (Page

et al., 2011) In Kenya, in contrast, no such relationship has been found and mothers sought care for children when symptoms became worse after over the counter drugs or home remedies failed to work (Mukiira, 2012).

Reasons for not seeking medication during child diarrhea also differed and they were multifaceted. Several studies had been conducted to ascertain these reasons and found out that accessibility to health facilities, cultural beliefs, social and economic class and women's independence among other factors had an adverse effect on care-seeking behavior (Shaikh & Hatcher, 2005; Katung, 2001; Navaneetham & Dharmalingam, 2002; Fatmi, 2002; Uchudi, 2001; Stephenson & Hennink, 2004). In developing countries, the major reason found was cultural practices and beliefs which caused inappropriate care-seeking behavior (Shaikh and Hatcher, 2005). In Yemen, for instance, cultural practices such as the use of local herbs and massage practices for treatment of diarrhea were preferred by the majority (Webair & Bin-Gouth, 2013). In Kenya, lack of properly regulated health care facilities was considered to be a major factor impeding mothers from seeking proper health care for their sick children (Mukiira, 2012).

Oral Rehydration solution use coverage in Kenya had stayed fairly consistent for the last decade, Zinc coverage remained comparably low. According to Kenya Demographic and Health Survey (KDHS) (2009), about 39% of children were treated with ORS. None of the caregivers in Kenya had reported using Zinc for the treatment of diarrhea and this was in line with a 2008-09 KDHS report where only 1 per cent of respondents had used zinc supplements to treat diarrhea in their children despite being introduced in the country in 2006 (Mukiira, 2012). Even in Pakistan, inappropriate medication use had been reported with 77% of the children with diarrhea administered with antibiotics which was not

recommended by the Diarrheal Disease Control Programme. In low-income peri-urban communities in Pakistan, only 2% of healthcare practitioners administered zinc supplements, 31.1% prescribed injectable medicine and 40.8% administered ORS (Quadri *et al.*, 2013).

An analysis of health-seeking behavior is very important in helping reduce child mortality resulting from diarrheal incidence (Shaikh & Hatcher, 2005) . This is because it provides an understanding on the motivations behind why caretakers seek, or do not seek, medication for the sick children under their care. From the literature reviewed, it was evident that health-seeking behavior varied from region to region and according to the caretaker's area of residence. Factors ranging from accessibility to health care facilities to the availability of ORS and zinc supplements all had an impact on the health-seeking behaviors of caretakers.

As a whole, there is an increasing amount of literature on Health-seeking behavior and the predictors of health care use, particularly in developing countries (Shaikh & Hatcher, 2005). The challenge, however, is that this literature often merely describes the behavioral patterns instead of going a step further to expound on the root causes of such behavior and in the process neglects to provide the requisite recommendations (Grundy & Annear, 2010). This represents a major knowledge gap which ought to be filled to save lives of millions of children across the developing world who die needlessly from an easily preventable and curable disease such as diarrhea.

2.6. Sustainability of effective strategies employed to curb children diarrhea incidences

According to Scoones (2009) sustainability of sanitation interventions is defined as the ability to maintain interventions aimed at reducing diarrhea morbidity among children below 5 years for a longer period of time. Similarly, Elbers, Godfrey, Gunning, van der Velden, and Vigh (2012) defined sustainability of sanitation interventions as the capacity to maintain the intervention services that provides ongoing benefits in the reduction of diarrhea morbidity to a target population for an extended period of time after its implementation. Clasen *et al.* (2010) argue that the implementation of sanitation interventions targeting to reduce diarrhea morbidity is not as challenging as sustaining the interventions. He defined sustainability of sanitation interventions by assessing if the adopted interventions are maintained in their functioning. For instance, the provision of latrine facilities is an effective intervention towards the reduction of diarrheal morbidity; however the sustainability of the intervention is determined by the ability to keep the facility clean, use it properly and easy accessibility by the population in question (Hanchett, Krieger, Kahn, Kullmann, & Ahmed, 2011).

Their study points out that the sustainability of sanitation interventions may also be measured by assessing if the created structures are still existing and functioning long after they were initiated or through the use of a normative concept where outcomes or impact of a project or programme aimed at reducing diarrhea incidences are measured against preliminary defined goals.

Intervention sustainability is an important aspect because it creates a lasting improvement in the health and quality of life of the targeted population. Hanchett *et al.* (2011) point out

that if there is no sustainable impact then it is a waste of resources that could have been used elsewhere and also may lead to the diminishing of the community based support and trust that can impact on future projects in the community.

Many authors have criticized sustainability interventions as they claim that these approaches have not succeeded to have a longer lasting impact on the community (Devine & Sijbesma, 2011; JENKINS, 2005; Movik & Synne., 2010). However, approaches like community-led total sanitation (CLTS) and sanitation marketing have been widely perceived as promising to provide a lasting impact on behavior change beyond the duration of the project since they are still new and there are few evidences based on the evaluation to justify the perception (Mukherjee, Kumar, Cardosi, & Singh, 2009).

Chambers & Kar (2008) describe CLTS programme as a community wide behavior change that can mobilize communities to take responsibility of sanitation issues and take initiatives to stop open defecation. CLTS has been promoted in 50 countries across Asia, Africa and Latin America and has recognized that merely provision of toilets does not guarantee their use nor result in improved sanitation and hygiene. This programme was pioneered by Chambers and Kar together with VERC (Village Education Resource Centre) in 2000 in Mosmoil while evaluating a traditionally subsidized sanitation programme. Chambers & Kar managed in persuading the local non-governmental organizations to stop down toilet construction through subsidy. He advocated for change in institutional attitude and need to draw intense local mobilization and facilitation to enable members of the community to analyze their sanitation and waste situation and bring up a decision to stop open defecation (Chambers & Kar, 2010).

According to Chambers & Kar (2010), CLTS had a potential for contributing towards meeting the United Nations Development Programme goals both on sanitation and water (goal 7) and impacts of improving sanitation on combating major diseases especially diarrhea, improving maternal health and reducing child mortality. He added that it can also be an effective point of other livelihoods activities and mobilize community members towards collective action and empower them to take action for the future. Bongartz, Musyoki, Milligan, and Ashley (2010) asserted that the CLTS outcomes can illustrate what communities can achieve by undertaking further initiatives for their own sake and future development. Plan, UNICEF and Water Aid are important disseminators and champions of CLTS.

In Uganda, 65% of rural residents had access to safe water by October 2010, while in urban areas the figure was at 67% (WSP & PATH, 2012). The report further points out that despite the improvements that had been achieved with respect to sanitation and hygiene, still in the same year 30% of the Ugandan rural residents did not have access to latrines and thus continued to practice open defecation. According to USAID (2010) the national Uganda average sanitation coverage stood at 70% while the rural coverage was 49%. Hand washing practice coverage stood at only 28% nationally indicating that the level of utilization of this important practice was still significantly low in Uganda. In Kenya CLTS had been adopted in Mathare and Nairobi city where Plan International together with California Children services (CCS) did an Urban Community-led Total Sanitation pilot (CLTS, 2015)

According to the UN (2009) the main aim of Goal 7 of the Millennium development goals (MDGS) was to ensure environmental sustainability and reverse the loss of the

environmental resources with specific targets of reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation facilities. It is estimated that more than 2.5 billion people lacked access to adequate sanitation and more than 900 million people all over the world lacked safe drinking water (WHO, 2008). The world was thus likely to meet the MDG targets for drinking water even though many countries in Sub-Saharan Africa and Oceania still lagged behind in their individual targets.

Research conducted by Whaley and Webster (2011) in Zimbabwe compared the effectiveness and sustainability of CLTS and Community Health Clubs (CHC). The research indicated that the main weakness of CLTS was that it relied on relatively few face to face interactions, which is the main advantage of the community health club. They therefore concluded that long term behavior change that was likely to persist beyond a project's life time requires frequent face to face visits from outsiders in order to sustain the measures of sanitation intervention in the community (Scoones, 2007).

Mihelcic (2004) asserted that the MDG requirement for sustainable access to safe drinking water and basic sanitation needed to meet the target without compromising the ability of future generations to meet their water and sanitation needs in an economical way and without impacts on human health and the environment. Current trends showed that in sub Saharan Africa and southern Asia the population was still struggling with low sanitation coverage. Open defecation declined globally from 24% in 1990 to 15% in 2011. This decline showed that the sustainability of the project was still not sufficient in many countries. Eastern Asia, South eastern Asia and the Latin America and Caribbean have seen a steady decline (WHO and UNICEF, 2013).

2.6.1 Social marketing with reference to sanitation intervention

MacStravic and Scott (2000) defined social marketing as a process for creating, communicating and delivering benefits that a target population requires in exchange for the community to adopt a behavior that profits the whole society. He added that in social marketing interventions a specific behavior is targeted for modification or adoption for the benefit of the society. Similarly, Kline and Weinreich (1999) defined it as the use of commercial marketing techniques to promote the adoption that will improve the health or well-being of the population in question or the whole society.

According to MacStravic and Scott (2000), the key to the success of social marketing lies on the understanding of what the target population wants. Andreasen (2001) pointed out that commercial marketing strived to benefit the sponsoring organization, while the benefit of the target population or the society at large were more of the primary focus. He argued that social marketers who claimed to act in the interest of the society must continuously critically question the ethicality of both their goals and the source of their revenue. Social marketing programmes aim at improving societies and to fulfill certain set goals. They are usually aware of the competing priorities that determine consumers' behaviors and recognize the importance of promoting the desired behavior change in the society in a way that it is perceived as the top priority of the population that is targeted (MacStravic & Scott, 2000).

Weinrich (1999), noted that the 4P's of commercial marketing which comprises of Price, Product, Promotion and Place were usually adapted and used differently in social marketing in order to fit the purpose of social marketing. However, they recommend the use of four additional P's; Public, Partnerships, Policy and Purse Strings that reflects

on the differences of commercial and social marketing. Kotler and Lee (2007) indicated that marketing strategies were developed around the structure of the basic 4P's framework. He argued that clear understanding of the four P's enabled the development of appropriate sanitation products for the community, at the right price, that was easily available through the strategic sales placement and known well to the target population through promotion.

Peal, Evans, and van der Voorden (2010) asserted that the product within sanitation marketing approaches may not necessarily be physical items like a latrine provision but can also be services like pit emptying or even a shift in sanitation related practices such as the adoption of hand washing culture or stopping open defecation which are able to enhance proper sanitation hence reducing diarrhea morbidity in children below the age of 5 years. The place in which the product of sanitation is made available needed to be easily accessible to the target population. The supply chains for the products have to be improved so that they may reach every individual in the community (Valdmanis & Cairncross, 2006). In order to increase awareness of the sanitation products in the community, different channels of communications may be used for the promotion. Peal *et al.* (2010) points out that public channels such as government extension workers, local NGOs volunteers and individual local traders may be used as a means of bringing the market of the product closer to the target population. Mass media campaigns, well designed posters and word of mouth may be used to get the customers' attention as well as convince them to use the service or the product.

According to Obika (2006) the price of the sanitation product is regarded as the greatest impediment in the implementation of sanitation intervention aimed at reducing the

morbidity of diarrhea among the children below 5 years. Sanitation marketing therefore needs to be done with the aim of assuring the target population on the development of sanitation product with affordable prices. Though the 4 P's of social marketing have been traditionally applied in the sanitation marketing approaches, many studies have recommended to have them extended to include the component of policy or politics emphasizing the importance of legislations and other government policies in the implementation of sanitation interventions (Kotler & Roberto, 1989).

2.6.2 Social marketing of Oral Rehydration Salts

UNICEF (2010) notes that diarrhea can be treated at home with over the counter oral rehydration solution and zinc supplementation so that thousands of lives can be saved. The policy also reinforces the comprehensive prevention and treatment recommendations highlighted by the WHO and UNICEF including Zinc supplements and the use of ORS to prevent rehydration. Diarrheal morbidity can be prevented through exclusive breastfeeding, Vitamin A supplementation, proper hygiene practices like washing hands with soap and access to improved water supply.

According to a report by (WHO, 2004) most of the deaths that occur as a result of diarrhea can easily be prevented by the use of Oral Rehydration Salts (ORS). In 2004, the WHO and UNICEF recommended that all children with diarrhea receive ORS and Zinc therapy which could prevent up to 95% of deaths as a result of diarrhea. However, another study conducted by WHO and UNICEF (2009) that sought to establish why children below five years were still dying, found out that the usage of ORS globally was still low despite the efforts by various agencies to market the product. This was attributed to the low level of awareness about the importance of ORS in the treatment of diarrhea

amongst caregivers as well as Healthcare providers. Despite the fact that many healthcare providers were aware of the ORS therapy, a good number of them didn't recommend it since they consider anti-diarrheal and antibiotics as a quick acting alternatives to ORS.

In India, the World Health Organization ORS campaign was initiated by ICICI Bank with the main aim of sensitising people to use the Oral Rehydration therapy in the management of diarrhea especially in children below 5 years.

A research conducted in Burundi by Kassegne, Kays, and Nzohabonayo (2011) indicated that diarrhea still remains the second leading cause of death for children below the age of five even after the WHO recommended the use of Oral Rehydration Salts (ORS) as the first-line treatment for all children suffering from diarrhea. This was attributed to the low usage of the rehydration salts as a treatment for diarrhea in the country due to the poor social marketing that the product received. In 2004, Burundi started a social marketing intervention that targeted to promote the usage of ORASEL in the treatment of diarrhea among the health workers and caregivers of children below five years. The usage of ORASEL was popularised through the use of mass media and interpersonal communication activities that targeted to reach all people in the country with the main aim of influencing behavior change that will result to increased usage of the product.

Another survey was conducted by the Population Service International (PSI) (2007) on women of reproductive age to determine the key behavioral determinants and exposure to the ORS intervention in the country. A sample of 30 households in each of the 115 rural and urban centres was selected to give information on the characteristics of ORS users, association between exposure to the intervention and changes ORS use and the

behavioral determinants associated to the changes on ORS usage. The study established that there was a significant increase in the usage of ORS among the caregivers at their children's last diarrheal episode from 20% in 2006 to 30% in 2007. The study also indicated that there were notable positive changes on behavioral determinants associated with ORS use. It was established that the higher level of exposure to the social marketing campaign of ORS was highly associated with increased usage of the product.

Many studies from African countries have indicated that majority of the healthcare workers and caregivers use antibiotic therapy to treat diarrhea as opposed to the use of ORS and fluid intake. This has been attributed to the inadequate social marketing of the importance of using ORS for diarrhea treatment. For instance, a study in Nigeria by Ene-Obong, Iroegbu, and Uwaegbute (2000) reported that 68% of a cohort of 80 women caregivers administered antibiotics to children who had diarrhea with only 23% reported to be using ORS for diarrhea treatment. Another research from Nigeria investigating the usage of ORS among children with Diarrhea indicated that Traditional medicine was the first-line medicine for the treatment of diarrhea with only less than 10% of the female caregivers using ORS.

A longitudinal survey carried out in Kenya by Zwisler, Simpson, and Moodley (2013) found out that more than 45% of the caregivers used antibiotics to treat diarrhea in children with only 13% reporting the use of ORS. The low use of ORS in Kenya was linked to the perception that caregivers had towards the cause of diarrhea. For instance, caregivers who believed that diarrhea in children below five years was associated with teething were less likely to seek medical attention in case of diarrhea in children.

However, ORS use in Kenya has increased tremendously due to increased communication and social marketing campaign (Wilson *et al.*, 2013).

2.6.3 Community Led Total Sanitation and Sanitation Marketing

According to Kappauf (2011) CLTS and sanitation Marketing approaches are not only mutually compatible but also complimentary and therefore should be used as a reason to polarise the proponents of either side. In Kenya, CLTS was introduced in 2007 by plan Kenya and the approach was embraced by many sanitation actors in the country with the key actor being the Government through the ministry of Public Health and Sanitation (CLTS, 2015). On satisfaction with the efficacy of the CLTS in initiating and sustaining behavior change through improving latrine coverage and reducing open defecation, the ministry of Public Health and Sanitation approached UNICEF for support of the programme to enhance the scaling up of the approach. According to (Bongartz, Musyoki, Milligan, and Ashley (2010) sanitation marketing do not incorporate the effective promotion or advertising of sanitation behavior change. It has a strong focus towards engaging communities, creating demand for sanitation and developing systems that are sustainable and apply the appropriate technology which is geared towards behavior and social change in the communities.

Devine and Sijbesma (2011) assert that sanitation marketing has different approaches which are targeted to achieve a common goal. The traditional approach to sanitation was supply-driven which had a specific focus of building latrines and empowering communities to support construction projects by giving subsidies. Another approach to sanitation marketing was where the donor community and the community development planners determined what sanitation products that the community was in need of with no

consultation or allowing the local community participation. Mehta & Movik (2010) argue that though this approaches were regarded as a good step towards the realization of reduced levels of diarrhea morbidity, they viewed sanitation as a private household good that had a public benefit with an assumption that the community was unwilling or unable to invest in sanitation marketing. Obika (2006) emphasizes that any approach to sanitation marketing that did not take into account community participation was destined to fail in the long run. He therefore proposes that sanitation marketing approaches must be accompanied by sanitation messaging which is mainly focused on informing the community on the health risks that the community is likely to encounter due to poor sanitation or open defecation as opposed to the practice of empowering communities by raising awareness and inculcating the culture of practicing improved sanitation as well as fostering positive attitudes among community members for proper sanitation practices.

According to Ann (2010) top-down approaches have been found to be ineffective in achieving total sanitation where the sanitation projects such as latrines often went unused with people continuing the culture of open defecation. She also notes that this approach excluded the most vulnerable populations that include the children, women, the disabled and the poor in the society who are usually excluded from the benefits of sanitation in the community. Contrary to this, UNICEF (2013) proposes that for total sanitation to be achieved, Community Approaches to Total Sanitation (CATS) such as Community led total sanitation and Total Sanitation approaches should be embraced. This is because this approaches start at the community level and as such involves all groups of people. They work to generate demand and leadership targeting to improve sanitation and foster behavior change in the society qualities that will produce sustainable facilities and

services engaging local people. This is in agreement with Mehta and Movik (2010) who noted that the success of this approach is a clear departure from the usual past approaches since it usually addresses the major learning in the sector that sanitation programmes like latrine usage will only increase in the community if there is a corresponding change in attitudes and behavior. They argued that the principle underlying this method is based on behavioral changes that are critical in shifting the communities approach towards sanitation and emphasize the need to abandon practices such as open defecation as well as encouraging the community to embrace improved sanitation facilities as opposed to simple pit latrines.

2.6.4 Sanitation marketing challenges

Sanitation marketing is the most suitable method that can help in overcoming the gaps in sanitation implementation (Devine & Kullmann, 2011). However, various studies have pointed out that it is facing numerous challenges especially in the rural set ups that have limited the potential of the approach to achieve its expected outcomes.

Various researchers have pointed out that one major challenge to sanitation marketing is inadequate information at the community level (Willets & Wickens, 2011; WaterAid, 2011). They argue that lack of information is a major hindrance in the development of rural sanitation markets. The demands for sanitation at the community level are usually unclear and as such remain unaddressed. Similarly, they cite that the general difficulties in the flow of information from implementation level to the community may result to undesirable outcomes in the outreach of promotional messages and supply information.

Another challenge to sanitation marketing has been linked to lack of an enabling environment within the country governments and the community in general. According to Water Aid (2011) the responsibility of providing proper sanitation to the community lies between several ministries who are regarded as actors of sanitation. Due to poor coordination and lack proper institutional arrangement for sanitation many sanitation programmes remain unaddressed at the community level. The decentralization of water and sanitation sector has also been cited as a major hindrance in rolling out large nationwide campaigns and surveys that are targeting to address the challenges in sanitation. As noted by Devine (2010), advocacy for sanitation marketing is usually affected negatively in countries that do not have a national sanitation policy and as such they do not identify sanitation marketing as a key approach

Sanitation marketing programmes have also become difficult to implement in various countries due to their complexity in design and high cost involved. Unlike CLTS programmes, sanitation marketing requires specialised skills such as conducting a thorough formal market research which is usually complex, time consuming and expensive. Godfrey *et al.* (2009) believe that obtaining such people from the commercial sector may create a major challenge where the commercial sector may not understand the complex rural sanitation sector, its requirements and the nature of sanitation programmes required at the community level. He argues that obtaining the necessary skills may even be more challenging in case the CLTS and sanitation marketing approaches are combined because they require different skills and knowledge for successful implementation.

2.6.5 Integrated Management of Childhood Illness

In order to address the problem of high mortality rate among children, WHO and UNICEF launched a campaign in 2009 that sought to find out why children were still dying and what could be done to reduce the deaths significantly. The campaign advocated for an integrated approach from the government of respective countries and other health related organizations to work together in implementing interventions aimed at reducing diarrhea morbidity among children below five years (WHO/UNICEF, 2009).

Diarrhea is one of the illnesses that are targeted by the programme of integrated management of Childhood Illnesses. The programme focuses on the control and treatment of major childhood illnesses which occur in children below 5 years of age among them pneumonia, diarrhea, malnutrition, measles and malaria. It is estimated that these diseases account for more than 70% of the deaths that occur in children below 5 years of age in developing countries. The main purpose of this program was to assist the health care givers make a rapid approach for diagnosis and management of common childhood diseases in developing countries with limited resources. In Kenya the Ministry of Public Health and Sanitation together with the Department of Family Health set national policy guidelines to redouble diarrheal disease management. The government through the Ministry of Health came up with charts that can help workers educate caregivers on how to care for their children at home.

Integrated management of childhood illnesses strategy was developed by UNICEF and WHO with the aim of initiating a successful intervention and management of childhood diseases. This programme addresses the main causes of infant and child morbidity in developing countries where diarrhea morbidity has been reported to be high. According

to Scoones *et al.* (2007), the interventions that aim at achieving an integrated management of childhood illnesses are successfully being implemented in various countries globally. The conditions usually occur in combinations and as such require holistic approach of treatment and care.

Successive implementation of Integrated Management of Childhood Illnesses globally, requires a well-coordinated strategy from all stakeholders (WHO & UNICEF, 1997). As per the report, each country must adapt three important components of IMCI at the country level to enhance effectiveness in service delivery. The first component involves the training of health workers and improving their performance in the country's healthcare system. It aimed at providing a guide to all health workers on the process of assessing signs and symptoms, disease classification according to training needs and providing appropriate treatment and health education to the child's caregivers. According to the WHO (2003) South Africa adopted the integrated management of childhood illnesses as a standard care for children in 1997, and became one of the 43% African countries to do so. A study conducted in by Gouws *et al.* (2004) indicated that training of health workers on management of children for a combination of illnesses significantly improved the quality of management of the sick. Findings concurred with another study that was conducted in Bangladesh by Arifeen *et al.* (2004) and that of Schellenberg *et al.* (2004) in Tanzania.

Improvement of the country's health systems is the second component of the integrated management of childhood illness. In order for any country to reduce the morbidity and mortality of diarrhea among the children below 5 years, it is important to invest heavily in projects aimed at supporting child health service delivery that ensure that there is

availability of enough drugs, effectively coordinated supervision, referral services and sophisticated health information systems. UNICEF/WHO (2014) indicates that many countries globally have made significant steps towards the improvement of the management systems and ensuring availability of drugs required to treat childhood diseases that affect children below 5 years.

Improving family and the community practices are important aspects targeted by the third component of integrated management of Childhood illnesses strategy. WHO (2009) indicates that more than 90% of diarrhea affecting children below 5 years is brought about by poor household practices adapted by individuals at family and community level. Community Integrated childhood illness strategy therefore supports the community to develop and implement community and household based interventions to increase the number of children and their caregivers practicing; breast feeding, complementary feeding, immunization and personal hygiene which are key in reducing illnesses in children below 5 years (Bhutta *et al.*, 2008).

Implementation of the integrated management of childhood illnesses in most countries worldwide has led to a drastic reduction in the number of deaths as a result of diarrhea. This has also been linked to the development, marketing and increased use of oral rehydration therapy. The IMCI guidelines have been regarded as very important in the management of diarrhea in children below 5 years since they assist health workers to grade the severity of dehydration correctly and take necessary steps to rehydrate the child suffering from diarrhea (Munos, Walker, & Black, 2010). Through this guidelines, healthcare providers are also able to identify cases of persistent diarrhea and make the necessary arrangements for further treatment and referral if need be.

A Joint statement by WHO/UNICEF (2012) and other partners made a commitment to support government in different countries through their Ministries of Health to implement the Integrated Management of Childhood diseases. Implementation of this programme is estimated to reduce the under-five children mortality by two thirds in order to achieve the millennium Development Goals by the year 2015. Despite the enormous work that has been done to appropriately train and equip the community health workers, this action has not reached out to all parts of the world. Therefore, there is need for action aimed at reaching out to the underserved populations to provide them with essential health services that they need (WHO/UNICEF, 2012).

2.7 Methodological approaches relevant to current study

A study conducted by Agustina *et al.* (2013) used a cross-sectional survey design to find out the association of food hygiene practices and diarrhea prevalence among Indonesian young children from low socioeconomic urban areas. In their research they assessed the prevalence of diarrhea from 7-day records on frequency and consistency of the defecation pattern of the children. They also conducted home visit interviews and observation where they assessed food-hygiene practices which included hand washing, buying cooked food, food preparation, and child's feeding hygiene, and environmental condition. Kageni (2011) while investigating diarrhea morbidity and nutritional status among pre-school children used a descriptive cross-sectional survey that was carried out in Muthurwa and Toi markets in Nairobi City. She used simple random sampling method in selecting the markets whereas systematic random sampling was used in respondent's selection. Another study on diarrheal disease morbidity, risk factors and treatments in a low socioeconomic area of Ilorin, Kwara State, Nigeria used a cross-sectional survey design

to investigate the potential factors of food-hygiene practices of mothers on the prevalence of diarrhea among their children. A face-to-face interview was conducted, and data on 206 mothers were analyzed (Oni, Schumann, & Oke, 1991).

A research on the progress and barriers for the control of diarrheal disease conducted by Santosham *et al.* (2010) used cluster randomized design to evaluate the objectives of the project. A union council was considered as a cluster for analysis where a total of eight clusters, four intervention and four in control were included in the study (Santosham *et al.*, 2010).

2.8 Conceptual Framework

The study is anchored on three theories, Snow's theory, Theory of Planned Behavior (TPB) and Threshold saturation theory. According Hempel (2013) Snow's theory was developed in 1854 by John Snow, who was born in York on 15 March, 1813. He later became a British physician. Snow stood out for his acute observation capacity, logical thinking and perseverance, first in anesthetics and later in epidemiology (Bynum, 2009). The theory was built on the basis that water quality, hygiene practices and utilization of sanitation facilities are key interventions in prevention of diarrheal diseases. He indicated that the major infectious agents that cause diarrhea are transmitted through fecal oral route. With a specific focus on cholera, he identified that the use of contaminated water was the major vehicle through which enteric pathogens were transmitted (Cabral, 2010; Snow, 1856). Snow's theory links the study to various environmental factors linked to transmission of diarrhea diseases such as availability of latrine, disposal of solid and liquid waste, type of water source and distance to water source.

The theory of planned behavior (TPB) was proposed by Icek Ajzen in 1985 through his article "From intentions to actions: A theory of planned behavior." developed from the theory of reasoned action which was proposed by Martin Fishbein and Icek Ajzen in 1975. The theory states that attitude towards behavior, subjective norms, and perceived behavioral control, together shape an individual's behavioral intentions and behaviors. The key component to the theory was behavioral intent; behavioral intentions were influenced by the attitude about the likelihood that the behavior had the expected outcomes and the subjective evaluation of the risks and benefits of that outcome. Interventions aimed at curbing diarrhea incidence in children under five years can only have impact through right behavioral practices such as safe water storage, effective utilization of latrines, hygienic feeding practices, time of introducing complementary feeding initiated and sustained in the community (Ajzen, 1985). Behavioral practices require motivation, understanding of risk associated with a given behavior and ability to perform a desired one.

The study also had a strong basis on the threshold saturation theory which explains the relationship of water supply, socio-economic status; health status and sanitation level (Shuval, Tilden, Perry, & Grosse, 1981). The theory was developed out of two concepts; one by Bradley (1980) which classified water related diseases to several groups depending on routes of transmission of the disease causing organism. In his concept, he emphasized the role of the human factor in the transmission of water-borne diseases; an approach that was also supported by (White, Bradley, & White, 1972).

Saunders and Warford (1976) put forward the concept that associated water use to the health status of the population. In their concept, the “water use link” was considered important since water use patterns of a population plays a crucial role in their health benefits derived from various program mixes of physical facilities, health education and water use. Shuval *et al.* (1981) further expanded the two concepts where he proposed the threshold saturation theory which relates health status to socio economic and health status to sanitation level, pointing out that there is a threshold of socio economic and health status below which no health benefits can be achieved by investing in sanitation and an upper limit of in sanitation where further investment in sanitation did not result in further improvement in health status (Shuval *et al.*, 1981; WHO, 2004 and Joshi & Amadi, 2013). The theory is linked to the study in the sense that; for improved sanitation to take place, investment that largely relies on socio economic status of a given household and the entire community comes in to play. For one to move up the sanitation ladder in improved sanitation, it needs Community Led total sanitation to move Household from Open Defaction to Defaction free. Sanitation marketing is required to promoted sanitation improvement products, however for the facilities set up to have a lasting impact there needs to be a sustained utilization of such facilities effectively long after implementation.

Theory of Planned Behavior and Threshold saturation theory both re-examine the effectiveness of translating various variables to water and sanitation behaviors. Since Snow Theory helps to identify the source of waterborne diseases, the TPB theory strives to examine specific surroundings and reports the most neglected opportunity for compliance. On the other hand, the Threshold saturation theory uses the reported

outcomes to vouch for investments in community sanitation and water supplies in tandem with residents' socioeconomic status and sanitation levels

Figure 2.1 illustrates pathway to diarrhea incidence. Availability of improved water sources, refuse disposal or latrines alone will not reduce diarrhea incidences without change in behavioral practices. Sources of water might be protected but contamination might occur during collection and storage. Investigating the environmental hazards and behavioral practices was useful in identifying risk factors that are behavioral or influenced by environmental conditions are useful in development of effective sustainable interventions. Diarrhea management policy implementation, enabling environment and availability of functional and friendly health care facilities curb diarrhea incidences.

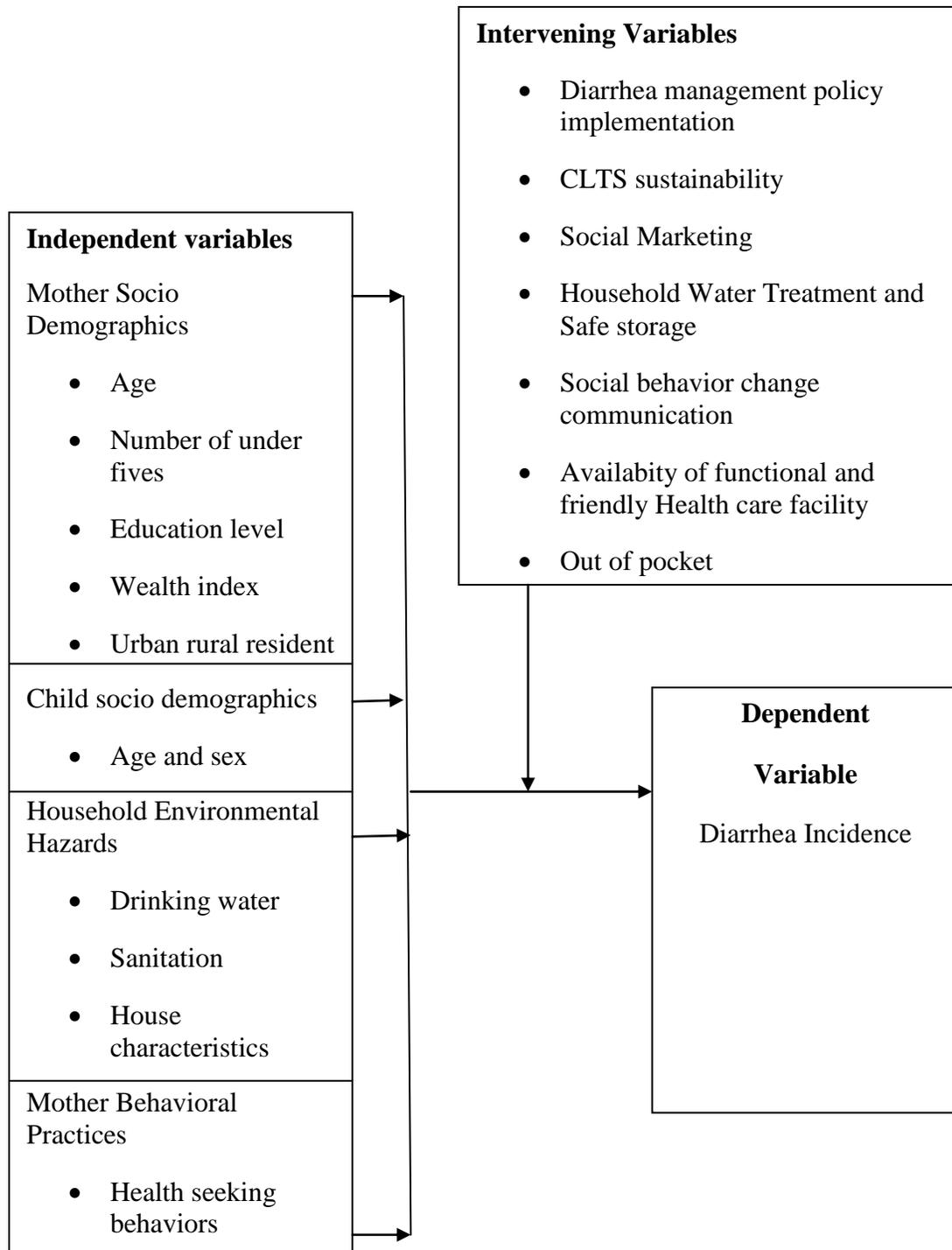


Figure 2.2 Conceptual framework

2.9 Summary

The Chapter elaborates on reviewed literature on the topic of study. The chapter consists of seven parts that provide explanations on varied environmental factors that facilitate diarrhea among children under five years as well as their possible solutions and gaps that the study intended to bridge. It also displays the behavior of the caregivers towards seeking health treatment during diarrhea. The manner in which caregivers seek health care was measured along awareness levels, area of location and levels of literacy. The multifaceted look was critical as health seeking behavior is not influenced in a linear progression but in many aspects that were deemed essential for the success of the research.

In the first three sections of the chapter, expound on diarrhea, its definition and frequency in the global and local level. It also builds on types of diarrhea by occurrences and mechanisms and their causes based on bacterial infection and poor hygiene by caregivers as well as in the households were explored. The comparison is deemed essential to understand influences and risks in the area of study. Exposure of various ways in which the disease is transmitted like behavioral practices of the caregivers, households' quality hygiene standards that are taken lightly leading to diarrhea in under five years. In addition, varied factors of household and water sources were also explored.

The chapter also expound on sustainable effective strategies used to restrict children diarrhea incidences. Rigorous explanations were given on the employed sustainability techniques, pointing out left out sectors leading to failure of good diarrhea curbing systems. Strategies put in place by national and international organizations were brought on board and failure of sustainability measures exposed. Concepts of social marketing

with reference to sanitation, oral dehydration salts and challenges were explained and their poor sustainability measures rose to respond to the research questions of the study. Review was also done on topics of integrated management of childhood illness and Community Led Total Sanitation and Sanitation Marketing and low levels of sustainability of these measures exposed alongside how such failures facilitate diarrhea among children under five years of age in the study area.

This section also figured on pertinent methodological approaches to contemporary studies on diarrhea. The section exposed the significance of the study design and related areas in which it was applied successfully. This gave a reason for the study to adopt the design in a different set up connecting the study to a reliable conceptual framework. The framework used built on the connection of the three theories that were employed to give direction towards achievement of the study goals. It also connected the study to many ecological tenets influencing transmission of and interventions used in curbing diarrheal diseases; which explained connection between the study objectives and the theories, enabling accurate guidelines on answering research questions

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the following: study area; study population; research design; sampling strategy; data collection instruments; pilot study; validity and reliability of instruments and data processing and analysis; ethical considerations; assumptions and study limitations. Figure shows the study area.

3.2 Study area

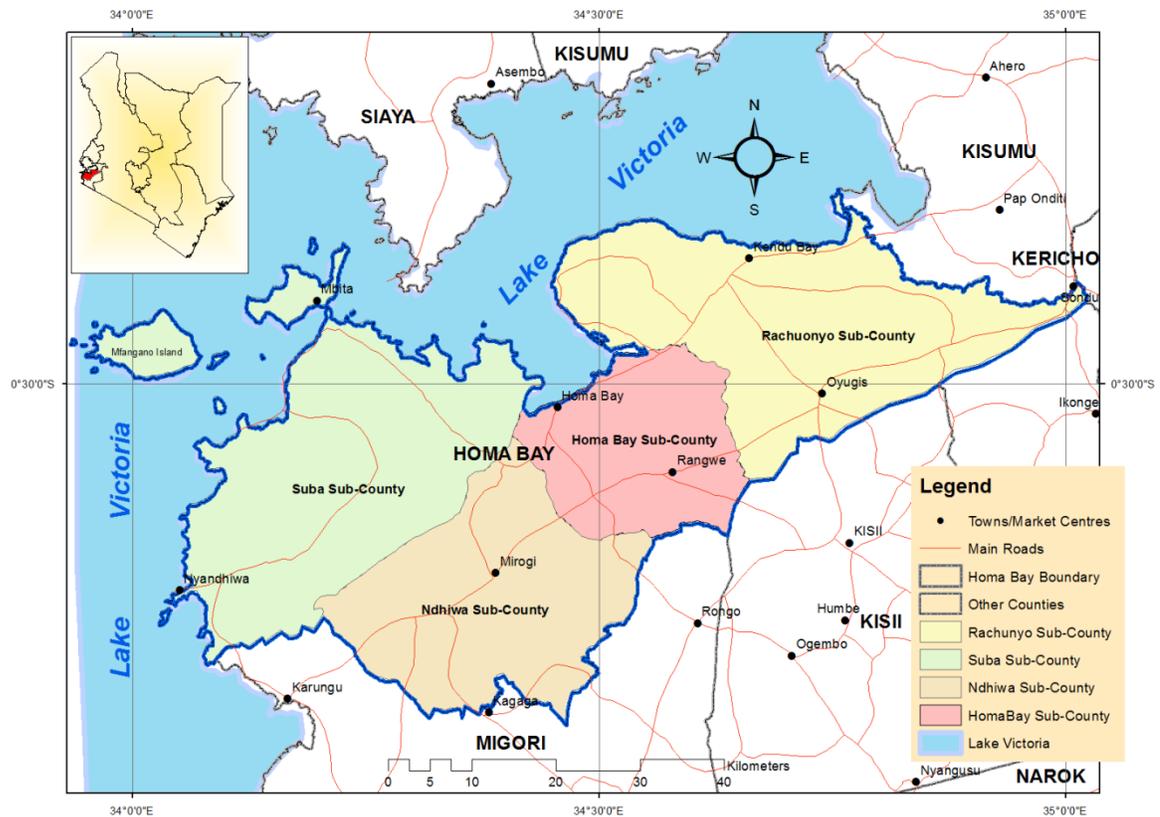


Figure 3.1: Map for Homabay County, Kenya, showing various Sub counties.

Source; Homabay County, CIDP, 2016

The study was carried out in Homa Bay County which borders Lake Victoria to the West and North, and the following counties; Kisumu and Kericho to the North East, Nyamira and Kisii to the East, and Migori to the South. Homa Bay County is located at 0.52⁰ South latitude, 34.45⁰ East longitudes and it is elevated 1166 meters above the sea level. Administratively, the county is divided into eight sub-counties, 19 divisions, 116 locations and 226 sub locations. Its capital and largest town is Homa Bay Town. Lake Victoria is the major source of livelihood for the residents of Homa Bay County.

3.2.1 Population Size and Composition

Homa Bay County has an estimated population of 1,038,858 persons consisting of 498,472 males and 540,386 females based on the 2009 population census report. In the county, 48.8 per cent of the population consists of dependents aged between 0 and 14 years while 27.5 per cent is comprised of the youth aged between 15 and 29 years (Kenya National Bureau of Statistics, 2010; Obonyo, 2012).

3.2.2 Climatic Conditions

Homa Bay County has an inland equatorial type of climate. It has two rainy seasons namely; the long rainy season from March to June and the short rainy season from August to November. The rainfall received in the long rainy season is 60 % reliable and ranges from 250 - 1000 mm while 500-700 mm is received in the short rainy season. The county receives an annual rainfall ranging from 700 to 800 mm. The vast majority of housing units in the county are iron-roofed (82.3 per cent); earth- floored (74.7 per cent) and mud-wood walled (65.6 per cent). 24.4 per cent of the housing in

the County had floors made of cement, 15.1 per cent were grass thatched and 16.5 per cent and 5.6 per cent had walls made of cemented materials and corrugated iron sheets respectively (County Government of Homa bay, 2013).

3.2.3 Health Access

There are 211 health facilities including nine tier three hospitals and four mission hospitals. The rest are health centres and dispensaries most of which are connected to community health units. These facilities are manned by 941 personnel mostly nurses with a doctor- population ratio still at 1: 40,000 and nurse-population ratio 1:1,500 (CIDP, 2013; KDHS, 2010).

3.3 Study Population

Study population refers to the entire group of individuals/subjects or a collection of units of observation and units of analysis which the study used to generalize the observation (Polit & Beck, 2004). It also entails any group of individuals with one or more common characteristics of interest to the researcher (Burns & Grove, 2010; Orodho, 2003)

The unit of observation was drawn from the eight sub-counties of Homabay County. The respondents included caregivers to children less than five years of age, Public Health Officers and Health records information officers from the sub counties that were sampled, Community Health Extension Workers and Community Health Volunteers from the study area.

3.4 Research Design

Burns and Groove (2009) defined research design as a blue print for conducting a study with maximum control over factors that may interfere with the validity of the findings, a plan that describes how, when and where data will be collected. A cross sectional study design was employed. The study design enabled the researcher to collect both quantitative and qualitative data. The design was used to collect data for the first objective. It involved using different groups of people who differed in the variable of interest but had other characteristics such as socio-economic status educational background and ethnicity. It involved examination of characteristics of, and the differences among several samples at a particular point in time. Data was collected over a short period of time and there was no need for long term cooperation between researcher and the participants. The second objective utilized descriptive study design.

According to Burns & Grove (2009) descriptive research “is designed to provide a picture of a situation as it naturally happens” The descriptive design is focused on generating detailed information regarding the key aspects. It is used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret it for the purpose of clarification (Orodho, 2003). The purpose of descriptive research is to determine and report the way things are in their natural setting, describe their relationship but do not predict relationship between variables (Mugenda & Mugenda, 2003; Orodho, 2008; Kombo, & Tromp, 2006). For the purpose of this study, descriptive research was used to determine the behavioral practices that were attributed to diarrhea among children less than five years of age.

Correlation design was used to collect data for the third objective. The design was appropriate since it was utilized to collect data on more than one variable from the sample, which was used to describe the relationship between the variables (Babbie & Mouton, 2001; Creswell & Creswell, 2017; Neuman & Dickinson, 2003).

The fourth objective utilized evaluation research design. The design helped in the determination of relative merits and approach interventions required and the sustainability of the appropriate interventions. The design helped the researcher make judgment on changes to current intervention approaches (Babie, 2010; Maxwell, 2012).

Babbie and Mountain (2001) define devaluation research design as a systematic application of social research procedures for assessing conceptualization, design and implementation and utility of social intervention programs. Gomm (2008) refers to evaluation research design as a design that helps people make wise choices about future programming. It's aimed at informing experiences and judgments, perceptions and experiences of program planners, practitioners and community participants.

Table 3.1 Research Design as per specific objective

No	OBJECTIVE	MEASURABLE VARIABLE	RESEARCH DESIGN
i.	To examine household environmental hazards associated with children under five years diarrhea incidence	Source of drinking water Time to water source. Toilet facility	Cross sectional
ii.	To explore household behavioral practices attributed to diarrhea among children under five years of age	Hand washing at five critical moments Household water treatment and safe storage Food storage Adult latrine utilization Disposal of child faeces Breast feeding status Introduction of complementary feeding	Descriptive
iii	To investigate health seeking behaviors of caregivers of children with diarrhea in Homabay County	Hand washing at five critical moments Household water treatment and safe storage Food storage Adult latrine utilization Disposal of child faeces Breast feeding status Introduction of complementary feeding	Correlation
iv.	Evaluate sustainability existing interventions aimed at reducing diarrhea incidences	Implementation of the National Diarrhoea Management policy at the county and Sub county level. Community Led Total sanitation, HWTS technologies	Descriptive

3.5 Sampling Strategy and Sample Size

Burns and Grove (2009) described sampling as the process of selecting subjects who are representatives of the population or events being studied. It also referred to selected elements of research population to be studied and expected to represent the research population (Kombo and Tromp, 2006; Polit & Beck, 2004). The study utilized multi stage random sampling where the entire population was divided into groups according to administrative boundaries and random samples picked at more than one stage ((KATEBIRE, 2007)). It is used where the researcher cannot get a complete list of members of the population (Burns & Grove, 2009). Purposive sampling was used to select Homabay County in which the mortality level of children under five years is above the national average levels. Simple random sampling was used to select Sub-counties to participate in the study. Simple random sampling has no complexities the eight were coded and used as the sampling frame. The codes were written on pieces of papers of same colour and size so that numbers could be concealed. They were then mixed in a box where lottery method was used to select one at a time without replacement till 50% of the sub counties (Mbita, Karachuonyo, Rangwe and Ndhiwa) were selected for the study. Data collected from the sample counties was generalized for the entire county.

At the second stage simple random sampling was used to select one division from each Sub-county Lambwe, East Karachuonyo, Kochia and Nyarongi were selected. Sub locations in each division were alphabetically listed and one sub location picked randomly from each division.

Table 3.2: Randomly Selected Administrative Areas

Sub-county	Division	Sub location	No of Villages
Mbita	Lambwe	Ogongo	18
Rachuonyo North	East Karachuonyo	Karabondi	14
Homabay	Kochia	Kowili	15
Ndhiwa	Nyarongi	North Kabura	10

Two villages were randomly picked from each sub-location making it a total of eight. An up-to-date number of households was obtained from the village administrator source. Selection of subjects was purposively sampled out. The village administrators helped identifying starting points of the villages. The research assistant started at points going in one direction interviewing mothers/care takers of children under five years of age after being made to understand the objectives of the study and getting express authorization for interviews until the required sample sizes from the villages was attained.

Sample size refers to the number of subjects, events, behavior or situations that are examined in a study (Burns & Grove, 2009). Gay and Diehl (1992) point out that descriptive research samples range from 10-20% of a population depending on the population size.

The results of the study had a 5% level statistical significance and a confidence level of 95%. The Z value at 95% confidence is 1.96. According to Mugenda and Mugenda (2003), when the study population is 10, 000 and above, a sample size of 384 is adequate.

This is arrived at using the following formula:

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n = desired sample size (if the target population is more than 10, 000)

Z = the standard normal deviate at the required confidence level

P = the proportion in the target population estimated to have characteristics being measured

q = 1- p

d = the level of statistical significance set

$$n = \frac{(1.96)^2(0.50) (0.50)}{(0.050)^2}$$

$$\frac{(3.8416)(0.50) (0.50)}{(0.0025)}$$

= 384 households.

To account for non response, an additional of 10% of the sample was considered hence the study used a sample size of 423.

Table 3.3: Summary of Sampling strategy and Sample Size

UNIT OF OBSERVATION	SAMPLING METHOD	SAMPLE SIZE
Women with children under five years /care takers	Simple random	423
Sub county Public Health officers, Community Health Extension Workers (Key informants)	Purposive	8(1 each cadre from each of the four sub counties) CHEWs from wards
Community Health Extension Workers(Key informants)	Purposive	4(Each from a community unit from the area where data will be collected)
Private Pharmacists and Sanitation products suppliers	Purposive	8 (Two from each category in the four sub counties)
Focus Group Discussions	Quota	8 (2 in each of the four ward)

3.6 Data Collection

3.6.1 Secondary Data

This was collected through review of County and Sub-County Annual Work plans, Strategic plans, Water quality analysis reports from Lake Victoria Environmental Programme Monthly and annual reports and peer reviewed journals.

3.6.2 Primary Data

Primary data comprised of both quantitative and qualitative data, which was collected through open ended questionnaires targeting caregivers selected to supplement the information gathered through Focus Group Discussions (FGDs) while additional qualitative data was collected through key informants of different cadres namely Public Health officers, facility in charges, Community Health Extension Workers, Pharmacists and sanitation products suppliers. Observation checklist were also utilized at household levels by the researcher where first-hand experience was gained that bridged the gap between what the respondents said at the household levels and what was actually done by caregivers. Table 3.4 is a summary of sampling method per population unit, sample size and primary data collection tools

3.6.3 Processing of Water Samples

Water samples were taken at the point of use directly from the container used for drinking from various households selected at random. The samples were collected at the end of the interview, placed in an icebox cooler and transported for laboratory analysis on residual chlorine level and presence or absence of fecal coliforms. Turbidity was measured using the turbidity tube in nephelometric turbidity units (NTU) with values

below 5NTU considered safe for drinking (WHO, 2000). Chlorine levels in water was detected using DPD complex tablets which dissociates and changes the colour of the water to pink if any chlorine compounds are present in the water sample. The samples were also analyzed for residual chlorine levels using calorimetric machine from which the chlorine optical density (OD) in the water samples was taken and recorded. The calorimeter was calibrated using pure water with zero traces of chlorine. Chlorine level of less than 0.2mg/ l was regarded as low and ineffective while chlorine levels of more than 0.2mg/l were regarded as sufficient and effective in protecting water from bacterial contamination.

Bacterial contamination in the water samples was detected by presence or absence of fecal coliforms using Filter Membrane Technique. One hundred milliliters (100ml) of the water samples was filtered through a membrane filter embedded with media. The membrane was then cultured on a pad of sterile selective broth containing an indicator. The number of coliforms colonies was then counted after incubation for 24 hours at the temperature of $35.5 \pm 0.5^{\circ}\text{C}$ to give the approximate number of *E.coli* in one hundred milliliters (100ml) of water. Detailed description of the Filter Membrane Technique is outlined below.

Water microbiological analysis was done by determining *Escherichia coli* (*E. coli*) by Membrane Filtration Method as described by Brenner *et al.* (1993) using a simultaneous detection technique (MI Medium). The method describes a sensitive and differential membrane filter (MF) medium using MI agar or MI broth for the simultaneous detection and enumeration of both Total Coliforms (TC) and *Escherichia coli* (*E.coli*) in the water samples in 24 hours on the basis of their specific enzyme

activities (Brenner *et al.*, 1978; Dufour, Strickland and Cabelli 1981). Two enzymes substrates, the fluorogen 4-Methylumbelliferyl- β -Dgalactopyranoside (MUGal) and a chromogen Indoxyl- β -D- glucuronide (IBDG), were included in the medium to detect the enzymes β -galactosidase and β -glucuronidase produced by TC and *E.coli*, respectively.

Water samples of 100mls were collected in sterile polypropylene sample containers with leak proof lids and filtered through a 47mm, 0.45 μ m pore size cellulose ester membrane filter that retains the bacteria that is present in the water sample. The filter was then placed on the absorbent pad which was saturated with 2-3ml of MI broth and the plate incubated at 35⁰C for up to 24 hours. The bacterial colonies that grew on the plate were inspected for the presence of blue colour that occurred as a result of the breakdown of IBDG by *E.coli* enzyme β -glucuronidase and fluorescence under longwave ultraviolet light (366nm) from the breakdown of MUGal by the TC enzyme β -galactosidase. The *E.coli* counts per millilitres (ml) were then determined according to the guidelines of microbiology guidelines described by Brenner, Rankin, Sivaganesan, and Scarpino (1996).

Table 3.4 Data collection using various instruments

STUDY POPULATION	SAMPLING METHOD	SAMPLE SIZE	INSTRUMENTS	APPENDIX No
House Holds with Care takers/Mothers of U5	Simple random	423	Structured Questionnaire	5
Sub county Public Health Officers	Purposive	4(1 from each sub county for the two cadres)	Unstructured questionnaire	7
Sanitation products suppliers/Hardware	Purposive	8(Two from each of the four sub counties)	Key Informant Guide	8
Private Pharmacy/Chemist	Purposive	8(Two from each of the four sub counties)	Key Informant Guide	9
Community Health Extension Workers	Purposive	4 (1 from each location where data will be collected.	Key Informant Guide	12
Nurse in charge	Purposive	4 (1 from each health centre/dispensary where data will be collected)	Interview	11
FGD	Quota	8-10 (two in each location)	FGD guide	10
House Holds with Care takers/Mothersof U5	Purposive	As observed	Observational checklist	13

3.7 Research instruments

The following research tools were used to collect data in the proposed study: Interview schedule, Questionnaire, Observation Checklist and Focus Group Discussion guide.

3.7.1 Key Informants Interview Guide

Best and Kahn (2006) view interview guides as superior to other data collection instruments because they create rapport between respondents and the researcher. A semi-structured interview guide was used as a guide to collect information from key informants from the sampled health facilities. The instrument contained open-ended and closed-ended questions. Enough space was provided to record answers from the respondents. The questions in the Key Informant interview guide aimed at answering most of the research questions based on the objectives of the study. The interview guide was used to collect in-depth information regarding the role of healthcare professionals and health facilities in reducing diarrheal cases among children less than five years of age.

3.7.2 Questionnaire

Kombo and Tromp (2006) assert that questionnaire enables collection of information from a large sample and diverse regions. The questionnaire comprised of both open-ended and closed questions which were used to collect information from the sampled caregivers. The questionnaire used in this study is in appendix three.

3.7.3 Focus Group Discussion Guide

The Focus Group Discussion (FGD) is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants gather to discuss issues and concerns based on a list of key themes drawn up by the researcher ((Kumar, 2005)). The focus group discussion guide utilized participatory approaches that included open ended questions, discussions and clarifications it was administered to groups of eight to twelve

caregivers who gave pertinent information on key diarrhea predictors among children in the community.

3.8 Pilot Study

A pilot study is a preliminary study which is conducted on a small scale in order to establish the effectiveness of data collection instruments (Mugenda & Mugenda, 2003). They indicate that a pilot study sample should be between 1% to 10% of the target population. In this study a pilot study was carried out in Rongo Sub-county in Homa Migori County to refine the research instruments. The questionnaires, interview guide and focus group discussion guide were pre-tested using procedures identical to those that were to be used during the actual study. A pilot study was undertaken to gain feedback on clarity and validity of the instruments to be used and time taken by respondents to answer to questionnaire items. The pilot study also helped to ascertain the feasibility of the study (Creswell, 2002; Kumar, 2005).

3.9 Validity and Reliability of Instruments

In order to ensure validity and reliability of the instruments, the researcher carried out a pretest of the instruments.

3.9.1 Validity

According to Kothari (2004) validity refers to the extent to which an instrument measures what it purports to measure in a research. It gives the degree with which the results obtained in the study accurately represent the phenomena under study (Babbie & Mouton, 2001). The researcher determined the content validity of the questionnaires through expert judgment. This ensured that data collected using the questionnaires adequately

represented the domains of variables that were measured. Assistance and opinion of researchers and other experts in Department of Emergency Management and Humanitarian Studies in Masinde Muliro University of Science and Technology was sought to assess the relevance of the content in the research tools against the objectives. Suggestions and opinions from experts were used to improve clarity of items in the questionnaires, Key Informant Guide and Focus Group Discussions Guides.

3.9.2 Reliability

Reliability is the consistency of measurements. Repeated measurements provide regular results (Brinberg & McGrath, 1985; De Vaus, 2002). Pilot study was carried out before conducting the main study to pretest tools that were to be used. Appropriate revision and adjustments were made to refine the instruments. The questionnaire was pre-tested in Rongo Sub County which has similar socio demographic characteristics as the area of study. Appropriate adjustments were made to the questionnaire after piloting where vague terms, questions and phrases identified were modified, rephrased or changed. Split-half technique of measuring reliability of the research instruments was used. The questionnaire items and interview guide questions were designed into parts based on odd and even appearances. The correlation co-efficient (r) between the two sides was then calculated using Pearson's products moment formula. According to Orodho (2008) a correlation co-efficient ranging from 0.75 to 1 indicates that there is a strong positive relationship between the variables. This indicates that the research instruments are reliable and appropriate for use in the study.

3.10 Ethical Considerations

Before conducting a study, it is required that the researcher has not only the expertise and diligence, but also observes honesty and integrity. To ensure that the research observes ethical values, the rights of human subjects involved must be recognized and protected. Therefore, the researcher ensured that the rights to self-determination, anonymity and confidentiality were observed. Participants for the study were voluntarily recruited without coercion; this was reinforced by signing the consent form translated to local language *Dholuo*. The respondents' consent was obtained before participating in the study. According to Burns and Grove (1993) an informed consent is the prospective subject's agreement to voluntarily participate in the study. Such consent is reached after the subject has been given essential information about the research and voluntarily accepts to participate in the study.

The researcher ensured that the research assistants comprehensively explained to the participants, the purpose, objectives and benefits of the study including means of data collection. Issues of anonymity were guaranteed to the participants by ensuring that their names are not attached either to the questionnaire or any feedback meant for the study.

Anonymity is defined as a condition where the subjects cannot be linked with his or her individual responses either by the researcher or any other person (Burns and Groves, 1993; Kumar, 2005). The study being a community survey which was restricted to only gathering data by asking questions, Focus Group Discussions, Key Informant Interviews and observations which had no health risk to the participants.

The researcher sought approval from two relevant authorities before commencing the research, that is: The Institutional Ethics Review Commission (IERC) based in MMUST which ensured the safety of the study respondents, later a research permit was sought from National Commission of Science, Technology and Innovation (NACOSTI). County Health Management Team, Sub-county Management Teams and administrators were also informed and permission secured before the commencement of the study. Children and caregivers who were found sick were advised to seek medical care from the nearby health facility.

3.11 Assumptions

The assumptions for the study were:

- i. Short recall periods of the past two weeks may have had an advantage of providing better quality data, hence the decisions that were made from the study effectively informed intervention strategies
- ii. All participants would cooperate.

3.12 Limitations

- i. Being a cross sectional study data was collected over a short period of time hence it did not account for season variation.
- ii. Child diarrhea was handled from the mothers/caretaker perception rather than as per clinical examination.

3.13 Data Analysis and Presentation

Data analysis refers to the process of bringing order to the data obtained from the field, organizing it into patterns, categories, sub-categories and descriptive units while looking for the relationship between them. Data cleaning was done immediately after receiving the questionnaires to clear errors and omissions. A random ten percent check was done to ensure accuracy during data entry. Open-ended questions in the questionnaires and interview guides were processed and analyzed by organizing them into thematic areas as per the study objectives. Qualitative data was transcribed for emerging themes, categories and sub-categories. Verbatim transcriptions in *Dholuo* were made from recorded FGDs and Key Informant Interviews. Continuous variables were summarized using means and standard deviations. Statistical Package for Social Sciences (SPSS) Version 20 was used for the analysis of data obtained from closed-ended questions. Qualitative data from both questionnaire and Key Informants interview guide were triangulated to have more in-depth understanding of the objectives being examined. Open-ended questions in the research instruments were also analyzed through a quantitative data analysis. Polit and Hungler (1995) indicated that the main aim of quantitative content analysis is to quantify emerging characteristics and concepts in a study. Concept analysis refers to the process of analyzing verbal or written communications in a systematic way so as to measure the study variables quantitatively.

3.14 Summary

This chapter is divided into twelve sections and provides an outline study design and methodological techniques employed to ensure accuracy and attainment of quality results. It also discussed various sampling procedures employed to gain proper

representation of the study population as well as the study area as many counties in Kenya face the same phenomenon. The design of the study permitted collection of both qualitative and quantitative data and stringent measure of ethical values observed, to avoid harm to the participants and research assistants.

In developing a suitable sampling framework, validity and reliability of the study was well elucidated. Detailed amplification on data collection methods and instruments and the modus in which data was gathered and employed in the study, shapes the range and precision of the work as well as contribution to the quality of the research.

Chapter three has also cautiously discussed some of the major assumptions and limitations faced with reference to data quality problems that are conceivably not always made clear in reporting research, specifically where quantitative data are apprehended. The manner in which the obstructions were handled is well articulated through a clear exposition of the research scheme, design and approaches. The study exhibits the way in which the study responds to research questions with precision as demonstrated at length in the next chapter.

CHAPTER FOUR

RELATIONSHIP BETWEEN HOUSEHOLD ENVIRONMENTAL HAZARDS AND DIARRHEA IN CHILDREN UNDER FIVE YEARS

4.1 Introduction

This chapter covers the results and data analysis on the household environmental hazards in the area of study and their relationship with the diarrheal incidences in children below five years. It covers the general overview of household environmental hazards and their effects on diarrhea in children, social demographic characteristics of the respondents in the area of study, prevalence of diarrhea in the area, household environmental hazards and water handling practices that predispose children to diarrheal infections.

4.2 General overview on household environmental hazards and diarrhea in children

Globally, more than ten million children have been observed to die annually as a result of diseases related to the environmental condition in which they live. Hence, the environment is a significant aspect in understanding the morbidity of children and their mothers. The WHO (2016) records that 1.6 million children have succumbed to death due to air pollution, water contamination, poor sanitation and other environmental risk factors for children. Children under five have encountered diarrhea leading to their morbidity and mortality.

The literature on the prevalence of diarrhea corroborated with the results obtained from the study as health practitioners and the local residents who took part in the study reported diarrhea as an epidemic in the area. However, it is not right to argue that it is a

problem all through the seasons. The participants identified diarrhea to be rampant during dry seasons. These findings were found to be consistent with the results of another study that was conducted by Bhavnani *et al* (2014) which found out that the prevalence of diarrhea was highest just before the rain season in the month of December 2008 as opposed to January 2009 which was the beginning of the rain season. This was attributed to the fact that, in the dry season, there is no sufficient water and the people consume dirty, untreated water. One of the men in a male FGD in Ndhiwa argued that,

Diarrhea is a common disease in this area and especially in the dry seasons. Though we also experience it in rainy seasons but it is minimal. I believe you all came here because you have heard over the radio that Ndhiwa is suffering from cholera otherwise if not the radio you would not be here. Male participant FGD No.#1 Ndhiwa.

However, these findings contradicted the results of a similar study by Thomas *et al.* (2006) which indicated that extreme rainfall and warmer environmental conditions were contributing factors to waterborne diseases hence leading to increased diarrhea cases in Canada. The statement of the participant and the involvement of the media announcing break out of diarrhea in the area is an indicator that the disease is serious in the region. The high proportions of diarrhea recorded in local and international literature motivated the need to look at existing relations between the environmental factors and diarrhea among children under five years of age. The results were critical to adding scientific knowledge geared towards examining the environmental factors that facilitate diarrhea among children under five in Kenya, based on generalized results from the study area. Table 4.1 reveals the distribution of the respondents who participated in the study.

Table 4.1 Distribution of the Respondents who Participated in the Study.

Study Population	Target Respondents	Respondents Interviewed	Response rate
House Holds with Care takers/Mothers of U5	423	315	82%
Sub county Public Health Officers	4(1 from each sub county for the two cadres)	3	75%
Sanitation products suppliers/Hardware	8(Two from each of the four sub counties)	7	87.5
Private Pharmacy/Chemist	8(Two from each of the four sub counties)	6	75%
Community Health Extension Workers	4 (1 from each location where data will be collected.	4	100%
Nurse in charge	4(1 from each health centre/dispensary where data will be collected)	4	100%
FGD	8(two in each location		100%
House Holds with Care takers/Mothers of U5	As observed		

4.3 Socio-Demographic Characteristics

A total of 315 (82%) respondents were interviewed in the current study. Majority 126 (40.1%) were aged between 25-35 years and 155 (63.3%) of the household heads had attained primary level of education. Majority of the women with children under five years 213 (73.4%) had attained primary level of education while 24 (70.6%) of the guardians had also attained primary level of education. Hundred and thirty four (42.7%) of the respondents were farmers and 262 (83.7%) were married. Majority 278 (88.5%) were residing in the rural areas and 264 (83.8%) were protestants as indicated in Table 4.2.

Table 4.2: Distribution of Respondents by Socio-Demographic Characteristics

Item		Frequency	Percent	
Age	Below 18 years	8	2.5	
	18-24	124	39.5	
	25-35	126	40.1	
	36-45	39	12.4	
	>45	17	5.4	
Lev-Educ of HH	No Education	5	2.0	
	Primary	155	63.3	
	Secondary	37	15.1	
	Tertiary	30	12.2	
	Higher Education	18	7.3	
Lev-Educ -Mother	No education	7	2.4	
	Primary	213	73.4	
	Secondary	42	14.5	
	Tertiary	23	7.9	
	Higher Education	5	1.7	
Lev-Educ-Guardian				
	Primary	24	70.6	
	Secondary	3	8.8	
	Tertiary	7	20.6	
Occupation	Business	93	29.6	
	Artisan	14	4.5	
	Fishing	4	1.3	
	Employed	22	7.0	
	Farmer	134	42.7	
	Self –Employed	4	1.3	
	Unemployed	43	13.7	
	Marital Status	Single	16	5.1
		Married	262	83.7
Divorced		1	0.3	
Widowed		34	10.9	
Separated		2	0.6	
Residence	Rural	278	88.5	
	Peri Urban	28	8.9	
	Urban	8	2.5	
Religion	Catholic	51	16.2	
	Protestant	263	83.8	

As indicated in Table 4.3, more than half 138 (51.1%) of the respondents reported having a total of 6-10 people living in the household and 161(43.8%) reported having totals of 1-5 people living in the household. Two hundred (63.5%) reported having between 0-2 children over 5 years in the household. Majority 287(85.0%) of the respondents reported having between 0-2 children under 5 years of age in their households. The essence of determining the numbers of persons living in the households was motivated by the need to align the study to the fundamentals of previous research which aptly related the household sizes to diarrhea incidences.

A research by Abdelhakeem *et al.* (2011) established that the number of children in a household and family size was a significant determinant of diarrheal incidences among children below five years residing in such families. The study found out that the family size in the research (7.0 for the total sample and 7.9 for the diarrhea group) was slightly higher in relation to 2007 Jordan's survey which was 5.3 for Jordan and 5.7 for the rural group. Similar to the findings of this study, Abdelhakeem *et al.* (2011) indicated that overcrowding at household level manifested by a higher crowding index ($CI > 1$) which was positively associated with unhygienic conditions hence high diarrhea incidences among children below 5 years.

According to a survey conducted by KDHS (2008) the mean Kenyan household size is 4.2 persons. The findings from the survey indicated that there was an association between the household size and the prevalence of diarrheal diseases. Household size was found to be significant determinant of the number of meals for children less than 5 years during food shortage. A study by Desalegn, Kumie and Tefera (2011) established that households with more family members recorded a higher number of diarrheal cases

compared to households with fewer members. This indicated that the higher the household size the more family resources were divided among many hence the adequacy of the meals and proper nutrients were limited (Lakkam, Wager, Wise & Wein, 2014).

Table 4.3: Distribution of Respondents by number of People living in the Household

Number of people	Frequency	Percent
Total		
1-5	138	43.8
6-10	161	51.1
10-15	15	5.1
Adults		
1-3	294	93.4
4-6	18	5.7
>6	3	0.9
Children >5yrs		
0-2	200	63.5
3-5	95	30.2
6-9	17	5.4
≥10	3	0.9
Children <5 yrs		
0-2	267	85
3-5	47	15

As shown in figure 4.1, a number of children under 5 years of age (26.8%) were reported to be 5th born position, 21.6% were realized to be in the 3rd position, those in the fourth

were 18.2%, and those at the second birth order were 17.2%. the remaining 16.2% appeared to be at the first birth order.

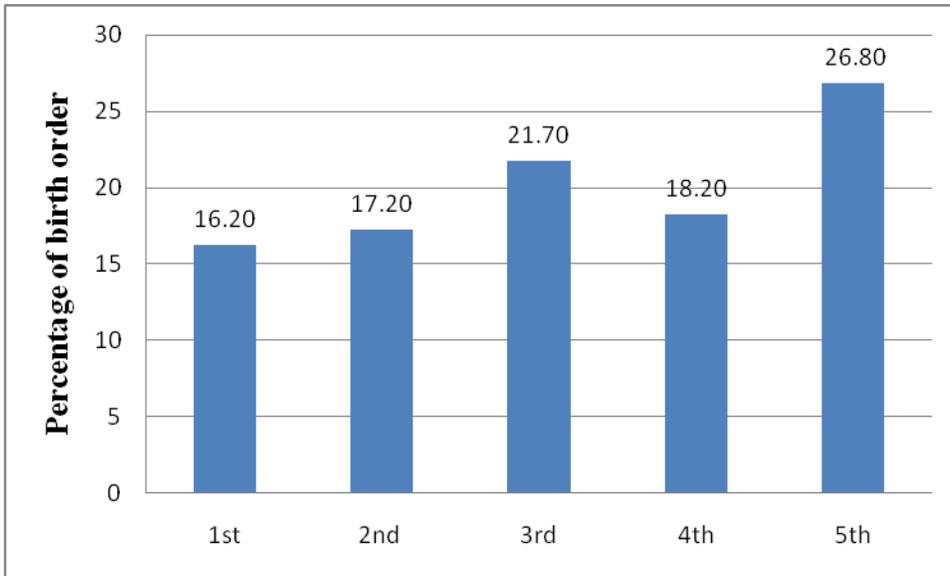


Figure 4.1: Distribution of Respondents with Respect to Birth Order of the Child

A Pearson product correlation on the incidences of diarrhea in children under five years and the birth order of the children was done as shown in Table 4.4. There was a weak positive correlation between the incidences of diarrhea in children under five years and the birth order of the children in the households ($r = 0.115$, $p = .041$). The statistical findings were an indication that the birth order of the children played a significant role in the identification of diarrhea cases in the households.

The findings in this study corroborated with those of another study which established that higher birth order of the child had a significant effect on the morbidity of diarrhea among children below five years (Thomas, Getahun and Teferra, 2014). The study also confirmed the finding that being the second, third, or sixth child increased the likelihood of such child to have diarrhea compared to the first born. Mengistie, Berhane and Worku

(2013) noted that the prevailing situation could be attributed to the instances whereby very great attention was accorded the first born children and records of the incidences of the interludes of sicknesses keenly recorded as opposed to the cases of children of the other ages whereby no caution was taken and records of the sicknesses similarly owing to the situation of parents getting used to the occurrences.

Table 4.4 Correlations of the birth order of the child and the incidences of diarrhea in children under five years

		Diarrhea in the past 2 weeks	Birth order of the child
	Pearson Correlation	1	0.115*
Diarrhea in the past 2 weeks	Sig. (2-tailed)		0.041
	N	315	315
	Pearson Correlation	0.115*	1
Birth order of the child	Sig. (2-tailed)	0.041	
	N	315	315

*. Correlation is significant at the 0.05 level (2-tailed).

The study also sought to find out the distribution of respondents with regards to items in the household as indicated in figure 4.2.

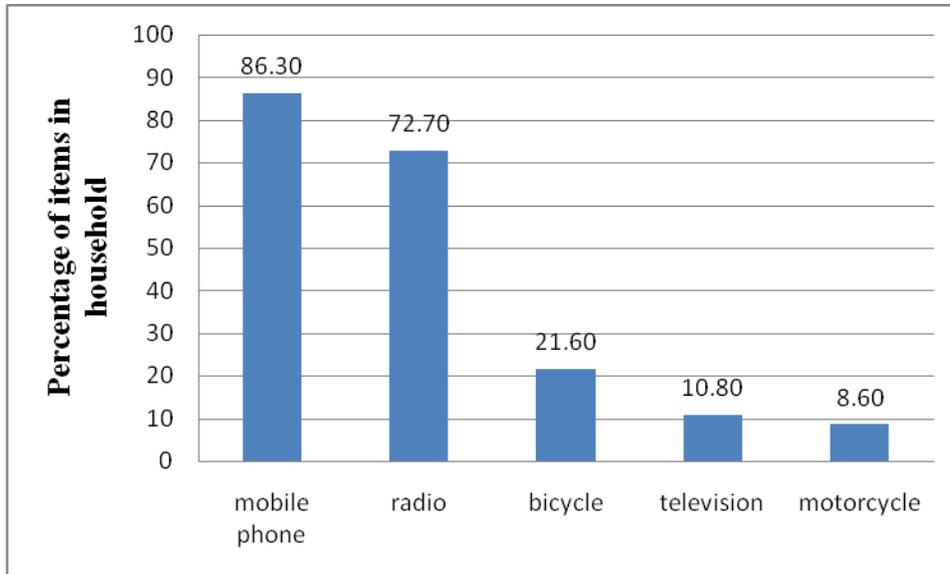


Figure 4.2: Distribution of Respondents with Regard to Items in the Household

Among the 315 respondents, majority 272 (86.3%) reported having mobile phones, 229 (72.7%) had a radio while only 27 (8.6%) reported having motorcycles as indicated in Figure 4.2. The information in Figure 4.2 is significant to the study as the government of Kenya together with Non-government organizations have been in the forefront to disseminate information on management of diarrhea among children under five years of age through the media and other sources. The items in the household made it possible to find out if there exists a relationship between household wealth and diarrhea among children less than five years of age. A study by Arif and Naheed (2012) established that there was a positive correlation between the household wealth and the incidences of diarrhea among children below the age of 5 years.

Table 4.5 shows a Pearson moment correlation which was run to find out if there was any significant statistical relationship between the household economic status and the frequent diseases occurring in the households affecting children under five years. The

indicators for the households' economic status were the presence of radios, television sets, mobile phones, bicycles and motorcycles. These were material attributes which can be directly related to the ability of the household to possess' disposable income or savings used to acquire the household items.

The study established that there was a high correlation between the household possessions and the occurrence of diarrhea among children below 5 years. This was an indication that there was a relationship between the individual household economic status and the frequent diseases occurring in the community affecting children under five years. This can be interpreted to mean that the household economic status played a role in the determination of the approaches used by the households in preventive as well as the curative programs used in managing diseases.

This finding is supported by Woldu, Bitew and Gizaw (2016) who established that the household's economic status is a significant determinant of diarrhea among the children under five years from the nomadic population of the northeast Ethiopia. It can thus be deduced to mean that the economic disposition of the households influenced the mitigating approaches used to take care of the occurrence of diseases affecting children under five years. Rahman (2006) attributes such findings to the fact that families that have a higher economic status have the a greater opportunity to use soap and other antiseptic solutions for hand washing or afford the use of aqua-guard in their households for water treatment hence significantly reducing microbial contamination in water for domestic use. On the other hand, Arif and Naheed (2012) also linked this finding to the fact that high income families unlike the low income families had the ability to construct

good toilets and other sanitation facilities which are essential in reducing diarrheal cases among children below five years.

Table 4.5 Correlations of the Household Economic Status and Frequent Diseases in the Households

		Radio in household status	Television in household	Mobile phone in household	Bicycle in household	Motorcycle in household	Most frequent disease
Radio in household status	Pearson Correlation	1	0.213**	.658**	0.319**	0.213**	0.037
	Sig. (2-tailed)		0.000	0.000	0.000	.000	0.514
Television in household	Pearson Correlation	0.213**	1	0.140*	0.669**	1.000**	0.055
	Sig. (2-tailed)	0.000		0.013	0.000	0.000	0.330
Mobile phone in household	Pearson Correlation	0.658**	0.140*	1	0.209**	0.140*	0.048
	Sig. (2-tailed)	0.000	0.013		0.000	0.013	0.398
Bicycle in household	Pearson Correlation	0.319**	0.669**	0.209**	1	0.669**	-0.016
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.781
Motorcycle in household	Pearson Correlation	0.213**	1.000**	0.140*	0.669**	1	0.055
	Sig. (2-tailed)	0.000	0.000	0.013	0.000		0.330
Most frequent disease in	Pearson Correlation	0.037	0.055	0.048	-0.016	0.055	1
	Sig. (2-tailed)	0.514	0.330	0.398	0.781	0.330	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Regarding major problems that the respondents face in their families, higher proportion of the respondents 124 (41.5%) reported lack money to meet their basic needs. Poor health was reported by 99 (32.9%), unemployment by 46 (15.3%), lack of access to health services was reported by 7.0% and 3.3% reported insufficient food as the most common problem in their families as illustrated in figure 4.3. The lack of money was mentioned as the major problem faced by households followed closely by poor health. The results corroborated with the results obtained from the participants in the FGDs and KIIs. A CHEW from Rachuonyo argued that,

The people in this area suffer from poverty, to an extent that they cannot even feed three times in a day. It is for this reason that they prefer to look for cheaper means to treat diseases as opposed to the hospital. Female CHEW No.#3 Rachuonyo

On the other hand, a woman from a female FGD in Rangwe reported,

The major problem in the area is poverty and poor health. People in this area are poor and not only that in the hospitals the doctors are not hospitable, our roads to the hospitals are bad and the distance to those hospitals a lot of issues are related to bad health in this area. Female FGD No.#7 Rangwe

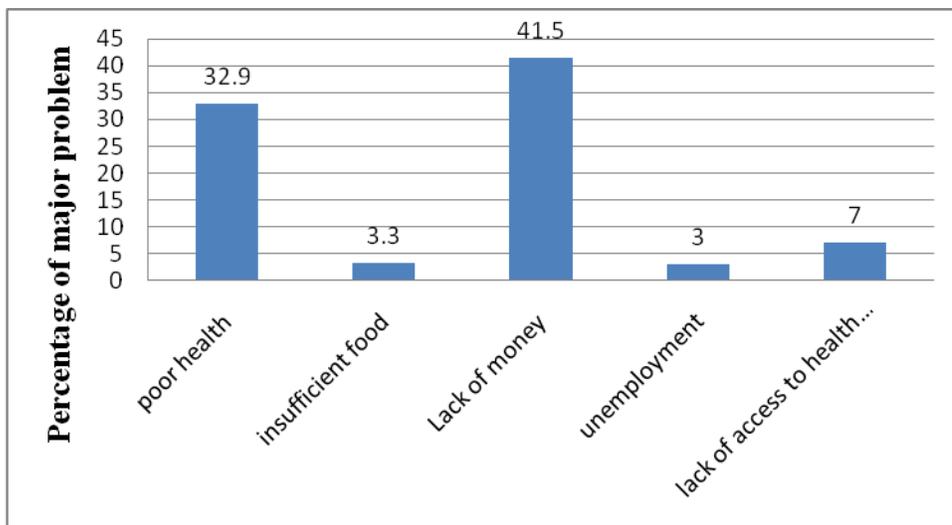


Figure 4.3: Major problems indicated in the Community

The study sought to investigate the relationship between the biggest problem faced by the family and parental age as shown in Table 4.6.

Table 4.6 Chi-square value on parental age and biggest problem faced by the family

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.197 ^a	16	0.943
Likelihood Ratio	9.194	16	0.905
Linear-by-Linear Association	0.600	1	0.439
N of Valid Cases	315		

a. 12 cells (48.0%) have expected count less than 5. The minimum expected count is .28.

A Chi-square test of independence was calculated to determine the frequency of the biggest problem faced by family in relation to parental age. There was no significant relationship between parental age and the occurrence of problems ($\chi^2 (16) = 8.197$, $p=.943$). The responses showed that the age of the parents was not a factor predisposing the occurrence of problems. This was thus confirmation that the problems in the households were prone to occur regardless of the parents' ages.

Table 4.7 shows a Pearson product moment correlation between the household economic status and the biggest problem faced by the households. Presence of radios, television sets, mobile phones, bicycles and motorcycles denoted the households' economic status. There was a positive correlation which had statistical significance at 0.01 level (2-tailed)

and 0.05 level (2-tailed). The values were between 0 and 1 except for the provision of motorcycles which denoted a value of -0.009 indicating that despite the motorcycles being in the households problems still faced the families. This confirmed the relationship between the individual household economic status and the kind of problems faced. This can be interpreted to mean that the household economic status affected the ability to effectively mitigate underlying issues as pertains to the problems faced (Arif and Naheed, 2012).

Table 4.7 Household economic status and biggest problems faced by families

		Radio in household status	Television in household	Mobile phone in household	Bicycle in household	Motorcycle in household	Biggest problem in your family
Radio in household status	Pearson Correlation	1	0.213**	0.658**	0.319**	0.213**	0.057
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.311
Television in household	Pearson Correlation	0.213**	1	0.140*	0.669**	1.000**	-0.009
	Sig. (2-tailed)	0.000		0.013	0.000	0.000	0.878
Mobile phone in household	Pearson Correlation	0.658**	0.140*	1	0.209**	0.140*	0.021
	Sig. (2-tailed)	0.000	0.013		0.000	0.013	0.707
Bicycle in household	Pearson Correlation	0.319**	0.669**	0.209**	1	0.669**	0.027
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.639
Motorcycle in household	Pearson Correlation	0.213**	1.000**	0.140*	0.669**	1	-0.009
	Sig. (2-tailed)	0.000	0.000	0.013	0.000		0.878
Biggest problem in your family	Pearson Correlation	0.057	-0.009	0.021	0.027	-0.009	1
	Sig. (2-tailed)	.311	0.878	0.707	0.639	0.878	

** . Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

Table 4.8 shows a Pearson moment correlation between the household economic status and the respondents' residence; in this case we had rural, peri urban and urban residences. Household items denoted the economic status. There was a positive correlation which had statistical significance at 0.01 level (2-tailed) and 0.05 level (2-tailed). The values were between 0 and 1 except for the provision of mobile phones and radios which denoted values of -0.070 and -0.155 indicating that regardless of the areas of residence access to radios and mobile phones was wide spread. The study thus deduced the ability to have a correlation between the residence of the respondents and the household economic status as denoted by material acquisitions. It can be interpreted to mean that the households with different residences in the rural, urban and peri-urban areas had varied dispositions with regard to economic status. The economic status however positively correlated with the areas of residence. It can thus be denoted that the residence had an inclination to the material disposition and economic status of the households. These findings highly correlated with those obtained from other similar studies globally (Gedefaw *et al.*, 2015; Rahman, 2006).

Table 4.8 Correlation between the residence and type of toilet used

		Residence.	Type of toilet facility used by household members
Residence.	Pearson Correlation	1	-0.062
	Sig. (2-tailed)		0.274
	N	315	315
Type of toilet facility used by household members	Pearson Correlation	-0.062	1
	Sig. (2-tailed)	0.274	
	N	315	315

A Spearman's Rank Order correlation was run to determine the relationship between the residence and the type of toilet used. There was a weak negative correlation between the respondents' residence and the type of toilet facility used ($r = -.062$, $p = .274$). It could thus be interpreted to mean that despite the varied residences, the type of toilet used was motivated by the individual preferences and financial ability. This showed that rural, urban and peri-urban communities had the benefit of choice and making decisions on their own as pertains to the type of toilet to use. However, other factors such as urban planning policy of the area, the economic status of the residents as well as the status of their sanitation facilities in case they live in a rented facility also influence the residents' choice of toilet.

Table 4.9 shows the correlations of the residences and the incidences of diarrhea in children under five years for a period of two weeks prior to the study.

Table 4.9 Correlations of the residences and the incidences of diarrhea in children under five years

		Diarrhea	Residence
Diarrhea	Pearson Correlation	1	-0.016
	Sig. (2-tailed)		0.771
	N	315	315
Residence.	Pearson Correlation	-0.016	1
	Sig. (2-tailed)	0.771	
	N	315	315

A Pearson product correlation on the incidences of diarrhea in children under five years and the residences of the children was done. There was a weak negative correlation between the incidences of diarrhea in children under five years and residences from which the children came from ($r = -0.016$, $p = 0.771$). The statistical findings were an indication that the residences in which the households were situated did not significantly affect the occurrence of the diarrhea cases. This was an indication that regardless of where the residences of the households were, the occurrence of diarrhea still sufficed. This may be attributed to the contamination of the water sources leading to the prevailing situations. However, these findings show a great contrast in relation to other studies conducted on the same subject indicating that the place of residence is a strong determinant of diarrhea among children below five years (Woldemicael, 2001; Gedefaw *et al.*, 2015; Mengistie *et al.*, 2013). These studies show that children living in urban areas are less likely to have diarrhea compared to children living rural areas.

Table 4.10 shows the relationship between the type of toilet used and the incidences of diarrhea in children under five years.

Table 4.10 Correlations of type of toilets used and the incidences of diarrhea in children under five years

		Diarrhea for past 2 weeks	Toilet type
Diarrhea for past 2 weeks	Pearson Correlation	1	-0.074
	Sig. (2-tailed)		0.191
	N	315	315
Toilet type	Pearson Correlation	-0.074	1
	Sig. (2-tailed)	0.191	
	N	315	315

A Pearson product correlation on the incidences of diarrhea in children under five years and the types of toilets used was done. There was a weak negative correlation between the incidences of diarrhea in children under five years and the types of toilets used in the households ($r = -0.074$, $p = 0.191$). The findings reflected a situation whereby regardless of the type of toilets used the occurrence of diarrhea in the children under five was motivated by other factors like the sources of drinking water, the hygiene in the households with regards to handling of the children and other pertinent dynamics. The findings were found to be consistent with those of another study by Desalegn *et al.*, (2011) which also indicated that the type of toilet present in the household was not significant as long as there was proper disposal of human waste. The study showed that children living in households without any latrine facilities were about 92% more likely to develop diarrheal diseases than those living in households which have such facilities regardless of the type.

The relationship between the kind of toilet facility used and the presence of fecal coli matter in water was found as indicated in Table 4.11.

Table 4.11 Correlation on the kind of toilet facility used and the presence of fecal matter in water for domestic use

		Type of toilet facility used	Presence of fecal matter
Type of toilet facility used	Pearson Correlation	1	0.054
	Sig. (2-tailed)		0.337
	N	315	315
Presence of fecal matter	Pearson Correlation	0.054	1
	Sig. (2-tailed)	0.337	
	N	315	315

A Pearson product correlation on the kind of toilet facility used and the presence of fecal matter was carried out. There was a weak negative correlation between the kind of toilet facility and the presence of fecal matter ($r = -0.054$, $p = 0.337$). The statistical findings alluded to the type of toilet facility directly affecting the occurrence of fecal coli forms in the water. The study findings may be attributed to incidences of night soil in the incidences of open defecation leading to the situation of water getting contaminated in the event of open water sources. This was thus an indication that the type of toilet used directly affected the occurrence of fecal coliforms in the water consumed in the households.

As shown in figure 4.4, 225 (75%) of the respondents acknowledged diarrhea to be the most frequent disease affecting children under 5 years of age in the community. Respiratory diseases were reported by 50 (16.7%) of the respondents among others. The question was of significance as the participants were in a better position to point out the most common disease affecting children below five years as they lived in the study area. Though literature showed that diarrhea was the most common cause of mortality and morbidity among children, it is essential to find out from the participants as to whether the same was in their area. The results from the study were in line with the arguments of organizations and existing literature as diarrhea was mention as a common disease among children below five years of age.

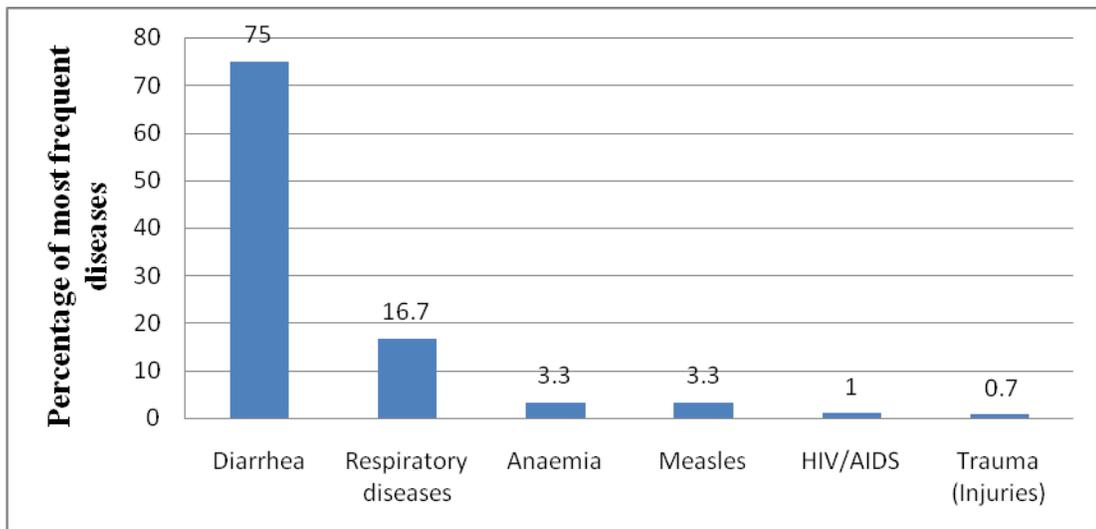


Figure 4.4: Most frequent disease in the community among under five children

The association between parental age and most frequent disease affecting children under five years was revealed as shown in Table 4.12.

Table 4.12 Chi-square values on parental age and most frequent disease affecting children under five

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.464 ^a	24	0.095
Likelihood Ratio	34.392	24	0.078
Linear-by-Linear Association	0.149	1	0.699
N of Valid Cases	315		

a. 27 cells (77.1%) have expected count less than 5. The minimum expected count is .05.

A chi-square test was calculated comparing the frequency of disease affecting children under five in parental ages. There was no significant statistical relationship between the parental age and situation of having particular frequent diseases affecting children under five ($\chi^2 (24) = 33.464, p=.095$). The responses showed that regardless of the parents' age the children under five were still vulnerable as driven by varied etiological parameters predisposing them to the occurrence of diseases. This finding is consistent with findings of a previous study by Woldemichael (2001) which also established that children below five years were the most affected by diarrhea than other age groups in the population.

Figure 4.5 shows the incidences of diarrhea which took place two weeks prior to the study.

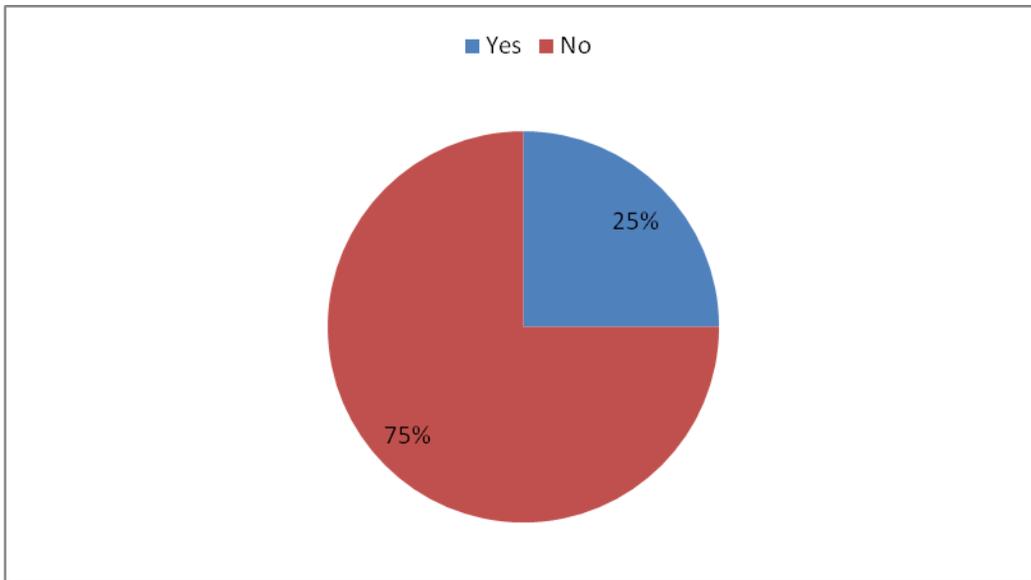


Figure 4.5 Incidences of diarrhea two weeks prior to the study

The results indicate that a significant percentage of the children under five had incidences of diarrhea in the sampled households. This confirmed the gravity of the situation as regards the occurrence of diarrhea cases in the study area.

4.4 Household Environmental Hazards

Findings of the study showed that, most respondents, 254 (81.2%) had their floors made of earth, sand and dung. Only 54 (17.3%) were observed to be made of cement. Regarding the wall material most respondents 261 (83.1%) reported their walls being made of poles and mud while 26 (8.3%) were observed to have cement blocks. Firewood was the most commonly used source of fuel 272 (86.6%) while 41 (13.1%) acknowledged using Charcoal as indicated in Table 4.13

Table 4.13: Distribution of the Respondents with Respect to Floor and Wall Material together with Fuel Facilities in the Households

Item		Frequency	Percent
Floor	Earth, sand, dung	254	81.2
	Ceramic tiles, Terrazzo	5	1.6
	Cement	54	17.3
Wall	Grass	2	0.6
	Pole and mud	261	83.1
	Sun dried bricks	8	2.5
	Backed bricks	14	4.5
	Iron sheets	3	1.0
	Cement blocks	26	8.3
Fuel	Paraffin	1	0.3
	Charcoal	41	13.1
	Firewood	272	86.6

Table 4.14 shows a Pearson moment correlation between the household economic status and the floor type in the households. Household items were indicators for the economic status. There was a positive correlation which had statistical significance at 0.01 levels (2-tailed) and 0.05 level (2-tailed). The values were between 0 and 1 in all the items. The study thus deduced that the floor type was hinged on the economic status of the households.

Table 4.14 Household status and type of floor in the house

		Radio in household	Television in household	Mobile phone in household	Bicycle in household	Floor type of your house
Radio in household	Pearson Correlation	1	0.213**	0.658**	0.319**	0.004
	Sig. (2-tailed)		0.000	0.000	0.000	0.939
Television in household	Pearson Correlation	0.213**	1	0.140*	0.669**	0.033
	Sig. (2-tailed)	0.000		0.013	0.000	0.560
Mobile phone in household	Pearson Correlation	0.658**	0.140*	1	0.209**	0.049
	Sig. (2-tailed)	0.000	0.013		0.000	0.382
Bicycle in household	Pearson Correlation	0.319**	0.669**	0.209**	1	0.046
	Sig. (2-tailed)	0.000	0.000	0.000		0.413
Floor type of your house	Pearson Correlation	0.004	0.033	-0.049	0.046	1
	Sig. (2-tailed)	0.939	0.560	0.382	0.413	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 4.15 shows a Pearson moment correlation between the household economic status and the wall type in the houses. Household items were indicators for the economic status. There was a positive correlation which had statistical significance at 0.01 levels (2-tailed) and 0.05 level (2-tailed). The values were between 0 and 1 in all the items. The

study thus deduced that household economic ability determined the type of wall in the houses within the community. It can thus be interpreted to mean that the economic positions of the households determined how the individual dwellings were with regards to the wall type.

Table 4.15: Wall type and household status

		Radio in household	Television in household	Mobile phone in household	Bicycle in household	Wall material for the house
Radio in household	Pearson Correlation	1	0.213**	0.658**	0.319**	0.005
	Sig. (2-tailed)		0.000	0.000	0.000	0.926
Television in household	Pearson Correlation	0.213**	1	0.140*	0.669**	0.094
	Sig. (2-tailed)	0.000		0.013	0.000	0.096
Mobile phone in household	Pearson Correlation	0.658**	0.140*	1	0.209**	0.004
	Sig. (2-tailed)	0.000	0.013		0.000	0.949
Bicycle in household	Pearson Correlation	0.319**	0.669**	0.209**	1	0.061
	Sig. (2-tailed)	0.000	0.000	0.000		.282
Wall material for the house	Pearson Correlation	0.005	0.094	0.004	0.061	1
	Sig. (2-tailed)	0.926	0.096	0.949	0.282	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 4.16 show a Pearson moment correlation between the household economic status and the type of fuel used in the households. Household items were indicators for the economic status. There was a positive correlation which had statistical significance at 0.01 levels (2-tailed) and 0.05 level (2-tailed). The values were between 0 and 1 in all the

items. The study thus deduced that economic positions affected the type of fuel used in the households. In the event of enhanced positions, the households used cleaner fuel and the reverse.

Table 4.16: Household status and type of fuel used

		Radio in household	Television in household	Mobile phone in household	Bicycle in household	Type of cooking fuel
Radio in household	Pearson Correlation	1	0.213**	0.658**	0.319**	0.080
	Sig. (2-tailed)		.000	0.000	.000	0.155
Television in household	Pearson Correlation	0.213**	1	0.140*	0.669**	-0.039
	Sig. (2-tailed)	0.000		0.013	0.000	0.489
Mobile phone in household	Pearson Correlation	0.658**	0.140*	1	0.209**	-0.007
	Sig. (2-tailed)	0.000	0.013		0.000	0.906
Bicycle in household	Pearson Correlation	0.319**	0.669**	0.209**	1	-0.015
	Sig. (2-tailed)	0.000	0.000	0.000		0.791
Type of cooking fuel	Pearson Correlation	0.080	-0.039	-0.007	-0.015	1
	Sig. (2-tailed)	0.155	0.489	0.906	0.791	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

The study sought to find out the relationship between household status and type of toilet facility. The results are indicated in Table 4.17.

Table 4.17 Household Status and Type of Toilet Facility

		Radio in household status	Television in household	Mobile phone in household	Bicycle in household	Kind of toilet facility used
Radio in household	Pearson Correlation Sig. (2-tailed)	1	0.213**	0.658**	0.319**	0.170**
Television in household	Pearson Correlation Sig. (2-tailed)	0.213**	1	0.140*	0.669**	0.056
Mobile phone in household	Pearson Correlation Sig. (2-tailed)	0.658**	0.140*	1	0.209**	0.129*
Bicycle in household	Pearson Correlation Sig. (2-tailed)	0.319**	0.669**	0.209**	1	0.044
Kind of toilet facility used	Pearson Correlation Sig. (2-tailed)	0.170**	0.056	0.129*	0.044	1
		0.000	0.000	0.000	0.000	0.002
		0.000	0.013	0.000	0.000	0.323
		0.000	0.013	0.000	0.000	0.022
		0.000	0.000	0.000	0.000	0.435
		0.002	0.323	0.022	0.435	

** . Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

Household items were indicators for the economic status. There was a positive correlation which had statistical significance at 0.01 level (2-tailed) and 0.05 level (2-tailed). The values were between 0 and 1 in all the items. The correlations were an indication that the individual economic disposition of the households determined the type of toilet facility in place. This had the ultimate bearing on the hygiene issues as pertains to the disposal of fecal matter predisposed by the economic positions of the households. This was consistent with the findings of a similar study by Bezatu, Yemane and

Alemayehu (2013) which found out that the wealth index of a family was a great determinant of diarrhea among children below five years. The study found out that among the low income population in the area of study, 112 children had experienced diarrhea against 373 children who had not had any diarrhea within the recall period [COR=1.09 (1.03-1.76); 95% CI]. Among the better income families, only 101 children had diarrhea against 385 children who had not suffered from diarrhea indicating that the economic status of the household was positively associated with the occurrence of diarrhea among the children below five years.

Figure 4.6 shows the distribution of the respondents with regard to the kind of the toilet facility in the household.

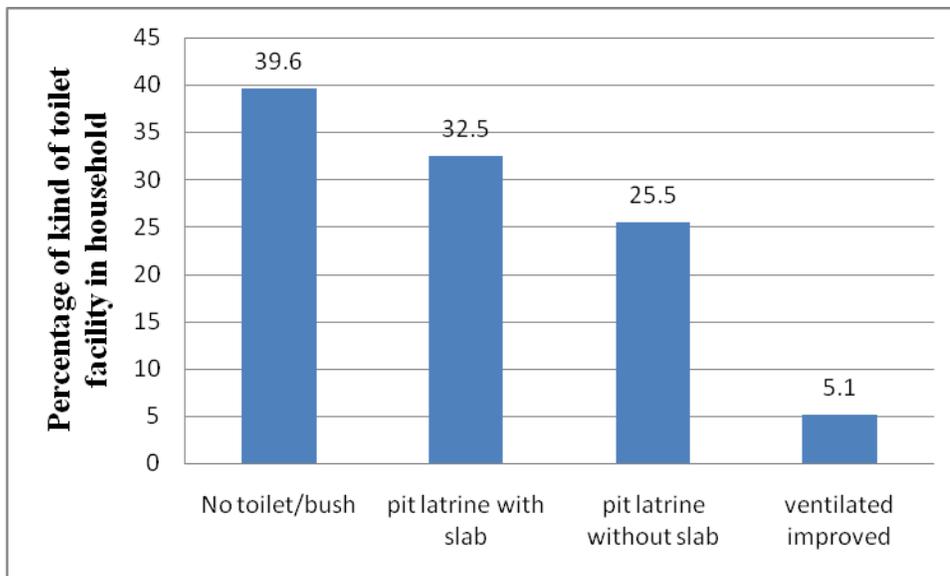


Figure 4.6: Distribution of respondents with regard to kind of toilet facility in the households

The study area was observed to have different toilet facilities adopted by the households. Majority 116 (36.9%) reported not to have any facility hence they resorted to use the bush. On the other hand, 102 (32.5%) had Pit latrines with slabs, 80 (25.5%) had open pit latrines as illustrated in Figure 4.6. The socio-cultural inclinations were also found to have influenced the type of toilet facilities in use. The practice of having cultural persuasions holding as a determinant in the use of the latrines even after the construction equally came out as an aspect that could have motivated the type of latrines in use (Alison, 2008).

Further investigations sought to determine the relationship between the type of toilet used and the frequency of cleaning as shown in Table 4.18.

It was determined that there was a strong positive correlation of statistical significance between the type of toilet used and the frequency for cleaning the facilities ($r = 0.752, p = .000$). It can thus be interpreted to mean that the type of toilet facility in use determined the frequency of cleaning undertaken by the users. This denoted the fact that in the event of toilet facilities which were cemented and with a slab they demanded higher standards in terms of hygiene and the frequency for cleaning. This was a contrast to the situation of non-cemented floors with no slab which would ultimately take longer before cleaning. The current study concurs with Agustina *et al.* (2012) that the frequency of cleaning toilets based on their type was a factor pre-disposing the users to the risk of contracting contagious diseases and enhancing the possibility for the occurrence of diarrhea in the community.

Table 4.18 correlation between the type of toilet facility and frequency of cleaning

		Toilet type	Cleaning frequency
What kind of toilet facility do members of household usually use?	Pearson Correlation	1	0.752**
	Sig. (2-tailed)		.000
	N	315	315
How often do you clean your toilet?	Pearson Correlation	0.752**	1
	Sig. (2-tailed)	0.000	
	N	315	315

** . Correlation is significant at the 0.01 level (2-tailed).

4.5 Water handling practices predisposing children to diarrhea

Regarding the main source of drinking water, a larger percentage 124 (39.5%) of the respondents recorded using water from borehole, while 65 (20.7%) used water from rivers/springs. Only 33 (10.5%) got their drinking water from the piped system as shown in Table 4.19 below. The information was essential to the study as it showed how water sources influenced diarrhea among children under five years of age. According to a study by Clasen *et al.* (2006) the source of water for domestic use had a positive association with the incidences of diarrhea among children below five years

Table 4.19: Distribution of Respondents with Respect to Main Source of Drinking Water

Source	Frequency	Percent
Piped water	33	10.5
Water from well	44	14.0
Water from bore hole	124	39.5
Surface water	23	7.0
Rain water	23	7.3
Vendor	2	0.6
River/Spring	65	20.7
Lake	1	0.3

Further investigations were carried out to find out the distance and time period taken to get water from the source to the household. The responses were as evidenced in Table 4.20. Almost all 300 (95.5%) respondents reported taking between 0-1 hour in getting water from the source while only 1 (0.3%) said he takes more than 4 hours to get water from the source. On the other hand, more than half of the respondents 202 (64.3%) reported covering a distance less than 250 meters to get to the water source and back while 5 (1.6%) cover more than a kilometer to and from the water source. Research has shown that the time taken by a household member to collect water from the source for domestic use is associated with the occurrence of diarrhea in children below five years (Mengistie *et al.*, 2013). The study found out that there were 118 cases of diarrhea reported by households that took less than 15 minutes to get drinking water while there were only 92 cases of diarrhea reported by the respondents who indicated that they took more than 30 minutes to get drinking water.

Table 4.20: Distribution of respondents with regards to the distance and period covered to and from the water source

Item		Frequency	Percent
Hours	0-1hr	300	95.5
	2-3hr	13	4.1
	4 and above hrs	1	0.3
Distance	Below 250 meters	202	64.3
	251-500 meters	93	29.6
	501-1000 meters	14	4.5
	More than 1 km	5	1.6

Further statistical tests were employed to find out the relationship between the persons fetching the water and the distances from the households to the water sources. This was as shown in Table 4.21

Table 4.21 Relationship between the persons fetching water and distance to the water source

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.004 ^a	12	0.445
Likelihood Ratio	11.865	12	0.457
Linear-by-Linear Association	0.319	1	0.572
N of Valid Cases	315		

a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is 0.02.

A Chi-square test of independence was calculated to find out the relationship between the person fetching water and the distance to the source of water had. A significant relationship was found ($\chi^2 (2) = 12.004, p=0.445$). It can be interpreted to mean that, statistically, there was no significant relationship between the person fetching water and the distance to the water source. The responses denoted situations whereby when the persons fetching water were male or female adults the distance covered does not depend on gender. The results are contrary to Oadi and Kuitunem (2005) who found out that the distance covered to fetch water dependent on the gender of the person.

The statistical findings confirmed the positions taken by some participants in some of the FGD discussions. They were of the view that the distance and period covered to and from the water source was critical to the study to help understand why some households preferred to look for alternative sources that lead to diarrhea. The FGD participants from the four areas of the study demonstrated that the distances to water sources were shorter during rainy seasons but during dry seasons the distances were slightly longer. The variation was based on the fact that there were sources that dried up during dry seasons forcing the households to look for water from distant water sources. One of the men from a male FGD in Mbita said,

In the rainy seasons we get water from the boreholes around but when they dry up in dry seasons, we have to get to the pump which is very far from the villages here. So you find that women look for nearer water sources like stagnant waters around to draw water. These stagnant waters like the dam here, are dirty, animals drink from there, people shower in its surrounding and even litter is thrown in the water so we automatically get sick. Male FGD No.#5 Mbita

From the statement it was evident that the long distances experienced during dry seasons were strenuous to women hence, they opted for risky alternatives. The study findings concurred with past research findings by Hunter *et al.* (2013) which indicated that distance to and from the source of drinking water is an important determinant of diarrhea among children.

The study further sought to confirm the relationship between the respondents' occupations and the sources of water supply. This was with an aim of relating the occupations to economic disposition and the ability to influence the water supply sources. The responses were as shown in Table 4.22

Table 4.22 Comparison of respondent's occupation and source of water supply

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.820 ^a	42	0.075
Likelihood Ratio	57.984	42	0.051
Linear-by-Linear Association	3.425	1	0.064
N of Valid Cases	315		

a. 39 cells (69.6%) have expected count less than 5. The minimum expected count is .01.

A Chi-square test of independence was calculated to compare respondents' occupation and source of water supply. There was no significant statistical relationship between the respondents occupation and the source of water that they relied for household consumption (χ^2 (42) =55.820, p=0.075). The responses reflected a situation whereby despite the respondents occupation the source of water supply was dictated by other factors mainly driven by the geo-locational disposition of the household. The occupation

of the respondent was thus not a factor directly influencing the source of water supply for the household.

The study also sought to determine the presence of chlorine residues in water. This was with intent of relating the chlorine residues to water treatment practices. The findings were as shown in Table 4.23

Table 4.23 Presence of residual chlorine in water

	Frequency	Percent
Chlorine residue in water	65	20.6
No residual chlorine in water	250	79.4
Total	315	100.0

Evidence of residual chlorine in the water samples was confirmed from 20.6% of the households. This was an indication that a significant percentage of the households engaged in water treatment activities geared towards assuring them of wellness of the water used in the households. Further analysis was done to relate the presence of residual chlorine to the main sources of water and the distance of collection and handling. This was with a view of determining the extent to which the factors affected the water treatment practices used. The findings were as shown in Table 4.24. The means analysis for the households with presence of residual chlorine in the water samples showed that the greatest motivating factor for the treatment method was awareness of the source of water. This is because it has the highest means and standard deviation thus an indication

that treatment of the water by way of chlorination was greatly influenced by the actual source of water that the families relied on (Hunter, MacDonald, & Carter, 2010).

Table 4.24 Descriptive Statistics on presence of chlorine and main source of water , distance of collection and handling

	Mean	Std. Deviation	N
Presence of residual chlorine in water	1.79	0.405	315
Main source of drinking water for household	3.73	1.961	315
Water collector	1.12	0.461	315
Time taken to water source	1.05	0.228	315
Distance to water source	1.43	0.656	315

The study further sought to establish the pertinent factors of water handling that predisposed the occurrence of fecal coli-forms in water for domestic use. The parameters that were evaluated entailed; containers used for storage, treatment method used and perceptions about water contamination spreading diarrhea. The results were as shown in table 4.25. The means analysis for the households with presence of residual chlorine in the water samples showed that, the water sources that the households relied on were the greatest contributing factor to the treatment mode. This is because the highest mean difference was denoted in the attribute of the mode of treatment that the water was subjected to before ferrying home.

Table 4.25 Descriptive Statistics on the presence of chlorine and pertinent aspects of water handling in the households

	Mean	Std. Deviation	N
Presence of residual chlorine in water	1.79	0.405	315
Containers used for fetching drinking water	2.46	1.601	315
Treatment given to water at the source before carrying home	3.75	1.496	315
Reason for using the method	3.03	0.964	315
Contaminated water and spread diarrhea	1.02	0.148	315

The study also examined various parameters that predisposed various individuals to diarrheal diseases such as containers used for collection and storage of water, water treatment method used as well as the water handling at the source.

The study established that households that used drinking water which was drawn from unprotected source recorded high fecal coliform levels compared to those who indicated that they obtain their water for domestic use from ‘Source B’ in plate 1 above. “Source A” shows unprotected water source that is open to contamination while some protected water source equipped with a chlorine dispenser for water treatment at the source. Various studies conducted to determine the relationship between the water source and the incidences of diarrhea among children below five years indicate that water quality greatly depends on whether the source is protected or unprotected and therefore significantly affect the incidences of diarrhea among children (Clasen *et al.*, 2006)

The study further sought to establish the levels of fecal coliforms contamination in the water samples in the community. The results were as shown in Table 4.26

Table 4.26 Presence of fecal coli forms in the water samples

Responses	Frequency	Percentage
NIL	115	36.5
Fecal coliforms present	200	63.5
Total	315	100.0

The majority of water samples collected from the households had evidence of fecal coliforms. There was an indication of the fact that some of the water sources relied upon by the households had traces of contamination with fecal matter. This was confirmation of the intermittent risk that the community members faced as regards to the vivid contamination of the water used in the households thus the inherent risk of predisposing the residents to incidences of diarrhea.

Further statistical tests as shown in Table 4.27 were done by use of a Pearson product correlation on presence of fecal coli-forms and the treatment given to water before carrying home was done. There was a weak negative correlation between the presence of fecal coli-forms and the treatment given to water before carrying home was done ($r = -0.227, p = .000$). The findings showed that the presence of fecal coli-forms in the water samples reduced as water treatment increased. The presence of coli-forms in the water can also be attributed to other factors other than contamination at the source.

Table 4.27 Correlation on presence of fecal coli-forms and the treatment given to water before carrying home

		Presence of fecal matter	Treatment given to water at the source
Presence of fecal matter	Pearson Correlation	1	-0.227**
	Sig. (2-tailed)		0.000
	N	315	314
Treatment given to water at the source	Pearson Correlation	-0.227**	1
	Sig. (2-tailed)	0.000	
	N	314	314

** . Correlation is significant at the 0.01 level (2-tailed).

The study went further to confirm the association between the diarrhea cases in children under five years and presence of fecal matter in water samples as shown in Table 4.28. A Chi-square test was calculated to determine the relationship between diarrhea cases in children under five years and presence of fecal matter in water samples. There was no significant relationship between incidences of diarrhea in children aged less than five years and presence of fecal coli-forms in the water samples ($\chi^2 (1)=1.076, p=0.299$). The findings reflect a situation where the incidences of diarrhea may be attributed to other dynamics other than the fecal coli-forms contamination of water.

Table 4.28 Pearson chi-square test on the relationship between diarrhea cases in children under five years and presence of fecal matter in water samples

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.076 ^a	1	0.299		
Continuity Correction ^b	.763	1	0.383		
Likelihood Ratio	1.104	1	0.293		
Fisher's Exact Test				0.329	0.192
Linear-by-Linear Association	1.073	1	0.300		
N of Valid Cases	315				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 17.16.

b. Computed only for a 2x2 table

The study went out to further carry out an odds ratio test for the presence of fecal matter in water and the perceptions of its ability to spread diarrhea. The findings are indicated in Table 4.29.

Table 4.29: Odds ratio for fecal matter in water and perceptions of its ability to spread diarrhea

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for presence of fecal matter (NIL / present)	1.443	0.275	7.562
For cohort Do you think contaminated water can spread diarrhea? = Yes	1.008	0.975	1.042
For cohort Do you think contaminated water can spread diarrhea? = No	0.698	0.138	3.541
N of Valid Cases	315		

The relative risk of the ability of contaminated water to spread diarrhea was computed by comparing the values on the perceptions in the affirmative and those in the negative. In this case the value for the affirmative was 1.008 and greater than that of the negative thus the odds ratio of the contaminated water having the risk of spreading diarrhea was 1.008 and it portended a higher risk.

Further analysis for the odds ratio of the presence of fecal matter in water samples in relation to the practices of the households emptying water containers were carried out. This was with a view of determining the extent to which the water container emptying practices motivated the incidences of fecal contamination. The findings were as shown in Table 4.30

Table 4.30: Odds ratio for presence of fecal matter in water sample and the ability of the households to always empty storage container

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for presence of fecal matter (NIL / present)	2.060	.421	10.087
For cohort Do you always clean/empty the storage container before replacing with fresh water? = Yes	1.018	0.982	1.056
For cohort Do you always clean/empty the storage container before replacing with fresh water? = No	0.494	0.104	2.340
N of Valid Cases	315		

The relative risk of the potential to have fecal contamination from the failure to clean and empty the water storage container is computed by comparing the values on the perceptions in the affirmative and those in the negative. In this case the value for the affirmative is 1.018 and its greater than that of the negative thus the odds ratio of the of the potential to have fecal contamination from the failure to clean and empty the water storage container is 1.018 and it confirms the potential risk of contamination from the practice as confirmed by (Komarulzaman, Smits & Jong, 2014).

4.6 Summary

Chapter four describes the findings and analyzed data on household environmental hazards and its relations to diarrheal incidences in the study area. It portrays the impression of the socio-demographic characteristics of the participants and the significance of every feature to the study. Generally, findings of this study validated diarrhea as a predominant disease before rainy seasons. The results were analogous to those of other studies explored in various areas of the chapter. Diarrhea was also observed to be a public health concern that calls for national and international attention. For more understanding of the concept, household environmental influence on diarrhea was explained and inferential statistics employed to build on the connection between household caregiver's behavior and diarrhea among children under five years old. Water handling practices and household economic positions, were thoroughly investigated in the chapter displaying how they impact diarrhea among children below five years of age. In this chapter, it was revealed that incidences of diarrhea among the targeted group are attributed to other dynamics in the household beyond water contamination, thus household behavioral practices are discussed in chapter five.

CHAPTER FIVE

HOUSEHOLD BEHAVIORAL PRACTICES ATTRIBUTED TO DIARRHEA AMONG CHILDREN UNDER FIVE YEARS OF AGE

5.1 Introduction

Besides the environmental risk factors, social and behavioral factors have been identified to contribute greatly to the causes of diarrhea among children under five years of age. It has been established that maternal activities associated with hygiene, sanitary food preparation, breastfeeding and weaning are critical in understanding determinants of diarrhea morbidity and mortality among children below five years. The spread of diarrhea causing pathogens in Africa have been observed to be as a results of social and economic factors such as household status, level of education of the child's caregivers, toilet facilities, social-cultural practices, just to mention but a few. The objective on attribution of household behavioral practices to diarrhea among children under five years was deemed necessary to examine the practices in the study area that influence the occurrence of diarrhea epidemics.

5.2 Household Behavioral practices

The practice of water collection from the water points was reported to be mainly done by the female children under 15 years 124 (39.5%) while male children under 15 years were reported to go for water by 23 (7.0%) of the respondents as illustrated in Figure 5.1. This phenomenon was attributed to the fact that in the African society the division of social roles largely allocates fetching of water to the females. This finding concurs with the results obtained by Bezatu, Yemane and Alemayehu (2013) which also indicated that

young girls and women in the population who were largely involved with the fetching of water for the family. The results were also in line with the societal role allocations as female children less than 15 years of age were recorded to carry out the water collection practice. The reason behind the whole practice was defined by a participant from Rachuonyo during a male FGD, who said,

We grew up knowing that women are to fetch water to be used at home. Men took the animals to water in the river or lake but when there is no water they fetch for animals only. So it is what we do to date, the girls go for water. Male FGD No. # 4.

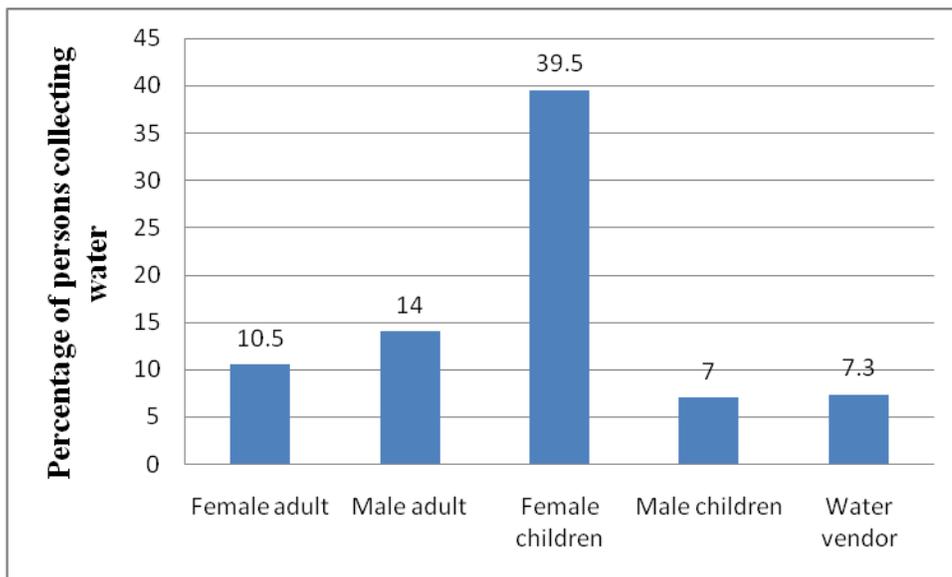


Figure 5.1: Types of Persons collecting water

The study went further to carry out a comparison of the person collecting water and the distance from the house to the water source. The results as reflected in Table 5.1 vividly showed that in the event of long distances, adult women had the responsibility of fetching the water. Support from the adult men was equally evident in the quest of supplying the households with water. Instances whereby the ingrained household gender asymmetries played a significant role in the determination of the chores undertaken was brought to the

fore. This was an indication that the traditional behavioral practices of particular household duties belonging to women still held major sway in the community where the study was carried out. Similar to the conclusion drawn by Clasen *et al.* (2007) there was need to ensure training and capacity building on the women members of the community as a measure of enhancing their water handling and hygiene knowledge to assure the households of access to good quality water.

Table 5.1 Comparison on who collects the water and distance to the source

		How far is the source/place where you get the water from?				Total
		<250 Metres	251-500 Metres	501-1000 Metres	More than 1 Kilometer	
Who collects the water?	Adult woman	190	84	12	5	291
	Adult man	6	6	2	0	14
	Female children under 15 years	7	1	0	0	8
	Male children under 15 years	0	1	0	0	1
	Water Vendor	0	1	0	0	1
Total		203	93	14	5	315

The study also sought to establish the frequency of cleaning toilets and the results obtained were as shown in Table 5.2. The respondents reported cleaning their toilets in varied periods. Ninety one (46.4%) cleaned their toilets on a weekly basis, 60 (30.7%) cleaned on a daily basis, while 18 (9.2%) did not clean their toilets. This question was necessary since the WHO (2013) considers poor sanitation as a result of inadequate

cleaning of toilets to cause diarrhea. When toilet facilities are not cleaned regularly, the diarrhea causing pathogens are likely to be spread by flies hence resulting to diarrhea among children and adults (Mengistie, Berhane & Worku, 2013). It is evident that from Table 5.2 those toilet facilities were not cleaned daily but on a weekly basis providing room for the spread of diarrhea pathogens in the region leading to diarrhea among children under five years of age. This was confirmed by one of the women in a female FGD from Mbita, who recorded.

We do not clean our toilets daily because they are rarely used. They are always locked and only opened for visitors, who we cannot argue, come on a daily basis. We mainly use the bush and the fences. Furthermore, the water to clean the toilets daily is not there so we only wash them with water left when doing laundry. Female FGD#6 Mbita

Table 5.2: Distribution of Respondents by frequency of cleaning toilets

	Frequency	Percent
Monthly	5	2.6
Fortnight	5	2.6
Weekly	91	46.4
Daily	60	30.6
Occasionally	17	8.7
Not cleaned	18	9.2

The study went on to find out the toilet facilities present in the households and the frequency of the cleaning activities undertaken. The findings obtained were as shown in Table 5.3. The study found out that in the event of ventilated improved toilet facilities, the frequency of cleaning was higher and tending towards daily basis. For the pit latrines with slab the frequency was equally high but tending towards weekly basis. Pit latrines

without slabs and open pits equally had frequencies tending towards weekly and daily basis but the situation of having the facilities not cleaned at all in some instances was highly ingrained.

The deplorable situation of a very significant percentage of the households not having pit latrines and defecating in the open was equally very highly pronounced. These findings were consistent with those of another research Desalegn, Kumie, and Tefera (2011) which found out that a significant percentage (58%) of households in Mecha District, West Gojjam Ethiopia had no latrine facility. Similarly, among the respondents who had latrines, only 16% affirmed to be cleaning their latrines daily. This was an indication on the need for training, advocacy campaigns and enforcement of the public health requirements with regards to household sanitation as a measure of stemming incidences of communicable diseases as recommended by Bartram and Cairncross (2010). Another study by Bezatu, Yemane and Alemayehu (2013) also found corresponding results in which only 68 of those who indicated that they had latrines had suffered from diarrhea while more than 259 respondents of those who said that they had no toilets had suffered from diarrhea before {COR=1.54 (1.14- 2.07); 95% CI}. This indicated that the increased occurrence of diarrheal diseases in the study area was linked to the absence of the toilet facilities in most of the households.

The study sought to confirm the relationship between the frequency of cleaning the toilets and the occurrence of diarrhea cases as shown in Table 5.3.

Table 5.3 Comparison on kind of toilet facilities members of households used and cleaning frequency

		How often do you clean your toilet?							Total
		Mont hly	Fortni ghtly	week ly	Daily	Occasio nally	Not Cleaned	no respons e	
What kind of toilet facility do members of househol d usually use?	Ventilated improved (VIP)	0	1	4	11	0	0	0	16
	Pit latrine with slab	2	1	50	32	13	2	2	102
	Pit latrine without slab/open pit	2	3	37	16	4	16	2	80
	No facility/bush use?	1	0	0	0	0	0	116	117
Total		5	5	91	59	17	18	120	315

A Chi-square test was calculated to compare the frequency of cleaning toilets and incidences of diarrhea in the households as indicated in Table 5.4. There was a significant relationship between the frequency of cleaning toilets and incidences of diarrhea in the households ($\chi^2 (4) = 2.783, p=0.595$). The statistical findings showed a positive correlation with other studies that there was a significant relationship between the occurrences of diarrhea incidences and the frequency of cleaning toilets in the households (Desalegn, Kumie, and Tefera, 2011; Mengistie, Berhane and Worku, 2013).

Table 5.4 Frequency of cleaning toilets and diarrhea cases

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.783 ^a	4	0.595
Likelihood Ratio	2.318	4	0.677
Linear-by-Linear Association	0.007	1	0.934
N of Valid Cases	315		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 0.75.

The statistical findings confirmed the position of Black *et al.* (2010) who asserted that the children's health is affected by environmental conditions as well as the social economic status of their family. A study conducted by UNICEF/WHO (2009) indicated that poor environmental conditions were strongly associated with the risk of diarrhea diseases. It was also established that maternal practices related to hygiene, breastfeeding, sanitary food preparation and appropriate weaning practices were potentially important determinants associated with diarrhea morbidity in children.

However exposure to diarrhea pathogens in developing countries is conditioned by factors such as age of the child, household economic status, the quality and quantity of water used for domestic purposes, level of education of the caregivers, availability of proper toilet facilities, good housing conditions, place of residence of the caregivers, proper feeding practices, personal and domestic hygiene (Teran, 1991; Schmidt, 2009; D' Souza, 2003). Woldemicael (2001) also shares a similar notion that diarrhea

morbidity in children is mainly determined by environmental factors as well as the socioeconomic status of the households under study.

The respondents reported using different containers to fetch water from the source. Wide mouthed pails were the most commonly used by the respondents to get water from the source 152 (48.4%), 82 (26.1%) reported using wide mouth pails with lids and only 3 (1%) reported using narrow mouthed clay pots Fig 5.2. The clay pots were observed to be less common in the contemporary society and were then categorized as jerricans that have replaced the traditional narrow mouthed clay pot. This was only aligned to fetching water from the source and not storage.

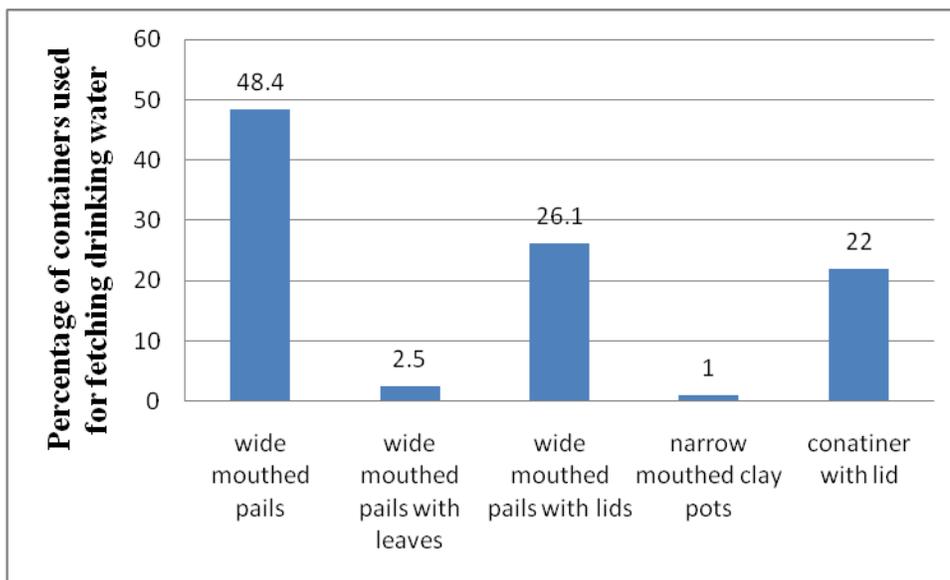


Figure 5.2: Containers used for fetching drinking water

Another study by Kageni (2011) in Kenya concurred with these findings that there was an association between storage of drinking water and diarrhea cases among children under five years. The study established that most mothers stored their water in buckets which were usually not covered or lacked fitting covers and thus exposure to dust and other

sources of pollution. More than half 62.7% of the mothers who stored their drinking water in buckets reported episodes of diarrhea. In addition, the study found that children usually scooped water for drinking directly from the buckets using any cup or bowl thereby increasing the risk of diarrhea morbidity. Drinking water should be stored in separate container from other domestic water and the water should be scooped using clean containers in such a way that hands or other objects cannot contaminate it (Trevett and Carter 2008; UN HABITAT, 2003; Karani, 2011).

Comparison on the distance covered to the water source and the kind of container used for fetching drinking water showed that in the event of distances which required short periods of time, preference for wide mouthed pails was evident. Longer distances pre-disposed the use of covered containers with lids. This was an indication that the handling of water from the source to the point of consumption in the households was mainly motivated by the distance which was a factor pre-determining the kind of container used and the levels of exposure of the water to potential contaminants. A study by Ercumen *et al.* (2015) concurs with these findings indicating that the nature of containers used in the transportation and storage of drinking water was a great determinant of the quality of drinking water in the household hence influencing the prevalence of diarrhea among children below five years.

Table 5.5 shows the comparison of distance to water source and the containers used for fetching drinking water.

Table 5.5 Comparison of distance to water source and containers used for fetching drinking water

		Containers for fetching drinking water					Total
		Wide-mouthed pails	Wide mouth pails with leaves	Wide mouth pails with lids	Narrow mouthed clay pots	Containers with lid	
Time taken to get water	0-1hr	148	8	79	3	62	300
	2-3hrs	4	0	3	0	6	13
	4 and above hrs	0	0	0	0	2	2
	Total	152	8	82	3	70	315

Further analysis was done on the choice of methods used for water treatment and they varied from one household to another. Most of the households never treated the drinking water thus an indication that they exposed themselves to the risk of getting diarrhea in the course of handling the water as evidenced in Table 5.6.

Table 5.6: Distribution of the respondents with respect to the method of treating drinking water

	Frequency	Percent
Filtering by cloth	4	1.3
Chlorinating	122	38.9
Solar disinfection	2	0.6
Let it stand and settle	11	3.5
None	169	53.8
Boiling	6	1.9

The findings confirmed the position of Bharti (2013) who asserted that drinking unsafe water exposed young children to diarrhea diseases especially in low income countries. It was evident that without clean water, maintaining hygiene was a huge problem. Water could be contaminated in many ways more especially at the source, during transport, in storage containers or improper handling. The findings further confirmed the position of Godana (2012) who looked at the determinants of acute diarrhea among children and found out the determinants of diarrhea to be sources of household water, availability of home based water treatment and consumption of left-over food stored at room temperature. Availability of home based drinking water was an independent predictor of diarrheal morbidity in the study. It was noted that children whose families used home-based drinking water treatment such as boiling were at a lower risk of getting diarrheal diseases compared to children from families where drinking water was not treated. The study findings also concurred with other studies that households that used water from unprotected water sources were likely to have diarrhea cases in their homes (Curtis, 2011; Godana, 2012).

Follow up analysis entailing a comparison detailing the main sources of water showed that most members of the community relied on boreholes for their water needs while the most predominant method of treatment was chlorination at the source. The findings depicted a situation whereby the essence of water treatment was largely known by most households and sensitization activities had been carried out to ensure the adoption of chlorination as a medium of treating the water at the source. A very large percentage of the households however did not treat the water from the points of collection. This denoted ignorance on their part and the risk of being pre-disposed to instances of

contamination of water at the source. Although borehole water is known to have little or no *E. coli* due to high retention time and filtration capacity of underground aquifers, the study showed a high coli-form count which is attributed to contamination during collection or transportation. A study by Ercumen *et al.* (2015) attached more emphasis to the proper storage of drinking water as opposed to the treatment with chlorine. Their study found out that safe storage alone was effective in reducing child diarrhea in Bangladesh rural area and that there was no additional benefit from chlorination if water storage was effective. In this study a 36% decrease in diarrhea cases compared to the controls was recorded in the safe storage plus chlorination arm (Prevalence ratio, PR=0.64, 0.55-0.73) while a 31% decrease was recorded in relation to the safe storage arm (PR=0.69, 0.60-0.80) of the intervention. In view of these findings, the research concluded that safe water storage significantly improved the quality of drinking water and that there was no additional benefit from the combination of chlorination of water and safe storage at the point of use.

Further analysis was done by way of a Spearman's Rank Order correlation which was run to determine the relationship between the water treatment option at the source before carrying home and the choice of the treatment method. There was correlation of statistical significance between the water treatment option at the source before carrying home and the choice of the treatment method ($r = 0.548, p = .01$). This is indicated in Table 5.7.

Table 5.7 Correlation between water treatment option at the source and the choice of the treatment method

		Treatment given to water at the source before carrying home	Motivation for choice of method
Treatment given to water at the source before carrying home	Pearson Correlation	1	0.548**
	Sig. (2-tailed)		0.000
	N	314	314
Motivation for choice of method	Pearson Correlation	0.548**	1
	Sig. (2-tailed)	0.000	
	N	315	315

** . Correlation is significant at the 0.01 level (2-tailed).

Responses on the factors influencing the choice of the water treatment methods used were as shown in Table 5. 8

Table 5.8: Responses on factors motivating choice of water treatment method

	Frequency	Percent
Cost	4	13
The method is effective	122	38.9
Cheap	2	0.6
No treatment	111	35

The study findings showed that the greatest motivating factor for the choice of the water treatment method was the effectiveness of the methods used. This was an indication that

the capacity to give the requisite results of the water treatment was a critical underlying factor as regards the choice of the method used. The findings showed that most of the respondents appreciated the risks posed by contaminated water. The findings denoted the ability of the respondents to aptly relate the varied treatment options to the risks posed by contamination leading to occurrence of diarrhea. This was evidence of the fact that the inherent risks occasioned by contamination predisposing the households to diarrhea were a factor motivating water treatment at the source. This confirmed the fact that the knowledge on the risks underlying had been clearly disseminated to the community through campaigns aimed at enhancing water treatment process as a way of reducing diarrheal diseases.

However, a study by Lilje, Kassely and Mosler (2015) which aimed at determining the factors that influenced water treatment behavior in Chad for the prevention of cholera contradicts this finding when it established that more than half of the respondents interviewed (55%) could not state even a single water treatment method. Interestingly, among the respondents who confirmed to know at least one method of water treatment, almost all of them (95%) mentioned chlorine in either liquid, powder or tablet form. These findings concurred with the results obtained from this study indicating that majority of the respondents 122 (38.9%) used chlorination for treating water with all of them asserting that their choice for chlorine is based on its effectiveness as opposed to the cost. Only 4 (13%) indicated that the choice of their water treatment method depended on its cost (Lilje, Kassely & Mosler, 2015).

The descriptive statistics on the presence of chlorine and factors related to water handling were as shown in Table 5.9

Table 5.9 Descriptive Statistics on Presence of Chlorine and Pertinent Household Practices Related To Water Handling

	Mean	Std. Deviation	N
Presence of residual chlorine in water tested in the lab	1.79	0.405	315
Other activities take place at the source or near the source of water	1.62	0.486	315
Capacity to always clean/empty the storage container before replacing with fresh water	1.03	0.167	314
Perception on the ability to clean /emptying the water spreading diarrhea	1.05	0.254	315
Frequency of replacing water in the storage container	3.17	1.022	315

The study carried out a means analysis for the households' water handling practices in relation to the presence of chlorine residues in the water samples. The results showed that the length of period storage of water in the containers determined the treatment method used. This is because the parameter had the highest means difference at 3.17 and a standard deviation of 1.022. This was reflective of the period taken before replacing the stored water being the greatest motivating factor for the water treatment method used and more so the use of chlorine. The other parameters had means differences of 1.62 and

standard deviation of 0.486 for other activities carried out around the water sources, 1.05 and a standard deviation of 0.254 for the perception of the cleaning and emptying of storage containers to spread diarrhea and finally the capacity to clean and empty the storage container before replacing with fresh water at 1.03 and a standard deviation of 0.167. This is was an indication that the use of chlorine for water treatment was greatly influenced by the frequency of replacement of water in the storage containers after fetching. This may be partly attributed to the perception of having the water storage period being the guiding benchmark for the households as regards the mode of treatment and the propensity to use chlorine (Tubatsi, Bonyongo & Gondwe, 2015).

The study went further to establish the relationship between the presence of fecal matter and incidences of diarrhea and the statistical findings were as shown in Table 5.10

Table 5.10 Pearson chi-square test on the presence of fecal matter and diarrhea incidences in recent past

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.802 ^a	3	0.050
Likelihood Ratio	7.559	3	0.056
Linear-by-Linear Association	5.988	1	0.014
N of Valid Cases	315		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.81.

The Pearson chi-square test on the presence of fecal matter and the presence diarrhea incidences in the previous 2 weeks was calculated. There was a significant relationship between presence of fecal matter and the diarrhea incidences in the previous 2 weeks (χ^2

(3) =7. 802, $p=0.05$). The findings indicated that the presence of fecal coli forms in the water used for domestic purposes in the household shows that there was a high possibility of having diarrhea cases. A study by Tubatsi, Bonyongo and Gondwe (2015) also found out that all (100%) of the river samples collected for analysis were contaminated with the fecal matter and therefore unfit for domestic use before undergoing prior treatment. The study concurred with the findings of this study that presence of bacterial coliforms in water for domestic use is an indication of contamination and thus predisposing the residents to diarrheal diseases. Tubatsi *et al.* (2015) found out that, up to 48% of the households confirmed to have experienced diarrhea in which most cases appeared during the early flooding seasons.

Table 5.11 shows the correlation of mothers with children under five years education levels and the presence of coli-forms

Table 5.11 Correlations of the mothers with children under five years and the presence of fecal coli-forms

		Mother of children under five years.	Presence of fecal matter
Mother of children under five years.	Pearson Correlation	1	-0.127*
	Sig. (2-tailed)		0.025
	N	315	315
Presence of fecal matter	Pearson Correlation	-0.127*	1
	Sig. (2-tailed)	0.025	
	N	315	315

*. Correlation is significant at the 0.05 level (2-tailed).

A Pearson product correlation on the incidences of diarrhea in children under five years and the education levels of the mothers was done. There was a weak negative correlation between the incidences of diarrhea in children under five years and the education levels of the mothers ($r = -0.127, p = 0.025$). This implies that the diarrhea incidences reduced with an increase in the education levels of the mothers.

Figure 5.3 shows other activities taking place at the water source.

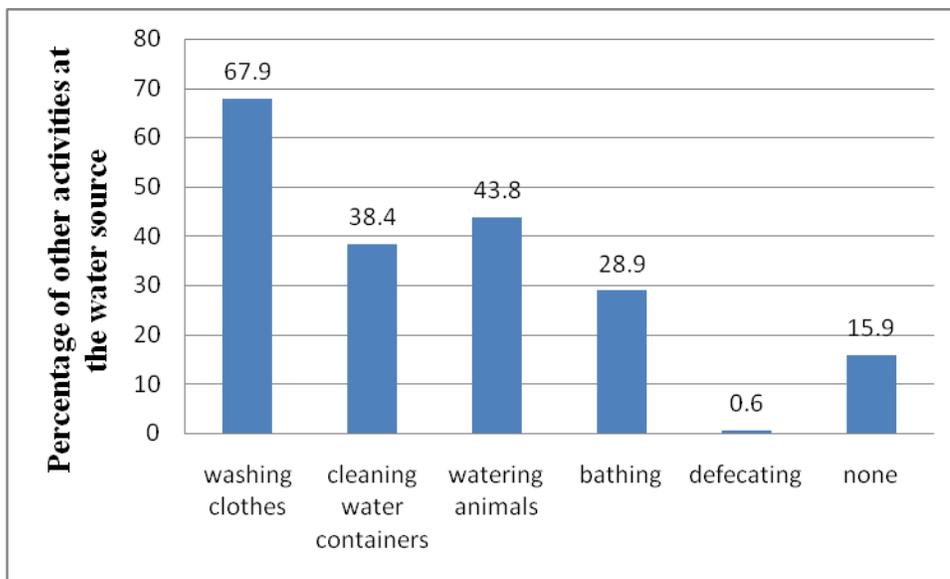


Figure 5.3 Other Activities taking place at the water source

Apart from fetching of water, 214 (67.9%) of the respondents indicated that washing of clothes is also done around the source of water while 138 (43.9%) reported watering of animals as another common practice at the source of water. The study established that only 2 (0.6%) reported defecating practice at the water source. The findings confirmed the results obtained in another study by Hunter, MacDonald and Carter (2010) which indicated that activities undertaken at the source of water for domestic use and their

affects as pertains to the contamination are great determinants predisposing the community members to the occurrence of diarrhea.

Further analysis was carried out to find out the relationship between the activities undertaken at the water source and the incidences of diarrhea in the children under five. The findings are shown in Table 5.12. The Chi-square test was calculated to determine the relationship between the activities undertaken at the water source and the incidences of diarrhea. There was a significant relationship between the activities taking place at water source and the incidences of diarrhea in children under five ($\chi^2 (1) = 4.368$, $p=0.037$). The findings were confirmation that the activities carried out at the water sources had a predominant effect on the predisposition towards the occurrence of diarrhea in the children under five. However, a study by Tubatsi *et al.* (2015) contradicted these findings when it identified that there was no statistically significant relationship between river water quality and diarrhea incidences across the study area ($p > 0.05$). The study found out that the failure to practice water treatment before using the water for domestic purposes was a statistically significant predictor of diarrhea incidents among the children below five years in the area of study ($p=0.028$).

Table 5.12 Pearson chi-square test of other activities taking place at water source and the incidences of diarrhea in children under five

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1- sided)
Pearson Chi-Square	4.368 ^a	1	0.037		
Continuity Correction ^b	3.827	1	0.050		
Likelihood Ratio	4.299	1	0.038		
Fisher's Exact Test				0.045	0.026
Linear-by-Linear Association	4.354	1	0.037		
N of Valid Cases	314				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.19.
b. Computed only for a 2x2 table

In reference to the ability of the treated water to have less incidences of diarrhea, a Pearson product correlation was run between presence of chlorine residues and incidences of diarrhea in children under five. There was a weak negative correlation between the presence of chlorine residues and incidences of diarrhea in children under five ($r = -0.115$, $p = .042$). The findings brought forth a situation whereby despite water treatment and the evidence of chlorine residues in the water, cases of diarrhea were still profound thus reflecting a situation of the incidences being predisposed by other factors other than the water quality as shown in Table 5.13.

Table 5.13 Pearson product correlation between presence of residual Chlorine and incidences of diarrhea in children under five

		Presence of residual chlorine in water	Under five years child with diarrhea two weeks prior to study
Presence of residual chlorine in water	Pearson Correlation	1	-0.115*
	Sig. (2-tailed)		0.042
	N	315	314
Under five years child with diarrhea two weeks prior to study	Pearson Correlation	-0.115*	1
	Sig. (2-tailed)	.042	
	N	315	315

*. Correlation is significant at the 0.05 level (2-tailed).

However, the results obtained in this study contradicted the findings of other previous studies that established that point-of-use treatment of drinking water with chlorine had significant effects on the incidences of diarrhea among the children below five years. For instance, a systematic review and meta-analysis conducted by Arnold and Colford (2007) indicated that the intervention of water treatment using chlorine products at the point of use in the households reduced the risks of diarrhea among the children below five years (pooled relative risk: 0.71, 0.58-0.87). Similarly, it significantly reduced the risk of stored water contamination with *Escherichia coli* (pooled relative risk: 0.20, 0.13-0.30) As indicated by Bharti *et al.* (2013) the period of water storage had a significant effect on diarrheal incidences in the household.

In regard to the period taken to replace water in the storage container, a total of 214 (67.9%) of the respondents stated that they replace water in the storage containers after every two days while 138 (43.8%) reported to replace the water after a period of more than three days. Only (121) 38.4% of the respondents indicated that they replace water in storage containers everyday as shown in Table 5.14. This indicated that majority of the household took more than two days to replace water in the storage containers hence, predisposing their children to diarrhea (Cairncross *et al.*, 2010).

Table 5.14: Period taken to replace water in the storage containers

	Frequency	Percent
Everyday	121	38.4
Every 2 days	214	67.9
Every 3 days	91	28.9
More than 3 days	138	43.8

The findings identified with another study by Kageni (2011) in Kenya who opined that there was an association between storage of drinking water and diarrhea cases among children under five years. The study established that most mothers stored their water in buckets which were usually not covered or lacked fitting covers and thus exposure to dust and other pollutants. More than half (62.7%) of the mothers who stored their drinking water in buckets reported episodes of diarrhea. In addition, the study found that children usually scooped water for drinking directly from the buckets using any cup or bowl thereby increasing the risk of diarrhea morbidity. Drinking water should be stored in separate container from other domestic water and the water should be scooped using clean

containers in such a way that hands or other objects cannot contaminate it (Trevett & Carter 2008; UN HABITAT 2003; Kageni, 2011).

Further statistical analysis was carried out with a view of confirming the perception that contaminated water spread diarrhea and the practice of always cleaning and emptying storage container before replacing with fresh water. A Pearson product correlation was run and the findings reflected a weak negative correlation between the perception of contaminated water spreading diarrhea and the practice of always cleaning and emptying storage container before replacing with fresh water ($r = -0.026$, $p = .646$). It can be deduced to mean that despite the respondents employing the practice of cleaning and emptying storage containers before replacing with fresh water, it was motivated by other factors but not safeguarding against the risk of contracting diarrhea as shown in Table 5.15.

The study also established that majority of the respondents 217 (69.1%) obtained water from the storage containers by dipping a smaller container while the remaining 97(30.9%) indicated that they get water from the storage container by pouring.

Table 5.15 Correlations on perceptions of contaminated water spreading diarrhea and the practice of cleaning and emptying storage container before replacing water

		Contaminated water	Cleaning of storage containers
Contaminated water	Pearson Correlation	1	-0.026
	Sig. (2-tailed)		0.646
	N	313	313
Cleaning of storage containers	Pearson Correlation	-0.026	1
	Sig. (2-tailed)	0.646	
	N	315	315

The study carried more statistical interrogations to determine the strength of the relationship between the frequency of cleaning and replacing water in storage containers and the practice of drawing drinking water from the storage container. A Pearson product correlation reflected a weak positive correlation which was statistically significant between the frequency of replacing water in storage containers and the practice of drawing drinking water from the storage container ($r = 0.149, p=0.008$). The findings can be interpreted to mean that replacement of drinking water from the storage container was motivated by the practice of drawing and the predominant ways were pouring and dipping. The findings were an indication that optimal knowledge dissemination had been carried out in the community as pertains to the handling of drinking water from the storage containers as evidenced in Table 5.16.

Table 5.16 correlation of the frequency of replacing water in storage container and practice of drawing drinking water from the storage container

		Frequency of Water Replacement	Methods of drawing water
Frequency of Water Replacement	Pearson Correlation	1	0.149**
	Sig. (2-tailed)		0.008
	N	315	314
Methods of drawing water	Pearson Correlation	0.149**	1
	Sig. (2-tailed)	0.008	
	N	315	315

** . Correlation is significant at the 0.01 level (2-tailed).

The statistical findings were in tandem with the position taken by Robert *et al.* (2002) who was of the view that in many developing countries, piped water was also unsafe for drinking because of inadequately maintained pipes, low pressure, intermittent delivery, lack of chlorination and many others. It was also noted that households that kept water in covered jerry cans had low rates of *E.coli* contamination compared to those that didn't.

A follow up to confirm the procedures adopted to treat the water showed that varied techniques were adopted in treating water in the storage containers. Majority (53.4%) reported using chlorination, 30.4% reported not using any method, 8.9% and 7.3% reported using filtering and boiling of water respectively as shown in Table 5.17

Table 5.17: Treatment of water before putting into storage containers

	Frequency	Percent
Boiling	23	7.3
Filtering	28	8.9
Chlorination	167	53.4
None	95	30.4

The respondents gave varied responses with regard to water containers used for storage. Similar percentages of 127(40.7%) reported storing water in narrow mouthed jerricans with lid and wide mouthed pails with lid. 41(13.1%) recorded storing water in wide Jerri cans without lids (figure 5.4).

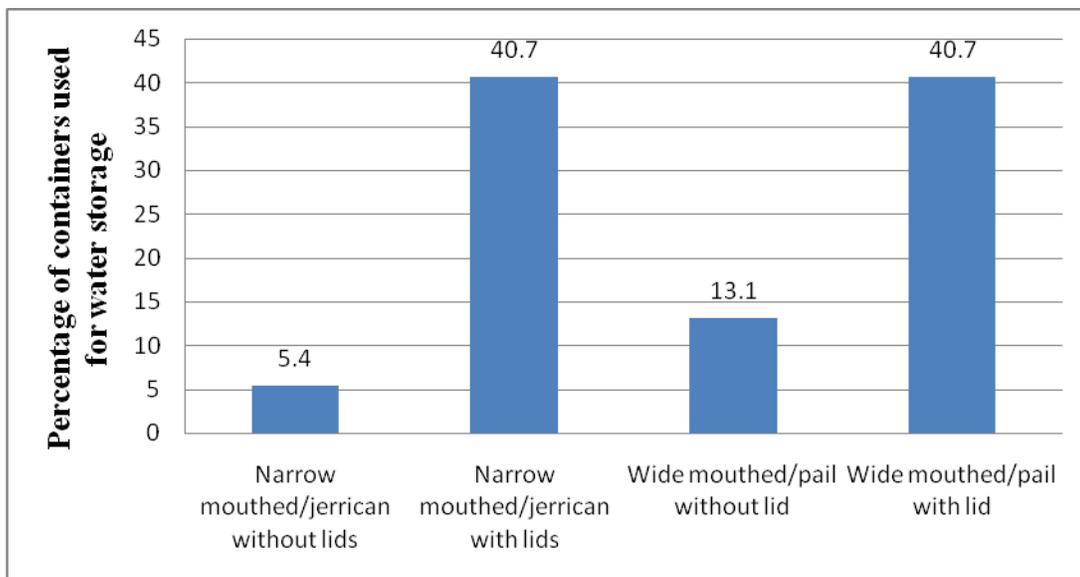


Figure 5.4: Containers used for Water Storage

The study found out that there was a significant relationship between the nature of container that was used for water storage and the incidences of diarrhea at the household level.

Majority of the respondents 300 (96.8%) reported fetching 20-50 litres of water per day while 9 (2.9%) recorded fetching 51-80 litres of water. Only 1 (0.3%) reported to be fetching more than 110 litres of water per day. On the other hand, almost an equal figure of 306 (98.7%) reported using 20-50 litres of water fetched in the household, only 3(1%) reported using 51-80 litres and the remaining 1(0.3%) acknowledged using more than 110 litres in a day as shown in Table 5.18 . The connection between the amount of water fetched and that used in a household was based on the size of the household and the purpose for which the water was used within the homes. The distance covered to get to the source also defined the amount of water one would fetch, the farther the distance, the less the amounts fetched while in short distances households went for more litres of water.

Table 5.18: Amount of water fetched and used per day

Item		Frequency	Percent
Amount Fetched	20-50	300	96.8
	51-80	9	2.9
	Above 110	1	0.3
Amount used	20-50	306	98.7
	51-80	3	1.0
	Above 110	1	0.3

Over three quarters 237 (75.7%) of the respondents reported fetching enough water for use at home on a daily basis. In this regard more statistical interrogations were done to confirm the relationship between the volume of water fetched per day and the presence of fecal matter. There was a weak negative correlation between the volume of water fetched per day and the presence of fecal matter ($r = -0.045$, $p = .425$). The statistical findings led to the conclusion that the volume of water used in a day did not affect the presence of fecal coli-forms. The statistical findings can thus be deduced to show that regardless of the volumes of water consumed in the households, the contamination at the source determined the presence or absence of fecal coli-forms as evidenced in Table 5.19.

Table 5.19 Correlation on the volume of water fetched per day and the presence of fecal matter

		Quantity of water fetched daily.	presence of fecal matter
Quantity of water fetched daily..	Pearson Correlation	1	-0.045
	Sig. (2-tailed)		0.425
	N	315	315
presence of fecal matter	Pearson Correlation	-0.045	1
	Sig. (2-tailed)	0.425	
	N	315	315

Similarly, the study went further to relate the incidences of diarrhea in children under five years and the numbers of persons living in the households. There was a weak positive

correlation between the incidences of diarrhea in children under five years and the numbers of persons living in the households ($r = 0.014$, $p = 0.804$). The findings were an indication that the numbers of persons living in the households affected the incidences of diarrhea. This was mainly attributed to the handling of the water and the volumes involved owing to the populations in the households. These findings were in agreement with another research by Agustina, Sari, Satroamidjojo and Feskens (2013) which argued that children belonging to families with more than six household members had 2.3 times higher risk of suffering from diarrhea (95% CI =1.03-4.48) compared to the families that fewer than six members. These statistical findings pointed out to the possibility of some household members not exercising the requisite caution when fetching water due to the need to just meet the immediate needs thus getting it from unsanitary quarters as shown in Table 5.20. This poses a risk of developing diarrheal diseases to the entire household especially the children below five years who are most vulnerable.

Table 5.20 Correlations of the number of people living in the households and the incidences of diarrhea in children under five years

		Number of adults in household	Diarrhea in past two weeks
Number of adults in household.	Pearson Correlation	1	0.014
	Sig. (2-tailed)		0.804
	N	315	315
Diarrhea in past two weeks	Pearson Correlation	0.014	1
	Sig. (2-tailed)	0.804	
	N	315	315

The statistical findings identified with the results of a survey conducted by KDHS (2008) which showed that the mean Kenyan household size is 4.2 persons. The findings from the survey indicated that there was an association between the household size and the prevalence of diarrheal diseases. Household size was found to be significant determinant of the number of meals for children less than 5 years during food shortage. It was also established that households with more family members recorded a higher number of diarrheal cases compared to households with fewer members. This indicated that the higher the household size the more family resources were divided among many hence the adequacy of the meals and proper nutrients were limited (Lakkam, Wager, Wise & Wein, 2014).

When the study sought to establish when the respondents started breast feeding their children who are below five years, the responses obtained were as shown in Table 5.21 below.

Table 5.21: Distribution of the respondents with regard to when they started breast feeding

	Frequency	Percent
Within 24 hours after delivery	285	91.1
After 24 hours	19	6.1
No response	9	2.9
Total	315	100.0

Majority of the respondents 285 (91.1%) indicated that they started breast feeding their children within 24 hours after delivery while 19 (6.1%) said that they started after 24 hours. Only 9(2.9%) of the respondents did not respond to the question. The high number of respondents starting to breast feed their babies within 24 hours after delivery is attributed to the fact that the healthcare providers are educating their clients on the importance of breast milk in the body of their newborns as suggested by (Horta & Cesar, 2013).

The study sought to find out the distribution of respondents with regard to period of breast feeding and the findings are shown in Table 5.22.

Table 5.22: Distribution of the respondents with regard to period of breast feeding

	Frequency	Percent
0-5 months	25	8.0
6-11 months	51	16.3
12-17 months	103	33.0
After 18 months	85	27.2
Still breast feeding after 24 months	48	15.4

The respondents reported having breast fed their last children under five years over distinct periods. Majority of the respondents (33.0%) reported breast feeding for a period of 12-17 months, 27.2% reported breast feeding for a period of after 18 months, 15.45% reported still breast feeding their children, 16.3% mentioned breast feeding their children

for 6-11 months while the remaining 8.0% reported to have breast fed their children for only 0-5 months. The practice of breast feeding of last children was critical to understand the manner in which care and immunity of the children under five years was considered. In a number of FGDs, and the reports from the KIIs, precisely the CHEWs revealed that breast feeding of the children was hindered due to a number of factors such as, women's desire to maintain their figure, economic activities and poverty. A CHEW from Ndhiwa said,

Most of the women in the area do not breast feed their children because they are poor and cannot afford a meal three times a day so the children are weaned at a tender age and denied breast milk. Male CHEW No.#1 Ndhiwa

The study findings identified with the position taken by Black, Allen & Bhutta *et al.*, (2008) who pointed out that in developing countries only 40-50% of infants less than two months and 25-31% of infants 2-5 months are exclusively breastfed and the proportion of infants 6-11 months of age receiving any breast milk is significantly low. In a system review on the benefits of breastfeeding on diarrhea and pneumonia mortality conducted by Bernardo, Cesar and WHO (2013) found out that breastfeeding protects against diarrhea and respiratory infection in children under five years. It was emphasized on the other review conducted by Kramer *et al.* (2004) on the effect on the child health and growth of exclusive breastfeeding for 6 months which showed that morbidity from gastro-intestinal diseases was lower among infants who were exclusively breastfed for 6 months in comparison to infants exclusively breastfed for at least 3-4 months.

The findings equally confirmed research carried out by Lamberti *et al.* (2011) who found out that lack of exclusive breastfeeding among infants 0-5 months of age and no

breastfeeding among children 6-23 months of age are associated with increased diarrhea morbidity and mortality in most developing countries. The study found out that human milk glycans, which include oligosaccharides in their free and conjugated forms, are part of a natural immunological mechanism that accounts for the way in which human milk protects breastfed infants against diarrheal disease. In addition, a research conducted by Mirhshahi, Peat and Kabir (2008) in Chittagong, Bangladesh showed that breastfeeding reduces exposure to contaminated fluids and foods, and contributes to ensuring adequate nutrition and thus guarantees non-specific immunity. Further follow up was carried out to find out the exact periods that the mothers with children under five years had breast fed the babies. The periods of breast feeding were varied with the bulk of the respondents doing it for periods of 12-17 months. This was an indication that they carried out the breast feeding for adequate time frames before introducing the babies to complimentary feeds.

Follow up analysis on the periods that the respondents weaned their babies was carried out to relate the time taken to the babies' immunity and predisposure to diarrhea incidences. According to the results obtained from the study, 82.1% reported weaning the child focused on during the study while 17.9% reported not weaning their children focused on during the study as illustrated in the Table 5.23.

Table 5.23: Distribution of the respondents with regard to weaning

	Frequency	Percent
Yes	256	82.1
No	56	17.9
Total	315	100.0

The findings confirmed previous works by Kageni (2011) who found out that most mothers gave complimentary feeds to their children before the age of six months which was contrary to UNICEF recommendations that solid foods should be introduced to infants at the age of 6 months because by that age breast milk was not sufficient to maintain the child's growth (UNICEF, 2010). The findings of the study agreed with those reported by Waswa *et al.* (2014) in which all mothers who participated in the study had introduced their infant to food before six months. Children fed at the age of three months were exposed to diarrheal disease compared to those who were introduced to complementary feeding at six months. This was as a result of the child's digestive system not being fully developed and thus the exposure to ulceration and irritation of the gastrointestinal tract hence diarrheal incidences.

Agustina *et al.* (2013) further argued that food hygiene plays a big role in causing diarrhea and malnutrition among children in low socioeconomic communities. A study conducted by Agustina, Sari, Satroamidjojo and Feskens (2013) that aimed at finding out the association of food hygiene practices and diarrhea prevalence among Indonesian young children from low socio-economic urban areas found out that in areas with

limited hygiene and sanitation facilities tended to have poor hygiene practices such as the use of dirty utensils for feeding young children. Poor food hygiene especially in food preparation and feeding practices which increased the risk of diarrheal diseases, up to 70% of these diseases were caused by water and food contaminated with pathogens. Contamination of food can be related to the storage of food at room temperature for a long time and in the rainy seasons (Godana, 2012; Mhrshashi, 2008; WHO, 2008). A cohort study in Turkey revealed that children whose houses did not have kitchens were more likely to suffer from diarrheal diseases compared to those who had (Etiler *et al.*, 2004). A similar study in Nigeria showed that children who lived in houses with private kitchens had lower incidences of diarrheal diseases than those children who did not have (Oni *et al.*, 2009). These findings were attributed to the fact that children living in houses that have no separate kitchen were more likely to access food leftovers as well as the one that drops on the floor which predisposes them to diarrhea.

Analysis was done to relate the study findings to the occurrence of diarrhea attributed to the hand washing practices. The responses as shown in Table 5.24 reflected that majority of the respondents (81.3%) washed their hands before meals while 75.3% recorded washing hands after using the toilet. Only 37.7% of the respondents indicated that they washed their hands after cleaning the child who has defecated while 25.9% and 22.2% reported cleaning their hands before preparing food and before breast feeding the baby respectively. It was interesting to note that only 12% of the respondents reported washing their hands in all occasions. In addition, 89.6% of the respondents reported washing their hands with soap and water, 13% mentioned washing their hands sometimes with water alone and 7.6% reported washing hands always with water alone. Only 1.6% indicated

that they did not wash their hands with soap and water while 0.3% did not give a response to the question.

Table 5.24: Hand washing practices

Item	Frequency	Percent	
Wash-hands	After using the toilet	238	75.3
	Before meals	257	81.3
	Before breast feeding the baby	70	22.2
	After cleaning the child who has defected	119	37.7
	Before preparing food	82	25.9
	Anytime	38	12.0
How	With soap and water	283	89.6
	Do not wash hands with soap and water	5	1.6
	Always with water alone	24	7.6
	Sometimes with water alone	41	13.0
	No response	1	0.3

Table 5.24 shows that 283 (89.6%) of the respondents washed their hands with soap and water whereas 24 (7.6%) washed their hands with water alone. The study findings confirm the position of Sebastian, Paul & Alexandra (2012) whose research aimed at promoting hand washing intervention in Peru with an attempt to improve child healthcare. Their study showed that a 42% - 47% reduction in diarrhea can occur when the culture of hand washing with soap and water is introduced and sustained in the community. The study also established that hand washing promotion and intervention were estimated to have the potential to prevent more than one million deaths from diarrheal diseases in a year. KNBS & ICF Macro (2013) established that in the year 2012, 38,800 children lost

their lives to diarrhea and pneumonia in Kenya alone. In spite of many attempts by various organizations to promote hand washing through modern communication channels in Kenya, the practice has not been fully embraced.

African Population and Health Research Centre (2002) established that even though many people in Kenya wash their hands with water very few wash their hands with soap after visiting the toilet, changing diapers or before eating. The findings of this study also concurred with a study by Mohammed & Tamiru (2014) which indicated that poor maternal hand washing practices were positively associated with diarrheal morbidity among the children below five years. The research found out that children whose caregivers had poor hand washing practice were 2 times at high risk of developing diarrhea compared to those whose caregivers had good hand washing practice (APR=2.33 {95% CI: 1.80, 4.15}). Mohammed and Tamiru concluded that there was need for mothers being the main caregivers for their children to wash their hands properly before feeding children to minimize the occurrence of hygiene related diseases. Many past studies have emphasized on the essence of proper hand washing before feeding children especially those below five years to prevent diarrhea and other related diseases (Vieira, Silva and Vieira, 2003; Yilgwan, Yilgwan and Abok, 2005).

The study also sought to find out the hygiene practice of disposal of children faeces. The responses were as shown in figure 5.5

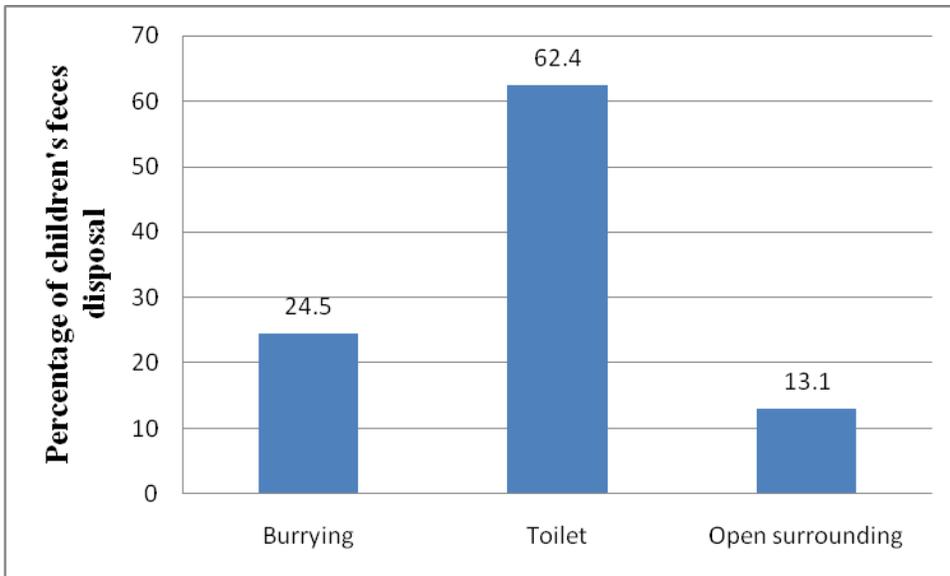


Figure 5.5: Disposal of Children Feces

More than half of the respondents 196 (62.4%) reported to be putting the child's feces in the toilet, 77 (24.5%) reported burying of the child's feces while the remaining 41(13.1%) reported throwing the feces away in open surroundings. The practices were reflective of the situation whereby the disposal of faeces by the households was a factor which pre-disposed them to the risk of contracting diarrhea from the exposure (Buttenheim & Alison, 2008).

An analysis of the care offered to the children after defecation and the methods used showed that a total of 90.4% of the respondents reported cleaning the child right away after defecating while the other 9.6% reported cleaning the child after sometime as shown in Table 5.25. Further evaluation of the practices carried out in the cleaning process showed that 36% reported cleaning the babies with water, 30.2% reported using leaves while 28.4% mentioned using tissue paper. The remaining 5% and 0.4% mentioned using cloth and dragging the baby on the ground respectively.

Table 5.25: Care given to Children after Defecating and Method Used

Item		Frequency	Percent
Care after defecating	Cleaned right away	161	90.4
	Cleaned after sometime	17	9.6
Bottoms wiped	Water	100	36.0
	Dragged on ground	1	0.4
	Tissue	79	28.4
	Leaves	84	30.2
	Cloth	14	5.0

Analysis of the facilities used for defecating in the households showed that the highest number of respondents 210 (66.8%) reported using the latrine only as a defecating facility in the homes, the use of the bush was reported by 101(31.9%) of the respondents and the remaining 4(1.3%) reported using the neighbors' toilet for defecating as illustrated in Figure 5.6. The findings indicate that availability of a toilet facility in a household is an important factor in reducing the risk of diarrhea among the children below five years. These results are in agreement with the findings of a study by Woldemichael (2001) which indicated that there was a significant association between the availability of toilet facility and the diarrheal morbidity at the household level. In the multivariate model which included two demographic variables and the toilet facility, the toilet facility retained its negative significant effect. Similarly, it was also found out that the presence and correct use of the toilet facility reduced the risk of diarrhea by 26%.

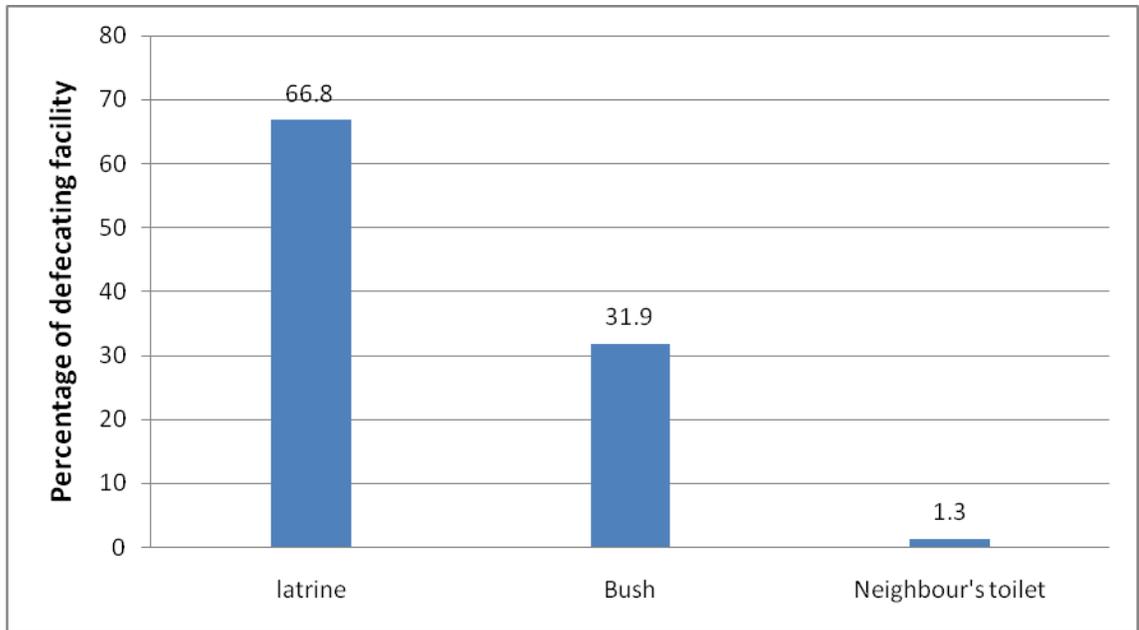


Figure 5.6: Facilities used for Defecating in the Household

The study went further to relate the toilet facilities used in the households and the occurrence of diarrhea incidences. The statistical findings were as shown in Table 5.26

Table 5.26: Spearman rank order correlation between type of toilet facility and incidences of diarrhea in children under five

		Toilet type for used	Diarrhea in past two weeks
Toilet type used	Pearson Correlation	1	-0.074
	Sig. (2-tailed)		0.191
	N	315	314
Diarrhea in past 2 weeks	Pearson Correlation	-0.074	1
	Sig. (2-tailed)	0.191	
	N	315	315

A Pearson product correlation on the type of toilet facility and incidences of diarrhea in children under five was done. The findings reflected a weak negative correlation which did not have statistical significance between the type of toilet facility and incidences of diarrhea in children under five ($r_s = -0.074, p = .191$). This showed that regardless of the

toilet facilities in use, the incidences of diarrhea could be predisposed and attributed to other factors other than the type of toilet facility available.

A Chi-square test was calculated to establish the relationship between the care given to children after defecating and the incidences of diarrhea in the households. There was no significant relationship between the care given to children after defecating and the incidences of diarrhea in the household ($\chi^2 (4) = 2.783, p = 0.595$). The statistical findings confirmed that the practices used in the handling of the children after defecation had no direct bearing on the exposure to the inherent risks of diarrhea in the children less than five years of age. There was thus no relationship between the treatments proffered to the kid after defecation and the incidences of exposure to diarrhea in the community as shown in Table 5.27.

Table 5.27 Chi-square test of the Care given to children after defecating and the incidences of diarrhea in the households

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.783 ^a	4	0.595
Likelihood Ratio	2.318	4	0.677
Linear-by-Linear Association	0.007	1	0.934
N of Valid Cases	315		

a. 3 cells (30.0%) have expected count less than 5. The minimum expected count is 0.75.

A Pearson product correlation test on the relationship between the incidences of diarrhea in children under five years and the faeces disposal practices was done as shown in Table 5.28. There was a weak positive correlation between the incidences of diarrhea in children under five years and the faeces disposal practices ($r = 0.018$, $p = 0.754$). The findings showed that the faeces disposal practices directly contributed to the incidences of diarrhea by virtue of the contribution to night soil and related contamination in the households. These findings were found to be consistent with those of other studies globally. For instance, a study by Cronin, Sebayang, Torlesse and Nandy (2016) that sought to find out the association of safe disposal of child feces and the reported diarrhea cases in Indonesia indicated that the unsafe disposal of child feces at the household level is strongly associated with an increased number of diarrhea cases (OR: 1.46; 95% CI: 1.18-1.82, $p = 0.001$).

Similarly, a meta-analysis that examined 10 observational studies across several countries noted that risky child feces disposal behaviors such as open defecation and stool disposal in the open surrounding were associated with 23% increase in diarrhea morbidity (RR: 1.23, 95% CI: 1.15-1.32). On the other hand, the analysis found out that safe disposal or handling of child feces through latrines, potties, toilets and dippers were borderline protective and therefore they reduce the morbidity of diarrhea among the children below five years (RR: 0.93, 95% CI: 0.86-1.00).

Table 5.28 Correlations of the feces disposal practices used and the incidences of diarrhea in children under five years

		Diarrhea in past two weeks	Disposal of feces
Diarrhea in past two weeks	Pearson Correlation	1	0.018
	Sig. (2-tailed)		0.754
	N	315	315
Disposal of feces	Pearson Correlation	0.018	1
	Sig. (2-tailed)	.754	
	N	315	315

Figure 5.7 shows the result of hand washing after defecating

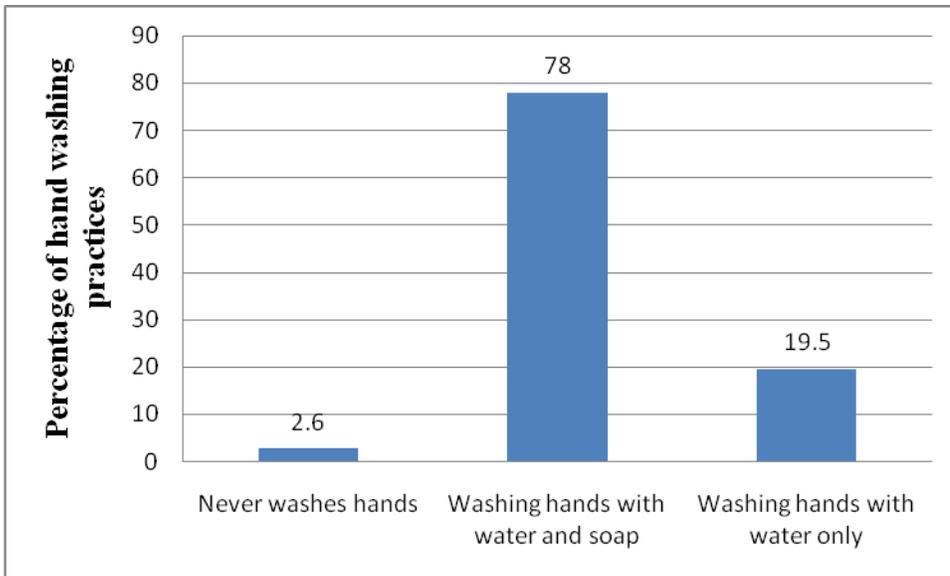


Figure 5.7: Washing of hands after defecating

Regarding to the washing of hands after defecating, 61 (19.5%) indicated that they washed their hands with water only as a way for caring for hands after defecating. A significant majority 244 (78%) reported washing hands with water and soap and only 8 (2.6%) reported never washing hands as illustrated in figure 5.7. The findings showed that quite a good number of respondents were aware of the role of hand washing in reducing diarrhea and other hygiene related diseases. The study findings were in tandem with Curtis & Cairncross (2003) who pointed out that diarrheal disease was mostly spread by person to person contact, ingestion of food and water contaminated by fecal matter or direct contact with infected feces. Studies by (WHO 2013; Curtis, 2011) showed that over 70% of diarrhea cases were attributed to ingestion of contaminated food and water.

Danquah (2010) indicated that the most important risk factors were behaviors that encouraged human contact with fecal matter which included improper disposal of

human waste and lack of hand washing after handling faeces and before handling food. He added that hand contact with ready to eat food without washing represented a high risk of causing diarrhea diseases. In many low income countries, households lacked facilities for proper disposal of human waste and even where available they were not adopted for the use of children (UNICEF/WHO, 2009). This led to defecation all over the household and hence increased the risk of handling excreta by mothers, caregivers and even children themselves. Evidence showed that children's faeces contained higher concentration of pathogens than those of adults due to their increased interaction with contaminated materials in their environment (Woldemichael, 2001).

In figure 5.8, 218 (69.9%) of the respondents reported disposing waste food and water in the open surrounding while 94 (30.1%) reported disposing the waste food and water in the rubbish pit. A study by Mohammed and Tamiru (2014) defined proper waste food disposal as the best way of disposing refuses and food left overs which included burying in a pit, storing in a container and disposing of waste only in designated places while the disposal of waste food and water in open ground was considered unimproved-disposal method. It is evident from the data obtained from this study that majority of the respondents used unimproved waste disposal as opposed to proper waste disposal hence may be a contributing factor to the increased diarrheal incidents as established by (Oadi and Kuitunen, 2005).

However, it is interesting to note that Mohammed and Tamiru (2014) found out that only 39 (33.9%) of those who practiced improper waste disposal had suffered from diarrhea while an overwhelming majority 76 (66.1%) had not had diarrhea. Following these results they did not find the ground to positively associate the unimproved waste disposal

with the occurrence of diarrheal diseases since there was no statistical significance in the value obtained (CPR 1.14: 95% CI, 0.85-1.53 $p < 0.05$).

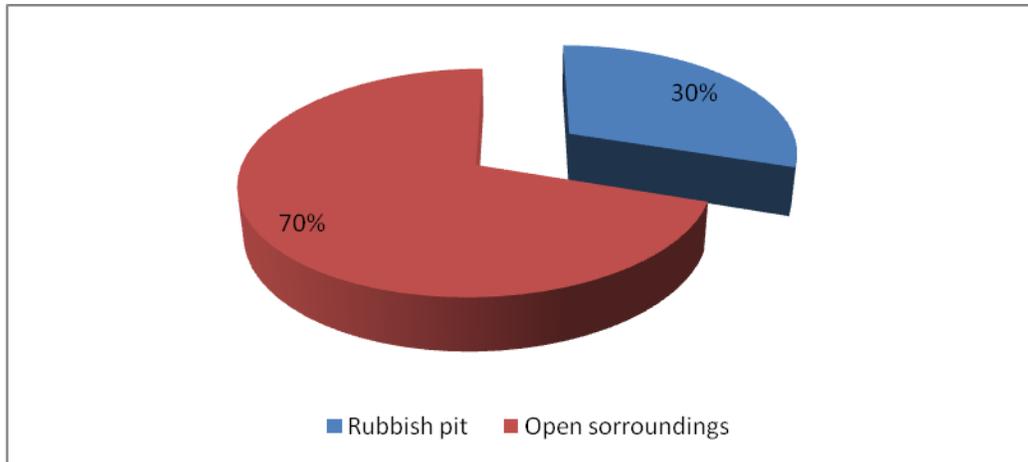


Figure 5.8: Disposal of Waste Food and Water

Similarly, the study further sought to carry out an odds ratio analysis on the probability of the perception of fetching enough water and the provision for the presence of hand washing facilities in the households. In the event of households perceiving themselves to fetch enough water, the provisions for having hand washing facilities in the households had an odds ratio of 1.197. This was an indication that by having adequate amounts of water the households would ultimately have adequate water for hand washing purposes. Table 5.29 shows the Odds ratio for the respondents' perception on the fetching of enough water and the availability of hand washing facilities in the households.

Table 5.29 Odds ratio for perception on fetching enough water and provision for hand washing facilities in the households

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Do you think you fetch enough water for use at home per day? (Yes / No)	1.226	0.536	2.802
For cohort Is there a place for washing hands? = Yes	1.197	0.574	2.500
For cohort Is there a place for washing hands? = No	0.977	0.892	1.070
N of Valid Cases	315		

5.3 Summary

The chapter brings out the manner in which household behavioral practices such as water collection, storage and management, influences diarrhea among children under five years old. The study adopted a reliable methodology to express the correlation between the phenomenon and various areas attached to water management. Extensively observation of water treatment was not only observed at the storage level but also from the sources, making it possible for the researcher to have a holistic view of the matter. Additionally, options preferred by the households for water treatment were discussed elaborately, giving an understanding of why some methods employed by organizations are not

sustainable within the study area. The chapter also explores the manner in which water gets from the source to the household, demonstrating the gender and age bracket of the persons who commonly go for water used in the households. Proper understanding of health behavior practices paved way for the researcher to explore aspects of health information and knowledge on diarrhea possessed by the caregivers.

CHAPTER SIX

HEALTH SEEKING BEHAVIOR OF CAREGIVERS OF CHILDREN FACING DIARRHEA

6.1 Introduction

Health seeking behavior of children under the age of five begins with that of the mother. Children in the developing countries have been observed to be highly susceptible to diarrhea infections. In these countries, health seeking behavior of caregivers has been identified to be a major factor influencing diarrhea among children under five years. A number of studies have proved that poor health seeking behavior has been a significant factor leading to the death of many children in developing countries. Therefore, the study herein found it necessary to examine the manner in which health seeking behavior of caregivers enable prevention of diarrhea among children under five years. The results from the study demonstrate varied aspects of health seeking behavior of the caretakers affecting prevention of diarrhea positively and negatively.

6.2 Health information

When the respondents were asked to state how they obtained health information, it was established that 46.2% got the information from Community Health Volunteers (CHVs)/Hospitals, 36% reported getting information from the radio while 13.4% indicated that they got the information from a friend or relative. 1.4% of the respondents got the information from the television and a further 1.4% mentioning books and newspapers as their source of health information. Only 1.0% reported getting the

information from the church while the remaining 0.7% reported getting the information from the notice and billboards as illustrated in the Table 6.1. The response from the majority of the respondents was not in line with that of the participants from FGDs and KIIs. Most of the female respondents in the study area appeared to seek information from other sources more frequently than the health facilities. Some of the mentioned sources are the pharmacists, relatives and friends and the old folk. The mentioning of hospitals and health volunteers as main source of information was disputed as one of the female participants from female FGD in Ndhiwa argued that,

There is a nurse here at Ndhiwa hospital that has made women afraid to even go to deliver there. We are farmers and one day a woman was from the farm and got home only to find the child ill, so she quickly picked the child not bothering how she appeared and ran to hospital. Instead of the nurse getting concern to help the child, she first quarreled the woman on how dirty she was, since then that woman does not go to hospital. Female FGD No.#2 Ndhiwa

Most of the male participants on the other hand reported that their women only visited the health facility for information during pre and post natal care after which they did not return at later stages when the children were sick. However, some of them indicated that they had to force their women to the hospital when a child was sick. It was argued that the fear of women seeing their children to hospital was based on either ignorance, lack of money or language barrier as many doctors and nurses in the facility used Swahili that was not understood by all community members depending on their literacy levels in the study area. This claim was supported by another study by Awoke (2013) which indicated that there were a significant number of mothers (27.3%) who did not seek treatment from health facilities for their children below five years. The study attributed this caregivers'

behavior to the assumption that the illness was not serious (53%) while 26.7% of the mothers linking it to lack of money.

Awoke (2013) noted that a significant number of mothers/caregivers (13.3%) did not see any benefit of taking their child to a healthcare facility. This created a worrying trend that necessitated the designing of a tailored health message for mothers and caregivers of children about the role of health information and health facilities in reducing the incidences of preventable childhood illnesses like diarrhea, acute respiratory infection among others. A male respondent said,

I do not know what happened at the hospital that our women do not want to see their children to hospital when sick. Some say that the doctors speak Swahili and it is hard for them to explain their status and that of the children in Swahili. But during pregnancy they are there until they deliver, though not all of them. Male FGD No.#1 Ndhiwa

Table 6.1 further provides evidence that accessibility to health information is still a challenge in many parts of Homabay County. The study found out that only 12.9% of the respondents received health information on a daily basis. Majority of the respondents (27.4%) received such information on a quarterly basis while 23.5% indicated that they receive the information on a weekly basis. 22.3% of the respondents received health information on a monthly basis while 8.1% received information on yearly basis. It was interesting to note that 5.8% of the respondents did not get any health information at all which may be a contributing factor in the rising cases of diarrhea and other hygiene related diseases in the study area.

Table 6.1: Distribution of the respondents with respect to health information

Item		Frequency	Percent
Health information	A friend or relative	39	13.4
	Radio	105	36.0
	Television	4	1.4
	Community Health Volunteer/Hospital	135	46.2
	Books and newspapers	4	1.4
	Notice and billboards	2	0.7
	Church	3	1.0
Freq of health matters	Daily	40	12.9
	Weekly	73	23.5
	Monthly	69	22.3
	Quarterly	85	27.4
	Yearly	25	8.1
	Not at all	18	5.8

6.3 Caregivers' knowledge on diarrhea

A total of 94.9% of the respondents who participated in the study acknowledged knowing diarrhea. Majority of the respondents were able to identify a number of signs related to diarrhea among children below five years. For instance, 203 (64.2%) of the respondents reported 3-4 unformed stools in 24 hours as a sign of diarrhea while 32% indicated that diarrhea is associated with abdominal pain. Vomiting was also identified by 27.5% of the respondents and only 21.5% linked fever with diarrhea among children below five years. Additionally, 15.8% and 10.8% mentioned fecal urgency and cramps as signs of diarrhea respectively with small percentages of 9.5% and 3.2% of respondents mentioning nausea and blood stains or mucus in stool respectively, as symptoms of diarrhea as evidenced in Table 6.2.

Table 6.2: Main signs and symptoms of diarrhea

	Frequency	Percent
3-4 Unformed stools in 24 hours	203	64.2
Abdominal pain	101	32.0
Fecal agency	50	15.8
Cramps	34	10.8
Nausea	30	9.5
Vomiting	87	27.5
Fever	68	21.5
Blood/mucus in stool	10	3.2

A Chi-square test was calculated to compare the knowledge of diarrhea and awareness of the signs of diarrhea. There was no significant relationship between knowledge of diarrhea and awareness of the signs ($\chi^2 (7) = 9.542, p=0.216$). The findings can be deduced to mean that regardless of the knowledge of diarrhea as a condition the situation of actual awareness of the signs predisposing the condition may not have sufficed in the population as shown in Table 6. 3.

Table 6.3 Chi-square test on the knowledge of diarrhea and awareness of the signs of diarrhea

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.542 ^a	7	0.216
Likelihood Ratio	10.948	7	0.141
Linear-by-Linear Association	3.860	1	0.049
N of Valid Cases	315		

a. 7 cells (43.8%) have expected count less than 5. The minimum expected count is .31.

The study equally established that other than knowing the signs of diarrhea, the participants in the study area were observed to have varied types of diarrhea defined by their causes, color and looseness. The types were essential as they reported each having a different technique for treatment. The commonly mentioned types were,

Green watery stool (Orianyanja)

Loose brownish stool (Caused by dirty water and food) it comes in line with malaria. When taken to hospital then the child is diagnosed with malaria

Yellow, whitish stool (Karenda renda-Father living an adulterous life)

Green and yellow (A child is put on diet above its age)

Extensive eating (Treated by one bottle top of chang'aa)

Blood diarrhea (Caused by varied cooking oils such as Poa, Chipsy, Somo, Fry Kings, Sunshine written free from cholesterol). Male Participant FGD No.#1 Ndhiwa

The study deduced that the variation in knowledge on diarrheal diseases and their treatments explains why the populations in the study area sought health information and treatment from wide-ranging sources. For instance, there are high chances that children with whitish yellow stool diarrhea will not be taken to the health facility when the caregivers/mother believes that such diarrhea in children below five years is a proof that the father is living an adulterous life.

A Chi-square test was calculated to relate the diarrhea cases in children under five years and the ages of the mother of the child under five years shown in Table 6.4. There was no significant relationship between incidences of diarrhea in children aged less than five years and the ages of the mothers with children under five years old ($\chi^2 (4) = 7.891$, $p=0.096$). The study thus deduced that statistically there was thus no significant

relationship between incidences of diarrhea in children aged less than five years and the ages of the mothers with children under five years old. The statistical findings can be interpreted to mean that regardless of the mothers' age, other factors not attributed to the care accorded the child may lead to incidences of diarrhea in the children under five years.

Table 6.4 Pearson chi-square test on the relationship between diarrhea cases in children under five years and the age of the mother of the child under five

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.891 ^a	4	0.096
Likelihood Ratio	8.713	4	0.069
Linear-by-Linear Association	2.718	1	0.099
N of Valid Cases	315		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 2.92.

A further Chi-square test was calculated to find out the relationship between diarrhea cases in children under five years and the highest education levels of the household heads as shown in Table 6.5. There was no significant relationship between incidences of diarrhea in children aged less than five years and the education level of the mothers with children under five years old ($\chi^2(5)=2.914$, $p=0.713$). The statistical findings can be interpreted to mean that household education levels notwithstanding other factors are not related to the knowledge levels of the household heads may occasion incidences of

diarrhea in the children under five years. These findings further reinforced the position of the children's mother's ages equally not being a predisposing factor to the occurrence of diarrhea. A study that was conducted by Mengistie, Berhane and Worku (2013) in Eastern Ethiopia contradicted these findings when it established through a multivariate logic regression analysis that maternal education had a significant relationship with the occurrence of diarrhea among children below five years. The analysis indicated that children whose mothers had low education level were five times more likely to have diarrhea as opposed to the children who have higher educated mothers (AOR [95% CI] = 5.6 [1.52, 19.4]).

Table 6.5 Pearson chi-square test on the relationship between diarrhea cases in children under five years and the highest education levels of the household heads

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.914 ^a	5	0.713
Likelihood Ratio	2.896	5	0.716
Linear-by-Linear Association	1.366	1	0.242
N of Valid Cases	315		

2 cells (16.7%) have expected count less than 5. The minimum expected count is 1.83.

Fig 6.1 shows that the children who had stool in the last 2 weeks experienced it in varied frequencies, an equal rate of 33.8% of the respondents argued that their children experienced diarrhea at a frequency of 3 episodes per day and 3-4 per day. 22.1%

reported a frequency of 4 episodes per day and the remaining 10.4% experienced frequencies of more than 4 times a day.

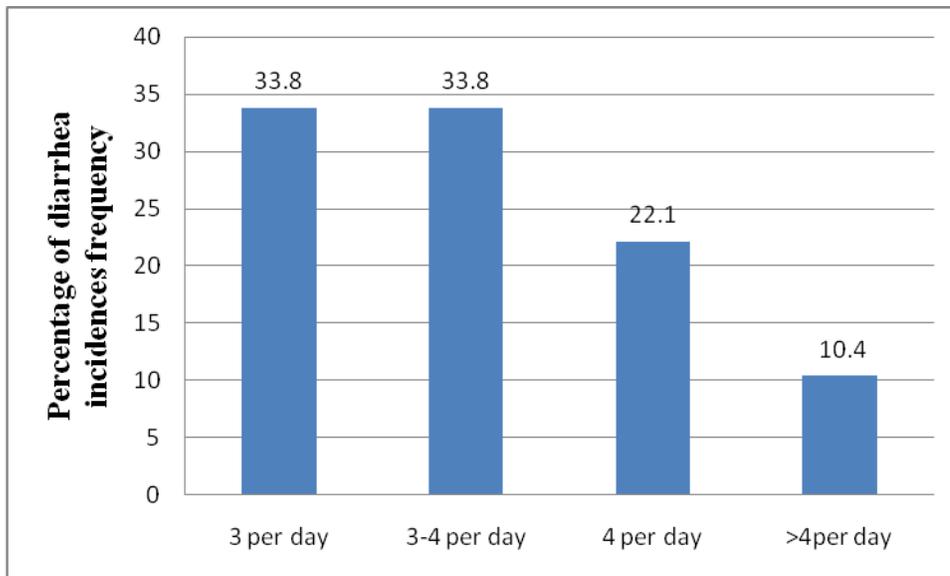


Figure 6.1: Diarrhea incidences frequency

Table 6.6 shows that more than 192 (61.9%) of the respondents reported organisms entering the body as the highest cause of diarrhea, 54 (17.2%) reported worm infection as a cause of diarrhea, while only 1(0.3%) of the respondents linked it to evil spirits. It was noted that only 1 (0.3%) of the respondents were not aware of any causes of the disease.

Table 6.6: Distribution of the Respondents with Regard to Causes of diarrhea perceptions

	Frequency	Percent
	1	0.3
Indigestible food	30	9.6
Worm infection	54	17.2
Crawling	9	2.9
Teething	27	8.6
Organisms entering the body	192	61.9
Don't know	1	0.3

The results from those who answered the semi-structured questionnaire that was administered during data collection were in line with that of the participants since they also indicated that organisms entering the body were the highest cause of diarrhea among children below five years of age. The organisms are said to develop as a result of poor hygiene in the area. The area of study had evidence of poor sanitation with some having no toilets at all. In Ndhiwa and Mbita, the study found out that the construction of toilets was so difficult due to loose soils. The participants in the study revealed that any time they raised the latrines then they would sink after a short while and more especially during the rainy seasons. Moreover, a number of them have latrines constructed for the chief to avoid being in conflict with the law. A male respondent from Ndhiwa argued that,

Truly speaking, our children have diarrhea because we do not have latrines. In this area we cannot construct reasonable toilets since the soil sinks with them. Constructing a good toilet is so expensive and due to poverty we cannot afford that. Hence we use the bush. But when we hear that the health people and the chief are doing inspection, then we dig a one fit pit and construct it well so that when the chief comes, we have a toilet. We always call it 'Choo mar chief (Toilet for chief)'. Male Participant FGD No #1 Ndhiwa

The aspect of diarrhea being a health hazard to children was agreed upon by 311 (99.4%) of the respondents. Majority of the respondents reported that they were aware of the best ways to prevent diarrhea. Only 45 (22.5%) of the respondents reported having ORS sachets in their houses and 166 (82.6%) of the respondents reported their children having not received ORS sachet in the last 2 weeks. Treatment of diarrhea in the study was not aligned to the existence of ORS sachets available in the household. The responses from the participants in FGDs and KIIs demonstrated that the community resorted to other contingency measures before undertaking conventional treatment methods. This was

based on the fact that varied kinds of diarrhea were treated differently. Moreover, they sought health services from other sources before resorting to the hospital or modern techniques of treating diarrhea. One of the PHOs argued that,

Some children are treated at home and they get cured. But a wide number do not get well and run to the health facility. However, in cases of bewitching, traditional herbs are considered as a solution and when it persists they run to us and they are warned not to give injection in such cases. We try to explain and later on they understand. They believe that if injection is administered then the child will die. Male Participant PHO No. #3 Mbita

The study findings concurred with the position taken by (NIPSP, 2007; Arifeen *et al.*, 2001) which opined that ignorance amongst caretakers is a significant contributing factor towards the diarrheal infection of children under the age of 5. In Pakistan, awareness on the importance of proper waste disposal and exclusive breastfeeding (only 2.2% were aware) was acutely low amongst caregivers. Kenya is also plagued by a lack of knowledge among caregivers on causes and management of diarrhea among children under five years which was discovered to be a contributing factor towards the mortality rate of 86 children per day and in 2010. Research has revealed that approximately 30% of Kenyan children infected by diarrheal diseases did not receive any oral rehydration salts or fluids (IRIN News, 2010). Table 6.7 shows awareness of diarrhea treatment.

Table 6.7: Descriptive Statistics for awareness of the diarrhea treatment

	Mean	Std. Deviation	N
Current treatment for diarrhea	1.36	.481	315
New current recommended treatment for diarrhea	2.91	1.692	315
Frequency of administering ORS solution	1.53	1.124	315
Amount of ORS solution for a child with loose stool	1.88	1.082	315
ORS sachet	1.86	0.350	315

The study made a follow up means analysis on the awareness of diarrhea treatment among the residents of Homabay County. The means analysis for the awareness of the current treatment of diarrhea showed that the attribute with the highest influence over the awareness of the current treatment of diarrhea was acknowledgement of the current treatment for diarrhea. This denoted the ability of the respondents to appreciate the recommended treatment for diarrhea and it was a factor which showed enhanced ability as regards the capacity to embrace the prevailing dynamics of the treatment regimens for diarrhea.

ORS was the mostly mentioned new treatment method by 60% of the respondents, 39% reported ORS + Zinc as the current treatment method while 1.0% reported Flagyl as a new treatment as illustrated in the Table 6.7. The responses further showed the frequency of ORS and Zinc administration to their children in diarrhea incidences. 62.2% reported not knowing how frequently Zinc solution should be administered, 35.2% reported administering of the Zinc 1-3 times and the remaining 2.6% reported administering the Zinc solution 4-5 times.

The mothers were observed to use both traditional and scientific methods. The use of multiple techniques explains why there is variation in number of those mentioning varied techniques. The commonly used scientific techniques were ORS, Flagyl, Doxy and Zinc Sulphate (Zwisler, Simpson and Moodley, 2013). The ORS and Zinc were reported to be obtained from the CHEWs in the community and also from the pharmacists. The response from the semi-structured questionnaire showed that ORS and zinc were the common treatment method. Additionally, the responses from the pharmacists, nurses, CHEWs and public health officers mentioned the regimens as the first to be administered to re-dehydrate the baby. One of the Nurses reported that,

We are not able to test the stool for children and so we first give ORS and Zinc Sulphate to re-dehydrate the child. Male Nurse No.#4 Rangwe

In contrast, however, other studies showed that caretakers in urban areas did not always exhibit positive health seeking behaviors. A study undertaken in two urban slums in Nairobi between 2006 and 2010 showed that 55 per cent of the caretakers in these two slums took highly inappropriate care whilst 35 per cent took no action whatsoever

(Mukiira , 2012). This seemed to show that it was not the mere setting that had an impact on care-seeking but other factors such as poverty levels since both rural and urban slum areas were characterised by poverty levels and lack of a proper health care infrastructure (Wilson *et al.*, 2013). Table 6.8 show the mixing of ORS solution.

**Table 6.8 Mixing ORS solution, the frequency and quantities
For children given ORS solution, how is it mixed?**

Responses	Frequency	Percentage
Correctly (1 sachet in 1 litre of water)	129	41.0
Incorrectly	173	54.9
Don't know/can't answer	13	4.1
Total	315	100.0
How many times (frequency)		
Every time the child has loose stool	247	78.4
Don't know/can't answer	20	6.3
1-2	6	1.9
3-4	33	10.5
Above 5	9	2.9
Total	315	100.0
How much ORS solution should be given to the child each time the child has loose stool?		
As much as the child can drink	132	41.9
Don't know/can't answer	141	44.8
1-2 spoons	11	3.5
3-4 spoons	10	3.2
Above 5	21	6.7
Total	315	100.0

As illustrated in Table 6.8, the study found out that 41% of the respondents were able to mix ORS correctly while 54.9% recorded wrong mixing of the ORS. Only 13 (4.1 %) of respondents admitted that they did not know how to mix the ORS sachet content. The results obtained showed that 78.4% of the respondents administered ORS every time a child had loose stool as recommended by (WHO, 2011). Only 6.3% indicated that they

didn't know the number of times it should be administered while 1.9% respondents indicated that ORS should be administered 1-2 times a day. Similarly, 10.5% of the respondents said they administered ORS 3-4 times a day while 2.9% indicated that they gave ORS above 5 times to a child suffering from diarrhea.. The respondents were of the view that the ORS solution should be given to a child every time that they have a loose stool at 41.9%, 44.8% didn't know 3.5% 1-2 spoonfuls, 6.7% 3-4 spoonfuls and 6.5% above 5 spoonfuls. This was an indication that the requisite exposure and knowledge levels had not been realized in the community as regards the usage and regimes allowable for the ORS solution.

The study sought to find out the presence of ORS solution at home, length of time kept after preparation and incidences of failure to get the ORS solution when needed. The results are shown in indicated in Table 6.9.

Table 6.9 Presence of ORS solution at home, length of time kept after preparation and incidences of failure to get the ORS solution when needed

	Frequency	Percentage
ORS present	45	14.3
ORS not present	270	85.7
Total	315	100.0
How long should you keep the prepared ORS solution?		
Until it is finished	71	22.5
Don't know/can't answer	132	41.9
0-1 days	101	32.1
2-3 days	10	3.2
Above 3 days	1	.3
Total	315	100.0
Have you ever failed to get ORS solution to treat diarrhea?		
Yes	117	36.1
No	198	63.9
Total	315	100.0

The study found that 14.3% of the respondents had ORS sachets in their homes at the moment of conducting the research while 85.7% did not have. The responses reflected a situation whereby adoption and usage of the ORS solution was low in the study community as evidenced during the data collection exercise. Awareness on the length of time that the ORS solutions should be kept after preparation showed that most of the respondents did not know and could not answer (41.9%) while (22.5%) were of the view that it should be kept until finished. Only (32.1%) were of the opinion that ORS should be kept for 0-1 days after preparation. Finally, (3.2%) indicated that ORS should be kept for 2-3 days while 0.3% said that it should be kept above three days. This was an indication that the knowledge levels as regards the period of time that the ORS solution could be kept after preparation was not good in the local community and there was need to enlighten the community as pertains to the handling and storage of the solution. This was in line with the recommendations made by (Wilson *et al.*, 2013). Instances whereby the local community members had failed to get ORS solution to treat diarrhea were evident in (36.1%) of the respondents. This was an indication that in some instances the situation of diarrhea management had failed to be actualized owing to the failure to access ORS solution by the local community members when they needed to. This was evident that the risk of failure to effectively manage diarrhea was profound in the local community since ORS solution was sometimes unavailable in the requisite manner.

Table 6.10 shows the opportunity of purchasing ORS solution and the water used.

Table 6.10 Opportunity of purchasing ORS solution and the water used

	Frequency	Percentage
Purchase	69	21.9
No Purchase	246	78.1
Total	315	100.0
What water do you use to mix ORS solution?		
Previously boiled and cooled water	246	78.4
Water also used as drinking water	55	17.5
Any available water	13	4.1
Total	315	100.0

Most of the respondents had not had the opportunity of purchasing ORS for their usage (78.1%) while (21.9%) had purchased it. The responses denoted inadequacy on the part of the respondents from the community with regard to the ability to effectively purchase the ORS solution at will. The findings may also have been a pointer to the situation of the ability to access the solution from institutions providing to the local community freely thus resulting to the local community members not purchasing ORS. Most of the local community members were aware of the need to have previously boiled and cooled water used for making the ORS solution.

The responses identified with the position taken by (Mukiira, 2012) who were of the view that Oral Rehydration solution use coverage in Kenya had stayed fairly consistent for the last decade, Zinc coverage remained comparably low. According to the 2009 Kenya Demographic and Health Survey (DHS), about 39% of children were treated with ORS. None of the caregivers in Kenya had reported using Zinc for the treatment of diarrhea and

this was in line with a 2008-09 KDHS report where only 1 per cent of respondents had used zinc supplements to treat diarrhea in their children despite being introduced in the country in 2006. Even in Pakistan, inappropriate medication use had been reported with 77% of the children with diarrhea administered with antibiotics which was not recommended by the Diarrheal Disease Control Programme. In low-income peri-urban communities in Pakistan, only 2% of healthcare practitioners administered zinc supplements, 31.1% prescribed injectable medicine while 40.8% administered ORS (Quadri *et al.*, 2013).

Traditional herbs have served as medicine since time imemorial. The herbs were not administered by ordinary people but a trained person in the field. The women and men in the study reported herbs and traditional practices being adopted in case of diarrhea to administer treatment to children less than 5 years of age. The common herbs taken during diarrhea were Nyalwet, Kwach, Omweny, mwarubaini and Akech. These are plants whose different parts such leaves, roots and trunk are used as medicine to cure diarrhea. For instance, the leaves, roots and the bark of mwarubaini are boiled in water and then the water administered as medicine. The roots of Omweny are crashed and mixed with water and then taken as medicine. With Akech, the leaves are boiled and the solution taken as treatment for diarrhea. One of the male respondents in Ndhiwa argued that,

Our women use traditional herbs such as Omweny, Akech, Kwach and Nyalwet to treat diarrhea. The herbs are very bitter and we give the solution to the children and they are just fine. Male Participant FGD No.#1 Ndhiwa

To deal with certain cases of diarrhea, traditional practices have to be conducted for treatment. Others involve washing of breasts, greeting of strangers, collecting of dust at crossroads and burning them in a metal plate over a child's head as well as crossing of a particular type of grass for cure. The varied practices were meant to treat diarrhea of different causes. For instance, the man who engages another woman and not the wife has to secretly go and cross the grass for the child's diarrhea to stop. Additionally, the situation is also treated by a woman collecting dust from a crossroad and burning it over the child's head. Greeting of strangers and washing of the breast is a practice to be conducted by the woman to avoid the spirit of women who lost their children not to follow them and cause diarrhea to their own. One of the female respondents in Rachuonyo argued that,

Our mothers in law tell us that we go and collect dust from a crossroad and burn the dust over the child's head when the diarrhea is caused by a man's unfaithful behavior. Female Participant FGD No.#4 Rachuonyo

The Table 6.11 illustrates that 31 (88.6%) of the respondents got the ORS sachets from the government health facility, and 2 (5.7) reported getting the sachet from the CHV while 1(2.9) reported getting the sachet from the private clinic and the drug shops.

Table 6.11: Distribution of the respondents with regard to where they went for the ORS Sachet

	Frequency	Percent
Government health facility	31	88.6
Private clinic	1	2.9
Drug shop/Chemist	1	2.9
Community Health Volunteers	2	5.7

The findings in the study area are a contrast to research carried out in Pakistan where an analysis into where treatment was sought by caretakers during the onset of diarrhea on children was likewise crucial. In low-income peri-urban areas, the first place that caretakers chose to seek care for the children was a local licensed doctor (56.2%) (Quadri *et al.*, 2013). The study obtained consistent results with a similar research in Ethiopia where an overwhelming majority of caretakers (87.2%) indicated that they sought treatment for their children from the health facilities while a comparatively lower number of 72.7 per cent of caretakers in the rural region of Bahir Dar sought care from governmental and private health care facilities (Assefa, 2008). Caretakers in Niger preferred health centres and health posts with less than 10 percent seeking care in a hospital (Page *et al.*, 2011). In Kenya’s urban slum settlements, mothers preferred to give their sick children home treatments or over the counter products, only seeking health care after symptoms had exacerbated to dangerous levels (Mukiira, 2012; African Population and Health Research Centre, 2002).

The study investigated the duration taken to seek treatment when a child experienced diarrhea and the results are indicated in figure 6.2.

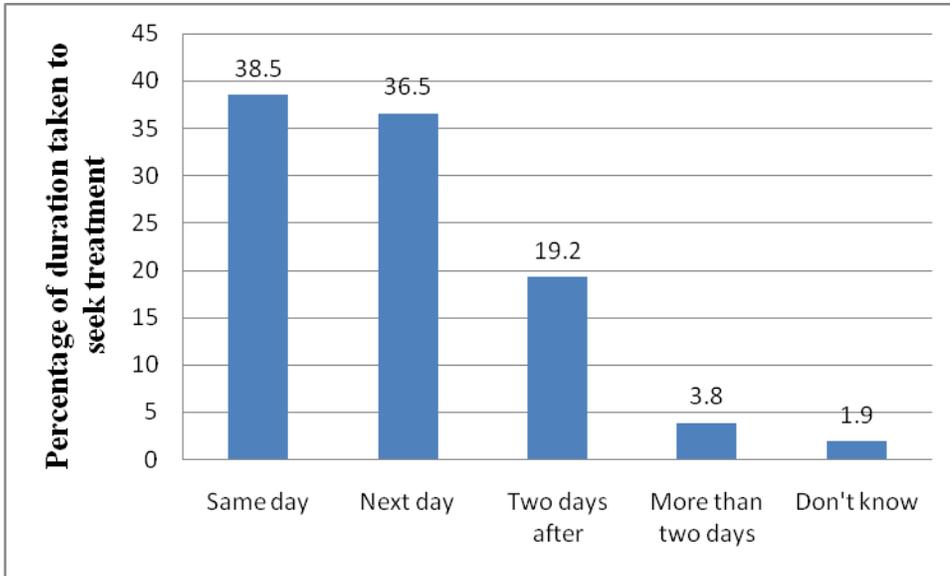


Figure 6.2: Duration taken to seek treatment when child experienced diarrhea

With regard to the duration taken by the caregivers to seek treatment in case the child developed diarrhea, a total of 20 (38.5%) reported seeking treatment in the same day, 31.9% reported seeking treatment the next day, 19 (36.5%) reported seeking treatment two days after while 1 (1.9%) didn't know.

Almost half of the respondents (46.8%) reported the health center to be the nearest facility, 43.3% reported dispensary being close, the drug shop was mentioned to be close by 5.4%, 2.5% was mentioned to be close by private clinic hospitals and the remaining 1.9% mentioned the herbalist to be the closet facility (Table 6.12). Other than the closest facility, the majority of the respondents (50.3%) reported seeking treatment from the health center when the child was sick. 41.4% reported seeking treatment from the dispensary, an equal rate of 3.8% was reported by respondents who seek treatment from

drugs shop and private clinics. The remaining 0.6% recorded seeking treatment from the herbalist as illustrated in Table 6.12.

Page *et al.* (2011) found contrasting results on the health seeking behavior of mothers and caregivers of children below five years in rural Niger who suffered from diarrhea during the recall period. More than 70.4% (95% CI: 66.6-74.1) reported to have sought for healthcare from health facilities while in severe cases, it is reported that 83.8% (95% CI 75.2-92.4) sought for medical care from the health facilities near their residence.

Table 6.12: Distribution of the respondents with respect to facility closest to the household and seeking treatment for the child

Item	Frequency	Percent	
Closest-facility	Drugs shop	17	5.4
	Health center	147	46.8
	Dispensary	136	43.3
	Private clinic hospital	8	2.5
	Herbalist	6	1.9
Seeking-Treatment-for child	Drug shop	12	3.8
	Health Center	158	50.3
	Dispensary	130	41.4
	Private clinic hospital	12	3.8
	Herbalist	2	0.6
Choice of the place for treatment	Confidence that the child will be cured	105	33.5
	Services available anytime	116	37.1
	Referred by previous provider	4	1.3
	Free services	23	7.3
	Closer to Home	65	20.8

Table 6.12 further shows that the choice of the place to seek treatment varied from a number of respondents to another. A proportion of 33.5% of the caregivers indicated that their choice of the facility to seek treatment was based on the fact that there was confidence that the child would be cured, 37.1% reported choice of the place due to services being available all the time while 20.8% of the respondents reported choice of the facility due to its closeness to home. Only 7.3% of the respondents reported choosing the facility due to free services and the remaining 1.3% chose the place because they were referred by previous provider.

The choice of place of treatment and why it was considered best for seeking treatment for children was based on advice given from various sources. Generally people tend to seek treatment in regard to the advice they receive from neighbors. The participants acknowledged having sought for advice on care for under 5 years outside the home. The theory of interdependence in humanity was observed to also apply to care given to under 5 years children in the study area. The choice of the participants to seek advice from outside their homes was based on a number of reasons. Distance, doctors' attitudes, availability of money and bad experience in hospitals pushed people to look for alternatives. In a male FGD in Ndhiwa a participant in Ndhiwa argued that,

The nearest hospital we have here is Ndhiwa District Hospital. It is one being used by people around this place and beyond. When you go there with your child when sick the queue is long and they give numbers like the cooperative bank you cannot crossover and at times the child ends up dying in the queue the woman returns home wailing. Next time we opt for the pharmacy than getting a long queue that leads to death. Male Participant FGD No.#1 Ndhiwa

The statement contradicts that response of health facilities being the area for seeking treatment and choice for medication. The long queues and least attention accorded to emergency cases in hospitals and the attitudes of health practitioners explains why many people fail to seek treatment of children from the hospital until the condition of the child gets beyond other treatment sources.

The respondents gave varied opinions over why some people do not seek health care at the hospitals. 28.8% reported not having money as the barrier, 14% recorded bad experience, 12.1% reported not knowing the reason behind such practice, 10.8% mentioned traditional beliefs and religion while 9.2% recorded the belief that the child will get well over some time. It was interesting to note that 7.3% mentioned fear of getting tested while 7.6% and 7% gave reasons of long waiting time at the facility and the far distance respectively, as a barrier to seeking health care. The remaining 3.8% reported ease in getting drug shop as the reason for not seeking health care at the health facility as indicated in Table 6.13. Over years, the economic positions of individuals have been reported to affect health seeking behaviors of many people in the society. The study area was not an exception as participants and primary household questionnaire respondents reported poverty as a barrier to their health seeking practices. A participant from the female FGD in Ndhiwa argued that,

Truly, poverty is another thing that has made people not to go to hospitals. That money you would take to the hospital, because the treatment is not free there are at times we are to pay for small things like books, syringe and such like things and we do not have that money to feed and pay for treatment so we rather buy food and use other forms of treatment. Female Participant FGD No.#2 Ndhiwa

Additionally, the information from a male respondent in Ogongo village said,

Actually in our area here, poverty is what is affecting many people. Let me give you an example of even this water guard for treating water many people cannot buy. That is why diarrhea cannot come to an end in this area. Male Participant FGD No.#7 Rangwe

The responses above exhibit the reasons behind poor health seeking behavior. The participant from Ogongo explains that as long as poverty is still a problem in the community then diarrhea among children under 5 years will not be brought to a stop as the prevention mechanisms cannot be attained and the correct medication cannot also be accessed.

The table further illustrates that more than half of the respondents (55.1%) take between 15-60 minutes to travel to the facility. A total of 31.8% take less than 15 minutes to get to the facility while 10.2% take between 60-120 minutes to travel to the facility and the remaining 2.9% mentioned a period greater than 2 hours used to travel to the health facility.

According to Webair and Bin-Gouth (2013) increased number of children dying before their fifth birthday is largely attributed to the caregivers' delays in accessing quality healthcare for the child. The study explains this delay using the three-delay model in which the first delay is experienced while the caregiver is taking time to decide whether to seek care or not, second delay happens when identifying and reaching the health facility while the third delay takes place on receiving adequate and appropriate treatment for diarrheal diseases.

The findings of this study are consistent with those of other earlier studies explaining the delay experienced between the onsets of a disease to the time the child gets access to quality healthcare (D'Souza, 2003; Kallander *et al.*, 2008). Webair & Bin-Gouth (2013) documented that despite the fact that 122 caretakers considered their children's illness as severe, only 19 of them took the sick children for medical care during the first day of the illness. The study also indicated that

about 43% of those who sought medical services and advice at the healthcare centres did so 24 hours after the onset.

Table 6.13: Distribution of the respondents with respect to seeking health care at the hospital.

Item		Frequency	Percent
People don't seek health	Too far	22	7.0
	Long waiting time at the health facility	24	7.6
	They have no money to pay	88	28.0
	ad experience	44	14.0
	Belief that the child will get well with time	29	9.2
	Easy to get drug from shop	12	3.8
	Fear to get tested	23	7.3
	Traditional beliefs and religion	34	10.8
Don't know	38	12.1	
Time to travel to the Facility	Less than 15 minutes	100	31.8
	15-60 minutes	173	55.1
	60-120 minutes	32	10.2
	Greater than 2hrs	9	2.9
Decision to take the child to hospital	Head of household (Father)	20	6.4
	Mother	221	70.4
	Both parents	68	21.7
	Guardian	5	1.6

In the Table 6.13, respondents recorded various persons who make decisions on whether the child is to be taken to hospital. A majority of 70.4% reported the mother to be the one deciding on whether the child is to be taken to hospital, 21.7% reported both parents making the decision, 6.4% mentioned the household head or the father being the one deciding on whether the child is to be taken to hospital and the remaining 1.6%

mentioned the decision being made by the guardian. The process of care provided for children under five years of age faces influence from aspects of decision making within the households. The background on which many women in the African society are brought up to believe that the man is the sole bread winner in the family, has made women look at men as the core providers in the household. The women reported their male partners to be the decision makers for they are the bread winners. One of the women from a female FGD in Ogongo village argued that,

If best the decision is to be made by the two parents, but in most cases it is our husbands who make the decisions for they provide finances. Female Participant FGD No.#8 Rangwe

The idea was opposed by some women and the opposition seconded by the responses of some male participants in various parts of the study area. In the normal human activities, the woman is believed to provide care and most of the time they take a lot of time with the children. The female participants in all the FGDs in the four areas of study acknowledged being the decision makers in the household as they stay with the children over a long period compared to their male partners. One of the female participants from Rangwe argued that,

The information was confirmed by a female participant from Ndhiwa who said,

You know we are the decision makers in the households but our husbands provide the money. We stay with the children all time and when they are sick we are the ones who know what is happening and not our men, they only stay at night with the children. Female Participant FGD No.#8 Rangwe

The findings of odds ratio values for awareness of danger signs of diarrhea and presence of ORS sachet are shown in Table 6.14.

Table 6.14 Odds ratio for awareness of danger signs of diarrhea and presence of an ORS sachet in the house

	Value	95% Confidence Interval	
		Lower	Upper
ORS sachet at home	2.047	0.260	16.136
For cohort knowledge of any danger signs related to diarrhea in a child = Yes	1.023	0.972	1.077
For cohort knowledge of any danger signs related to diarrhea in a child = No	0.500	.067	3.752
N of Valid Cases	315		

The odds ratio of presence of an ORS sachet in the house and knowledge of danger signs related to diarrhea showed that the probability of awareness of the diarrhea signs for households which had ORS sachets was 1.023 in comparison to 0.500 for those which did not have. This was confirmation that the awareness of the risks associated with diarrhea influenced the respondents to have ORS sachets in the households.

6.4 Summary

This chapter concentrated on health information and knowledge on diarrhea possessed by the care givers. Various sources of information, formal and informal from where the caregivers fetch knowledge on diarrhea were discussed at length. The commonly used sources for such information are mentioned and reasons supported by empirical evidence

given to make the information in the study reliable and essential for scientific knowledge. Comparisons on the effectiveness of informal and formal sources are given and factors that push caregivers to go for either of the sources explained. In the study, informal and formal sources of information have been elaborated with their pros and cons. The study does not dispute any of them but recommends on strength they would bring if synergy is created. Working with the gathered data, it brings on board their chances of being sustainable in curbing diarrhea incidences among children below five years, a discussion that is more elucidated in the next chapter.

CHAPTER SEVEN

SUSTAINABILITY STRATEGIES OF EXISTING INTERVENTIONS AIMED AT CURBING DIARRHEA MORBIDITY

7.1 Introduction

Sustainability of every program is always deemed necessary for it to be considered successful and ongoing as at the time of implementation. Various organizations have been working towards curbing diarrhea morbidity among children below five years. Quite a number of interventions such as the construction of latrines, observing hygiene, distribution of oral regimen for managing diarrhea among children under five years and many more have been put in place over time and space. This chapter will cover various strategies that have been put in place within the area of study to sustain the interventions aimed at curbing diarrhea morbidity.

7.2 Sustainability of community sanitation interventions

In this study, priorities given to water sanitation interventions were defined within particular documents within the county. The PHOs reported varied documents that mentioned sanitation interventions as illustrated in the Table 7.1. The mentioning of the documents is an indicator that the county has in its plans varied techniques to provide the right sanitation services to the community to help curb the morbidity of children under five in the area. Extensively, the study aimed to find out the varied kinds of sustainability strategies used within the study area to maintain interventions employed to curb diarrhea morbidity. Sustainability had a specific definition aligned to maintenance of interventions developed within the area as discussed further in this study.

Table 7.1: Distribution of the participants with respect to documents outlining priorities of water sanitation intervention in the county

PHO Frequency	Documents
2	County Government Act
3	County Integrated Development Plan
1	Water Sampling
1	Implementation of Community Led Total Sanitation
2	Population Dynamics, Environment and Sustainable Development in Homa Bay County
1	Household Water Treatment
1	Provision of Protected Water Points and Piped Water

According to Scoones (2007) sustainability of sanitation interventions refers to the ability to maintain interventions aimed at reducing diarrhea morbidity among children below 5 years for a longer period of time. Sugden (2003) argues that the implementation of sanitation interventions targeting to reduce diarrhea morbidity is not as challenging as sustaining the interventions. He defined sustainability of sanitation interventions by assessing if the adopted interventions are maintained in their functioning. For instance, the provision of latrine facility is an effective intervention towards the reduction of diarrheal morbidity; however the sustainability of the intervention is determined by the ability to keep the facility clean, use it properly and easy accessibility by the population in question (Hanchett *et al.*, 2011)

The findings of the study established that despite the fact that there existed various sanitation interventions in Homabay County, their proper use, maintenance and sustained benefit remains a pipeline dream. For instance, analysis of the facilities used for defecating at various households indicated that 210 (66.8%) had a latrine as a defecating facility in the homes but still a significant number of people 101 (31.9%) used the bush for defecating. Similarly, the number of people cleaning their latrines on a daily basis is still low hence predisposing the residents to diarrhea and other hygiene related diseases.

Results obtained from the study corroborated with the ideas of Hanchett *et al.* (2011). The mentioning of latrine as an intervention to help reduce the diarrhea morbidity was recorded across the sub areas of the study. According to the household respondents, the latrine facility was mentioned as an essential component that can enhance diarrhea in absentia. A mean of 70% of the participants within the ministry of health and the suppliers in the study area supported the statement. They believed proper construction and use of latrine facilities would save the lives of children under five years of age within the study area. The argument was supported based on the fact that poor sanitation was highly reported in the region due to poor soils, poverty and negative attitudes towards construction of permanent latrines.

The Public Health Officers within the county gave varied interventions employed in the region to enhance care for children under five against diarrhea. Majority of the PHOs, (100%) recorded promotion CLTS as one of the interventions used in the area. In addition, they also mentioned water sampling, Partners approach, legal and enforcement approach, provision and distribution of water treatment items, and health education against pollution of water points.

Promotion of CLTS was recorded by the majority of the PHOs, (100%) who participated in the study as one of the interventions used in the area to reduce the incidences of diarrhea among children below the age of five years. In the study area, CTLS is an approach that involves construction and promoting the use of latrines as a method used in reducing the levels of diarrhea in Homa Bay County. The mentioning was supported in the documentation of the County government's act as well as Implementation of CLTS and the community Integrated development plan. The declaration of the approach and its existence in the County documents is an indicator that Homa Bay County has it in their plans to ensure that the study area has a standard sanitation system.

The study found out that majority of the Nurses, CHEWs, Private Suppliers and Drug sellers supported the argument of the PHOs that CTLS program has positively contributed in reducing diarrhea incidents among the children below five years. One of the nurses, number 3 from Rangwe argued that;

The construction of latrines is core approach in managing diarrhea among children under five years of age. It is for this reason that we train our patients when they visit the facility to seek treatment in case of diarrhea.

Majority of the respondents indicated that the CLTS program that emphasized on the need to have improved latrines has significantly contributed to the reduction of diarrhea among children below the age of five years. It is evident that the state of the latrines used in most of the households before the intervention has greatly improved after CLTS program was implemented. Apart from the latrines, the other approaches that were mentioned by the participants in the study included; health education against pollution which was also mentioned by the nurses; continuous awareness mentioned by the

CHEWs and in FGDs as well as legal systems that was mentioned by the private sanitation suppliers. One of the participants in the male FGD number 1 in Ndhiwa argued that;

At Ndhiwa hospital here when a woman runs with the child to hospital as a result of diarrhea, the doctors do not run to that child's rescue as is the case with HIV. There is a very big tent there just for HIV, if you go to that tent, many doctors like thirteen will rush to check on you but on the side of child diarrhea there is no such response. So let the doctors give these diseases equal attention not ignoring others as if they are not serious and they are killer diseases too.

Sustainability of sanitation interventions may also be measured by assessing if the created structures are still existing and functioning long after they were initiated or through the use of a normative concept where outcomes or impact of a project or programme aimed at reducing diarrhea incidences are measured against preliminary defined goals. Intervention's sustainability is an important aspect because it creates a lasting improvement in the health and quality of life of the targeted population. Hanchett *et al.* (2011) points out that if there is no sustainable impact then it is a waste of resources that could have been used elsewhere and also may lead to the diminish of the community based support and trust that can impact future projects in the community. The question on sustainability is a challenge in the study area. It is evident that the County has very tangible plans to enhance proper sanitation to reduce the level of diarrhea morbidity in the area. The approach to construct latrine has been facing a number of setbacks that have hindered its implementation and sustainability. A number of social, economic and political aspects were mentioned across the study as a hindrance to construction of toilet facilities. To begin with, the PHOs reported challenges

experienced in the communities with regard to implementation and sustainability of the latrine approach as illustrated below;

In Ndhiwa, Mbita, Rangwe and Rachuonyo, PHO number 5, 3, 4 and 1 respectively argued that:

#5-Defiance and resistance to new changes in the society

#3-Poor norms and practices by community members were recorded.

#4-Non-compliance to sanitation policies

#1-Weak soil and poor weather conditions” were only mentioned to challenge the people in Ndhiwa and Mbita. On the other hand, Rangwe and Rachuonyo were the only regions facing the challenge of, “Lack of water sampling kits.

From the findings it is evident that the varied communities in the study area have resisted and defied the alternatives considered necessary to improve on the sanitation systems in the community. One of the female CHEW numbers 2 from Ndhiwa reported that,

The community is highly stuck on its past practices regarding latrine construction. The government has tried to come up with new techniques that will be essential in the development of better latrine facilities in this poor soil but they consider it to be too sophisticated for a mere latrine.

The statement develops how the community does not consider the latrine facility as an item that has to be developed in a standard manner. It is then clear why the use of the bush and the open surrounding exists in the study area. Additionally, cultural practices and traditions also influence hygiene and sanitation. Hence the communities in the study area still suffer the chains of tradition that have deterred their growth. It is evident that the government has a solution on how to develop proper latrine structures in the poor soils in the study, but their traditions and resistance to change highly influences their

response to adapt to a new technology. The poor water supply and treatment in the study area also contributes to poor sanitation in the area. Even if latrines are built with insufficient water supply the community is still likely to experience child morbidity facilitated by diarrhea.

The PHOs in the study area also provided varied challenges that have deterred latrine construction. A sum of 20% argued that failure to prioritize latrine use as a disease prevention option has made many people in the community to ignore latrine construction. Availability of large trace of land under vegetation (alternative) was considered a challenge as community members felt the need to use the land for production as opposed to developing latrines for personal use. Other mentioned challenges by a male PHO number 1 from Mbita were;

Low incomes, negative attitude regarding latrine use, collapsible soil-some latrine sink during the rainy seasons, poor soil type, ignorance, presence of bushes, traditional belief and rebellion and resistance to change i.e from lack of ownership of latrines.

Many authors have criticized sustainability interventions as they claim that these approaches have not succeeded to have a long lasting impact on the community (Devine, 2004; Scott, 2005; Movik & Mehta, 2010). However, approaches like community-led total sanitation (CLTS) and sanitation marketing have been widely perceived as promising to provide a lasting impact on behavior change beyond the duration of the project since they are still new and there are few evidences based on the evaluation to justify the perception (Mukherjee *et al.*, 2009). The ideology by Mukherjee *et al.* (2009) on improvement of management of sanitation in the community is realistic and sustainable. In Homa Bay County the CLTS has been essential in reducing the diarrhea

among under five years at a reasonable percentage. However, it cannot be sustained due to political and economic influence. The government in the study area has been on constant delay to provide sufficient facilities and resources considered necessary to enhance the CLTS programmes. One of the female Nurses number 6 from Rangwe argued that,

The county government has appreciated the CLTS as it has enabled the community to experience a reduced level of diarrhea cases among children under five years of age. We have been able to educate the community through the CHVs on best ways to manage emergency diarrhea cases as they rush to the health facility. However, the approach has been slowed down as the County government is slow in disseminating resources necessary for the implementation of the program

The statement of the nurse was also seconded by the information from a male private sanitation supplier number 4 from Rachuonyo who mentioned poor technology and high costs of latrine construction material to slow down the success of various approaches adopted by the County government in the study area. He said;

The government is really trying but the price at which the latrine construction materials are being sold is very for the poverty caged community to afford. We actually get buyers from high and middle class but those from low class do not purchase the materials because they are so expensive. So I feel it is the government to help us out by subsidizing on these prices so that a wide number of people can afford to have a latrine and save the under five years children.

The results obtained from the information provided by the PHOs also gave reasons for the failure of CLTS as an intervention in fighting diarrhea among children under five years of age. A female PHO number 3 from Ndhiwa argued that CLTS is challenged by;

Defiance and resistance to new changes in the society, poor norms and practices by community members, many are unwilling to comply willingly

to policies of sanitation, lack of water sampling kits, weak soils and unfavorable weather pattern, unreliable supply of water treatment items, increase in latrine coverage.

Another male PHO number 7 from Rangwe argued that CLTS is faced by the challenges listed below;

It is only being sought by those who are in attendance, the approach is slow since the area to be covered is big, sustainability of the latrines is a problem due to the collapsible soil, appreciably large homogenous groups of persons mobilize to improve their village sanitation and slow coverage due to minimal government funding of programs as well as communities reverting to old situation due to lack of follow ups

Kamal Kar (2010) describes Community Led Total Sanitation (CLTS) programme as a community wide behavior change that can mobilize communities to take responsibility of sanitation issues and take initiatives to stop open defecation. CLTS has been promoted in 50 countries across Asia, Africa and Latin America and has recognized that merely providing of toilets does not guarantee their use nor result in improved sanitation and hygiene. This programme was pioneered by Kamal Kar together with VERC (Village Education Resource Centre) in 2000 in Mosmoil while evaluating a traditionally subsidized sanitation programme. Kar managed in persuading the local non-governmental organization to stop down toilet construction through subsidy. He advocated for change in institutional attitude and need to draw an intense local mobilization and facilitation to enable members of the community to analyze their sanitation and waste situation and bring up a decision to stop open defecation (Kamal & Robert, 2008). Kamal Kar's argument in 2010 regarding the failure of the CLTS to improve on community hygiene is further demonstrated in the study. The construction of latrines in the study area is likely

to fail if considered to be the core approach due to the numerous social, cultural, economic and political aspects mentioned earlier.

The political and economic structures have been observed to affect CLTS performance. All the PHOs who participated in the study recorded not knowing the percentage of county budget allocated to sanitation. Extensively the PHOs had no sufficient knowhow on regulations, policy elements that support the suppliers of the materials for latrine construction. It is evident that the PHOs and other administrative structures concern with implementation and sustenance of CLTS are deemed to failure due to political hindrance within the county. It is then necessary that the authorities in the public health sector within the study area, to adopt a synergy of approaches to enable the community appreciate and possess the whole aspect of sanitation, giving meaning to the CLTS technique. Otherwise the implementation of CLTS alone is bound to fail as the community in the study area build temporary structures that will keep them safe from the arm of the law, what they commonly referred to as '*Choo mar Chief* (Toilet of Chief)'. The tag accorded to the latrines to be what the chief can see and consider the household obedient is not put to use as they run back to the bushes and open surrounding. As long as the latrines will be developed for the chief to see, the phenomenon of diarrhea in Homa Bay County will never be managed.

According to Robert (2009) CLTS has a potential for contributing towards meeting the United Nations Development Programme goals both on sanitation and water (goal 7) and impacts of improving sanitation on combating major diseases especially diarrhea, improving maternal health and reducing child mortality. He adds that it can also be an effective point of other livelihoods activities and mobilize community members towards

collective action and empower them to take action for the future. Bongartz *et al.*(2010) asserts that the CLTS outcomes can illustrate what communities can achieve by undertaking further initiatives for their own sake and future development. Plan, UNICEF and Water Aid are important disseminators and champions of CLTS.

In Uganda, 65% of rural residents had access to safe water by October 2010, while in urban areas the figure was at 67%. Despite the improvements that have been achieved with respect to sanitation and hygiene, still in the same year 30% of the Ugandan rural residents did not have access to latrines and thus continued to practice open defecation. According to the 2010 Joint Sector Review meeting, the national Uganda average sanitation coverage stood at 70% while the rural coverage was 49%. Hand washing practice coverage stood at only 28% nationally indicating that the level of utilization of this important practice is still significantly low in Uganda. In Kenya CLTS has been adopted in Mathare and Nairobi city where plan together with California Children Services (CCS) are doing an Urban Community-led Total Sanitation pilot.

According to the United Nation (2009) the main aim of Goal 7 of the Millennium development goals (MDGS) was to ensure environmental sustainability and reverse the loss of the environmental resources with specific target of reducing by half the proportion of people without sustainable access to safe drinking water and basic sanitation facilities. It is estimated that currently more than 2.5 billion people who lack access to adequate sanitation and more than 900 people all over the world lack safe drinking water (WHO, 2008).

A research conducted by Wharley and Webster (2011) in Zimbabwe compared the effectiveness and sustainability of Community Led- Total Sanitation (CLTS) and Community Health Clubs (CHC). The research indicated that the main weakness of CLTS is that it relies on relatively few face to face interactions, which is the main advantage of the community health club. They therefore concluded that long term behavior change that is likely to persist beyond a project's life time requires frequent face to face visits from outsiders in order to sustain the measures of sanitation intervention in the community (Scoones, 2007).

The study findings indicated that majority of the PHOs, CHEWs, Nurses and drug sellers were in agreement that there was need for the community to ensure sustainability of the intervention strategies put in place to guarantee continued benefits. Mihelcic *et al.* (2003) asserts that the MDG requirement for sustainable access to safe drinking water and basic sanitation needs to meet the target without compromising the ability of future generations to meet their water and sanitation needs in an economical way and without impacts on human health and the environment. Current trends have shown that in sub Saharan Africa and southern Asia the population is still struggling with low sanitation coverage. Open defecation declined globally from 24% in 1990 to 15% in 2011. This decline shows that the sustainability of the project is still not sufficient in many countries. Eastern Asia, South eastern Asia and the Latin America and Caribbean have seen a steady decline (WHO/UNICEF, 2013).

7.3 Social marketing with reference to sanitation intervention

Scott (2005) defines social marketing as a process for creating, communicating and delivering benefits that a target population requires in exchange for the community to adopt a behavior that profits the whole society. He adds that in social marketing intervention a specific behavior is targeted for modification or adoption for the benefit of the society. Similarly, Weinreich (1999) defines it as the use of commercial marketing techniques to promote the adoption that will improve the health or well-being of the population in question or the whole society. The definition of Scott (2005) and that of Weinreich (1999) have been the foundation of social marketing practices conducted in Homa Bay County. The nurses, PHOs, private sanitation suppliers, CHEWs and the drug sellers have sold out ideas of latrine development to the community to improve on their sanitation practices. The sale of sanitation ideologies was birthed by the increased rates of child morbidity facilitated by diarrhea. The commonly marketed practice by the PHOs is use of chlorine for water treatment, CLTS and construction of latrines. Only two PHOs recorded having social marketing as a part of intervention while the other three refuted the concept. The two male PHOs numbers 1 and 4 from Ndhiwa and Mbita respectively who considered marketing as an intervention were in agreement because

The CLTS approach is open to many preferences hence options should be available in the market to community and need to upgrade the existing facilities to conform to required standards and optimal functionality.

The male PHO number 1 from Ndhiwa was in a position to explain the significance of social marketing towards achievement of sanitation goals. He recorded that,

It brings on board private/public partnership in sanitation needs assessment and supply focusing and the other one thought it will avail most resources e.g. many latrines constructed and water projects too will spring up for the same.

Out of the Two PHOs whom recognized social marketing as an intervention, only one could speak of the manner in which he would be involved in monitoring of the programme. The male PHO number 4 from Mbita argued that

Probably in design and implementation of this approach at the community level and the other one said I will be involved in identifying needs of the community, linking of community and private players in sanitation e.g. hardware selling sanitation goods and monitoring standards once policies and regulations are in place.

On the other hand the private sanitation suppliers' market development of technologically improved latrines. The nurses and the CHEWs considered marketing of both proper use of latrines and use of water reagents for treatment of drinking water as they are likely to reduce high rates of contamination of drinking water. Observation of hygiene was marketed by CHEWs, Nurses and drug sellers. Additionally, the drug sellers and the CHEWs extended their marketing to use of ORS as the first treatment in case of diarrhea among children below five years of age.

In order to improve rural sanitation the community at large needs to stop the practice of open defecation, acquire and use hygiene sanitation facility, maintain the sanitation facility properly and properly dispose of children's excreta. In the past years disposal of child feces and careless defecation was recorded in the study. Not until late 2010 as recorded by the chief in Ndhiwa that the government and the health practitioners developed policies such as building of latrines and distribution of water treatment reagents. The response was positive as the communities within the study area have

managed diarrhea to a given extent. According to Scott (2005) the one key to the success of social marketing lies on the understanding of what the target population wants.

Andreasen (1995) points out that commercial marketing strives to benefit the sponsoring organization, while the benefit of the target population or the society at large is more of the primarily focus. He argues that social marketers who claim to act in the interest of the society must continuously critically question the ethicality of both their goals and the source of their revenue. Social marketing programmes aims at improving societies and to fulfill a certain set goal. They are usually aware of the competing priorities that determine consumers' behaviors and recognize the importance of promoting the desired behavior change in the society in a way that it is perceived as the top priority of the population that is targeted (Scott, 2005). It is evident that in the study area the beneficiary will not only be the community of Homa Bay but also the private sanitation product suppliers who push for improved latrine construction products that will enable stable toilet structures in the poor soil within the study area. According to the arguments of one of the male supplier's number 4 from Mbita, it is clear that the old fashion product is not highly sellable as the soil type in the region deters latrine long life. He said;

There is need for new technology in the latrine construction sector to help get sustainable latrines constructed in the poor soil. The reason being, the old fashioned materials we sell are not able to develop such latrines

Weinrich (1999) notes that the four P's of commercial marketing are usually adapted and used differently in social marketing in order to fit the purpose of social marketing and therefore they recommend the use of four additional P's, Public, Partnerships, Policy and Purse Strings that reflects on the differences of commercial and social

marketing. Kotler and Lee (2007) indicates that marketing strategies are developed around the structure of the basic 4P's framework. He argues that a clear understanding of the four P's enables the development of an appropriate sanitation product for the community, at the right price, that is easily available through its strategic sales placement and known well to the target population through promotion.

Results obtained from the study area reflect adoption of the 4ps system. However, in one way or another Ps are not highly achieved as desired due to interference of political, economic and social factors. The Public has always had its own financial constraints and cultural practices that deter proper connection with this category in the social marketing web. The public was confronted by the study to find out if they had embraced the marketed interventions to the extent of making payment for the services. The PHOs had varied reports over payment of sanitation technologies by the community. Four of the PHOs argued that the community members were not in a position to pay for sanitation technologies due to the enormous financial constrain in the area. On the other hand, one male PHO number 1 from Ndhiwa was in agreement that the community is willing to pay for sanitation technologies though they cannot do that for not many options have been made available for them. It is then possible that deficit of technological structures aligned to sanitation has denied the community to exercise their willingness to pay for the services.

Additionally, the PHOs reported a great delink with partnerships as many of the connections are done at the higher levels of the administration with little or no involvement of the facilities that directly deal with the stakeholders. The PHOs recorded that the developmental partners conduct feasibility studies before implementation of the

interventions. The PHOs considered the practice necessary for implementation of interventions as the study area is prone to frequent outbreak of diarrhea/diseases like cholera and so feasibility enables

Proper planning and implementation of the projects, in bottom up approach success is always guaranteed since methods of intervention will be acceptable to the community, to understand underlying factors to the problem they seek to solve in order to prioritize intervention areas and to ascertain if it is achievable/challenges and resources need for that work.

It is evident that the development partners seem to follow the right channel before implementation. However, a sustainability strategy of the interventions is still unattainable. It could be that the development management committee or the interventions introduced by the developmental partners are the cause to lack of sustainability. The Table 7.2 below demonstrates the existence of development management committees in the community to manage interventions. From the table majority of the participants (80%) argued that there are management committees in place at the community level while 20% refuted existence of such personnel for management of interventions on the ground (Table 7.2).

Table 7.2: Distribution of Participants in the Management Committee presiding over Sanitation Interventions at the Community Level

	Frequency	Percent
Yes	4	80.0
No	1	20.0
Total	5	100

The partnerships involved in interventions were considered of significance by all the PHOs who participated in the study. Their significance was observed by existence of a number of water projects and latrine construction within the community. A male PHO from Rangwe number 3 argued that;

Leading to springing up of many water projects in community & also improved latrine coverage, improvement in latrine coverage which has relatively reduced diarrhea diseases in the community, saves time while looking for water from long distances, increase in safe water sources, increase in uptake of latrine construction, increase in demand of usage safe water & sanitation, reduction in cases of diarrhea diseases and episodes of diarrhea disease outbreaks.

It is evident that development partnership involved in sanitation interventions in the study area followed each and every instruction deemed necessary to make the interventions a success as demonstrated by the findings from the PHOs, who are part of the intervention development and implementation strategies. One of the male PHO numbers 4 from Mbita argued that

Development partners consult/involve the public health office in design of programmatic interventions geared towards diarrhea reduction to these extents; planning, designs, implementation, the public health office is majorly involved during the surveys to get the baseline information, to greater extent, most cases do involve public health office and equally limited extent...even though they would seek opinions and large they have pre-determined budgets, guidelines and scope as well as priority areas of interest.

This then leaves the policy makers on the line of challenge as it was reported earlier that the PHOs have no information on policy structures. Hence, policy makers are not also left behind in the issue as they take long period to structure legal steps that can be used to ensure that sanitation is up to date within the study area. Therefore, the implementation of

sanitation programmes in the study area lags behind due to failure to connect the 4 Ps to the whole sanitation programme.

Peal *et al.* (2010) assert that the product within sanitation marketing approaches may not necessarily be a physical item like a latrine provision but can also be a service like pit emptying or even a shift in sanitation related practices such as the adoption of hand washing culture or stopping open defecation which are able to enhance proper sanitation hence reducing diarrhea morbidity in children below the age of 5 years. The arguments of Peal *et al.* (2010) clearly portray the picture of the situation of private sanitation suppliers in Homa Bay County. The health officials and the latrine product suppliers are focused on provision of items to help improve sanitation of the children under five years. However, they do not give the directions on how the items provided are to be put into use. The supply of water guard items in Mbita during the floods was not an assurance that the community members adopted its use as the male respondents reported throwing of the items into the Miriu River based on the fact that they interfere with the men's libido. The male participant from FGD number 6 said;

During the rainy season, the Miriu river flooded and the Red Cross team supplied a lot of water guard to help the community treat their drinking water. But all these items were thrown into the River as we believe that water guard makes a man impotent and nobody would like that.

From the argument, it is clear that suppliers of product and policy makers and implementers are not so much involved into knowing whether their efforts are making a shift in the lives of the people in the community. Moreover, they only wait to tell of existence of change by referring to the records on diarrhea instead of making a physical visit to monitor the progress of the implemented programmes. Yet the supplies are not

easily accessible to the stakeholders under question, a part of aspects that limit a perfect success of the sanitation approaches developed by the county government health practitioners.

The place in which the product of sanitation is made available needs to be easily accessible to the target population. The supply chains for the product have to be improved so that it may reach every individual in the community (Varley, Tarvid & Chao, 1998). In order to increase awareness of the sanitation product in the community, different channels of communications may be used for the promotion. Peal *et al.* (2010) points out that public channels such as government extension workers, local NGOs volunteers and individual local traders may be used as a means of bringing the market of the product closer to the target population. Mass media campaigns, well designed posters and word of mouth may be used to get the customers' attention as well as convince them to use the service or the product. The need for marketing as mentioned by Varley, Tarvid and Chao (1998), comes with making the product accessible to the consumers. However, the private sanitation suppliers in the study area reported being located at centres and towns far away from the consumers. Furthermore, no advert techniques are used by the team to ensure information about the products get to the consumers on time to benefit consumers, county health representatives and the suppliers. One of the male private suppliers number 2 from Rachuonyo said;

The sale of the products in the region is not up to standards as many of our buyers are from Kisumu and Kisii. We have very few local populations purchase the products because we are located at the Centre very far from the villages. Moreover, we have no ways to make the community realize the benefits of using the products to develop proper latrines.

According to Obika (2004) the price of the sanitation product is regarded as the greatest impediment in the implementation of sanitation intervention aimed at reducing the morbidity of diarrhea among the children below 5 years. Sanitation marketing therefore needs to be done with the aim of assuring the target population on the development of sanitation product with affordable prices. Though the 4 P's of social marketing have been traditionally applied in the sanitation marketing approaches, many studies have recommended to have them extended to include the component of policy or politics emphasizing the importance of legislations and other government policies in the implementation of sanitation interventions (Kotler & Roberto, 1989). The sanitation progress in the study area has highly been affected by economic aspects aligned to cost of products and financial constraints faced by the community members. In line with Obika's (2004) argument, the private sanitation suppliers also recorded the high prices of the products to sell to be to the community. The CHEWs also seconded the argument declaring that the villagers cannot afford to develop standard latrines and maintain treating of drinking water due to the prices at which the building materials and the water treating reagents are sold. One of the female CHEWs number 7 from Ndhiwa said,

The community may desire to have very reasonable toilet facilities on the poor soil. But the price at which the products are being sold is expensive for the poor people to afford. Moreover, before the water guard was supplied to the community for free but today it is purchased from the shops and the community cannot afford the item hence they do not bother to go for them.

7.4 Social marketing of Oral Rehydration Salts

The study established that majority of the households were aware of the use of ORS to treat diarrhea in children. Though, the study results revealed that there are other healthcare professionals who prescribed other medication such antibiotics in the treatment of diarrhea ORS was still identified as the most preferred mode of diarrhea treatment among the healthcare professionals. UNICEF (2010) notes that diarrhea can be treated at home with over the counter oral rehydration solution and zinc supplementation so that thousands of lives can be saved. The policy also reinforces the comprehensive prevention and treatment recommendations highlighted by the WHO and UNICEF including Zinc supplements and the use of ORS to prevent rehydration.

It was also established in the study that diarrheal morbidity can be prevented through exclusive breastfeeding, Vitamin A supplementation, proper hygiene practices like washing hands with soap and access to improved water supply. The results obtained from the study area clearly demonstrated how the health practitioners and the respondents from various households appreciate the home treatment with the use of ORS and Zinc supplements.

In order to reduce diarrhea mortality among children below 5 years in the Homa Bay County, the study found out that the CHEWs were engaged in the distribution of the ORS regimens for free to the community after sending the CHVs through the community to train the households on its use. Additionally, the nurses also recorded having ORT corners used to administer first treatment of diarrhea among children under 5 years of age.

On the effectiveness of the social marketing of ORS, the study indicated that most of the healthcare professionals who participated in the study concurred that the importance of using ORS for diarrhea treatment had been well disseminated not only among the health workers but also among the residents. The PHOs also argued that the ORS has been a commonly marketed product regarding diarrhea among children under five years. Extensively, the drug sellers reported having the supplement as the first solution administered to their clients at the time they seek treatment in case of diarrhea cases. Involvement of the different parties in the ideas of UNICEF 2010 shows the corroboration on the use of Zinc supplements and ORS.

According to a report by WHO (2004) diarrhea is the second highest cause of high mortality in children below 5 years of age globally. It indicated that most of these deaths can easily be prevented by the use of Oral Rehydration Salts (ORS). In 2004, the WHO and UNICEF recommended that all children with diarrhea receive ORS and Zinc therapy which could prevent up to 95% of deaths as a result of diarrhea. However, another study conducted by WHO and UNICEF (2009) that sought to establish why children below five years were still dying, found out that the usage of ORS globally was still low despite the efforts by various agencies to market the product. This was attributed to the low level of awareness about the importance of ORS in the treatment of diarrhea amongst caregivers as well as Healthcare providers. Despite the fact that many healthcare providers were aware of the ORS therapy, a good number of them didn't recommend it since they consider anti-diarrheal and antibiotics as a quick acting alternatives to ORS. The findings from the study proved the report of WHO (2004) on diarrheal morbidity among children. The facility heads recorded that before late 2010, diarrhea led to the

death of many children. However, after an intense campaign on the use of ORS at home before moving of the child to hospital enhanced a tangible change. However, use of traditional herbs and local diarrhea treatment are a hindrance to total usage of the supplement to get a 100% success. One of the male PHOs number 4 in Mbita said,

The ORS is among the first treatment we advise the health facilities, Drug Sellers and CHEWs to give to children suffering from diarrhea. It is distributed to the community freely. Although, the people have their own traditional ways of treating diarrhea that hinders proper use of the ORS and Zinc supplements.

The under use of the ORS is not only recorded in India but also in Homa Bay County-Kenya as illustrated by the results from the study. Therefore, the records of UNICEF 2009 for more awareness over the regimen was also conducted in the region and improvements observed from late 2010.

In the early stages, the CHVs reported to the CHEWs how negative attitude was accorded to the ORS supplements as the community believed that it was a way that the government wanted to use to reduce the growing population of Kenya. One of the male CHEWs number 5 in Rangwe reported that,

In the beginning as we introduced the ORS solution to the community, it was received negatively. As you know Kenya has a growing population and the women felt that we were administering the supplement to the households for free to reduce the population of the area. Furthermore, we were only advising them to give it to children under five years and not adults. So it suits their perceptions by then but with time the perception changed as we continued to create awareness on the product.

A survey conducted by the Population Services International (PSI) in Burundi in 2006 and 2007 on women of reproductive age to determine the key behavioral determinants and exposure to the ORS intervention in the country. A sample of 30 households in each

of the 115 rural and urban centers was selected to give information on the characteristics of ORS users, association between exposure to the intervention and changes ORS user and the behavioral determinants associated to the changes on ORS usage. The study established that there was a significant increase in the usage of ORS among the caregivers at their children's last diarrhea episode from 20% in 2006 to 30% in 2007. The study also indicated that there were notable positive changes on behavioral determinants associated with ORS use. It was established that the higher level of exposure to the social marketing campaign of ORS was highly associated with increased usage of the product.

Many studies from African countries have support the finding of this study that some of the healthcare workers and caregivers are still using antibiotic therapy to treat diarrhea as opposed to the use of ORS and fluid intake. For instance, a study in Nigeria by (Ene-Obong *et al.*, 2000) reported that 68% of a cohort of 80 women caregivers administered antibiotics to children who had diarrhea with only 23% reported to be using ORS for diarrhea treatment. Another research from Nigeria investigating the usage of ORS among children with Diarrhea indicated that Traditional medicine was the first-line medicine for the treatment of diarrhea with only less than 10% of the female caregivers using ORS.

Similar situation experienced in Nigeria as illustrated by Ene-Obong *et al.* (2000) was observed in the study area. In the early years when ORS was introduced and very low levels of social marketing done, the community believed in traditional medicines as well as the use of antibiotics. The commonly used antibiotics in the study area as mentioned by the nurses and the pharmacists' were; "Flagyl, Chlorophenical, Tinidole, Letrax, Septirn and many more." On the other hand, traditional systems enabled the community to categorize diarrhea into different classes, together with their causes and the possible

ways to treat the diarrhea. During the FGDs in various sub sectors of the study, it was realized that every diarrhea type is defined by the color of the stool, its looseness and the position of the child.

Similarly, the participants of this study demonstrated different traditional treatments accorded to the various types of diarrhea. The traditional techniques hindered adoption of the ORS supplement as the people considered their traditional ways as the best before seeking health care from the facilities. Though not well expressed, the people in the study area still start diarrhea treatment with their traditional medicines before they move to the use of ORS. Although, use of ORS is highly adopted in the area it comes second in many instances. The issue raises eyebrows as to why people still like prioritizing traditional medicines yet they have freely supplied ORS regimen? Therefore, it is critical for researchers in the social science field to find out why traditional medicines are prioritized for treatment and the modern techniques considered second.

A longitudinal survey carried out in Kenya by Zwisler, Simpson, Moodley (2013) found out that more than 45% of the caregivers used antibiotics to treat diarrhea in children with only 13% reporting the use of ORS. The low use of ORS in Kenya was linked to the perception that caregivers had towards the cause of diarrhea. For instance, caregivers who believed that diarrhea in children below five years was associated with teething were less likely to seek medical attention in case of diarrhea in children. However, the study agrees with the findings that the use of ORS in Kenya has increased tremendously due to increased communication and social marketing campaign (Wilson *et al.*, 2013).

7.5 Community Led Total Sanitation and Sanitation Marketing

According to Kappauf (2011) CLTS and sanitation Marketing approaches are not only mutually compatible but also complimentary and therefore should be used as a reason to polarize the proponents of either side. In Kenya, CLTS was introduced in 2007 by plan Kenya and the approach was embraced by many sanitation actors in the country with the key actor being the Government through the ministry of Public Health and Sanitation. On satisfaction with the efficacy of the CLTS in initiating and sustaining behavior change through improving latrine coverage and reducing open defecation, the ministry of Public Health and Sanitation approached UNICEF for support of the programme to enhance the scaling up of the approach. According to Bongartz (2009), sanitation marketing does not incorporate the effective promotion or advertising of sanitation behavior change. It has a strong focus towards engaging communities, creating demand for sanitation and developing systems that are sustainable and apply the appropriate technology which is geared towards behavior and social change in the communities.

The process of merging CLTS and Sanitation together as defined by Kappauf (2011) is in line with the arguments of some of the PHOs from Rangwe and Mbita who mentioned the need for a synergy of techniques so as to avoid leaving any loopholes that may lead to poor sanitation within the study area. A male PHO number four from Mbita said,

The County government needs not to focus on only one technique, latrine construction to reach the goals of sanitation in the region. Along the CLTS, a synergy of other approaches needs to be put in place so as to help fill the gaps left regarding sanitation.

The CLTS introduced by Plan International in the study area, was later appreciated and adopted by other organizations and community members. The efforts of Plan were later enhanced by the efforts of UNICEF, the Government and the community. The community in the region has focused on using CLTS forgetting other approaches to handle sanitation issues. Additionally, the approach has been combined with social marketing to spread its benefits and importance to sanitation of the study area. To attain these PHOs had wished to be involved at different stages of the intervention. These administrative personnel hoped to participate at different stages of interventions as illustrated in the Table 7.2 below. A sum of 60% of the PHOs wished to be involved in Planning of interventions. The reason being it will enable them monitor and evaluate the changes or progress of the interventions. Additionally, they felt planning would enable them to engage the community in awareness and preparation for the programmes. A total of 20% of the PHOs argued to be involved in implementation stage (Table 7.2). A male PHO from Rachuonyo number 3 argued that

Implementation helps in understanding Technical aspects of designs, Implementation-by supervision and enforcement, weaknesses can be jointly identified and rectified on time, local ideas (insider generated) are key for success.

The remaining 20% argued that they would wish to be involved in all the stages of intervention as illustrated in the Table 7.3. The male PHO from Ndhiwa considered number 1 argued that involvement in the entire stages would enhance;

Total ownership and commitment to the course, enhancing monitoring and evaluation of the outcomes of the intervention and also ensure they are correctly done.

Table 7.3: Distribution of PHOs with respect to levels they want to be involved in interventions

	Frequency	Percent
Planning	3	60.0
Implementation	1	20.0
Design	0	0
All Levels	1	20.0
Total	5	100

The study determined that Homa Bay County was still using the traditional approach to sanitation that was supply-driven in which it had a specific focus of building latrines and empowering communities to support construction projects by giving subsidies. Another approach to sanitation marketing that was mentioned in the community was where the donor community and the community development planners determined what sanitation products that the community was in need of with no consultation or allowing the local community participation. Though the two approaches mentioned had been used in the study area, they were not really met as the designs were mainly up-bottom approach, excluding the community members thus negatively impacting their sustainability. The subsidies on materials used in construction of latrines have not been implemented by the authorities. Moreover, the aspect of donor contribution towards the construction of latrines has also not been accomplished. Although, social marketing towards sanitation was used in the study area, it has mainly been directed towards supply as defined by Devine and Kullmann (2011). One of the male private sanitation supplier numbers 2 from Ndhiwa argued that,

We have a poor marketing system as many of the products are so expensive for the surrounding community within this area. There is need for subsidized prices and even support which has not yet reached the area

Movik and Mehta (2010) argues that though this approaches were regarded as a good step towards the realization of reduced levels of diarrhea morbidity, they viewed sanitation as a private household good that had a public benefit with an assumption that the community was unwilling or unable to invest in sanitation marketing. Obika (2004) emphasizes that any approach to sanitation marketing that did not take into account community participation was destined to fail in the long run. He therefore proposes that sanitation marketing approaches must be accompanied by sanitation massaging which is mainly focused on informing the community on the health risks that the community is likely to encounter due to poor sanitation or open defecation as opposed to the practice of empowering communities by raising awareness and inculcating the culture of practicing improved sanitation as well as fostering positive attitudes among community members for proper sanitation practices.

According to Ann (2010) top-down approaches have been found to be ineffective in achieving total sanitation where the sanitation projects such as latrines often went unused with people continuing with the culture of open defecation. They also note that this approach excluded the most vulnerable populations that include the children, women, the disabled and the poor in the society who are usually excluded from the benefits of sanitation in the community. Contrary to this, UNICEF (2013) proposes that for total sanitation to be achieved Community Approaches to Total Sanitation (CATS) such as CLTS and Total Sanitation approaches (TSA) should be embraced. This is because this approaches start at the community level and as such involves all groups of people. They

work to generate demand and leadership targeting to improve sanitation and foster behavior change in the society qualities that will produce sustainable facilities and services engaging local people. This is in agreement with Movik and Mehta (2010) who noted that the success of this approach is a clear departure from the usual past approaches since it usually addresses the major learning in the sector that sanitation programmes like latrine usage will only increase in the community if there is a corresponding change in attitudes and behavior. He argued that the principle underlying this method is based on behavioral changes that are critical in shifting the communities approach towards sanitation and emphasize the need to abandon practices such as open defecation as well as encouraging the community to embrace improved sanitation facilities as opposed to simple pit latrines.

7.6 Sanitation marketing challenges

Sanitation marketing is the most suitable method that can help in overcoming the gaps in sanitation implementation (Devine & Kullmann, 2011). However, various studies have pointed out that it is facing numerous challenges especially in the rural set ups that have limited the potential of the approach to achieve its expected outcomes. The argument of Devine and Killmann regarding challenges faced by social marketing corroborate with the results obtained from the study. The approach of social marketing is highly strangled by social, political and economic aspects in the study area. A male nurse number 6 from Mbita reported that,

The traditional practices of the people in the area are great barrier to the success of social marketing regarding sanitation

On the other hand, the PHOs also mentioned on the challenges encountered the approach of social marketing. A PHO from Rangwe said,

Social marketing is a very essential process in sanitation but county leadership strategies and poverty have made the process fail. The county government has always failed to provide the necessary resources and skills needed to enhance the success of the approach

Various researchers have pointed out that one major challenge to sanitation marketing is inadequate information at the community level (IRC and SNV, 2011; Waterm Aid, 2011). They argue that lack of information is a major hindrance in the development of rural sanitation markets. The demands for sanitation at the community level are usually unclear and as such remain unaddressed. Similarly, they cite that the general difficulties in the flow of information from implementation level to the community may result to undesirable outcomes in the outreach of promotional messages and supply information. Similar to Homa Bay County, the information on social marketing in the community is not clear as many have a very negative attitude towards the approach based on the fact that there is no sufficient expertise used to implement the program. A female CHEW number 10 from Rachuonyo said,

The community around has very little information about the approach of social marketing as the implementation was not done by experts to help spread the information clearly to the community members.

Additionally, the male private sanitation supplier number 3 from Rangwe recorded that,

The community does not have sufficient information on the significance of sanitation and latrine construction. Lack of information makes it very hard for the social marketing to be successful as designed during implementation.

Though the county government of Homa Bay has a well laid strategy in the ICDP (2013) on the implementation of sanitation services in the area, they study pointed out that there are still challenges related to sanitation marketing has been linked to lack of an enabling environment within the country governments and the community in general. A challenge that was recorded from the information gathered from the study area.

According to Water Aid (2011) the responsibility of providing proper sanitation to the community lies between several ministries who are regarded as actors of sanitation. Due to poor coordination and lack of proper institutional arrangement for sanitation many sanitation programmes remain unaddressed at the community level. The decentralization of water and sanitation sector has also been cited as a major hindrance in rolling out large nationwide campaigns and surveys that are targeting to address the challenges in sanitation. As noted by (Devine, 2010) advocacy for sanitation marketing is usually affected negatively in countries that do not have a national sanitation policy and as such they do not identify sanitation marketing as a key approach. The ideas of Devine (2010) gives an explanation as to why the implementation of social marketing approach with respect to sanitation has not gone far within the study area as well as other regions in Kenya.

Sanitation marketing programmes have also become difficult to implement in various countries due to their complexity in design and high cost involved. Unlike Community led Total Sanitation programmes, sanitation marketing requires specialized skills such as conducting a thorough formal market research which is usually complex, time consuming and expensive. Godfrey *et al.* (2010) believes that obtaining such people from the commercial sector may create a major challenge where the commercial sector may not

understand the complex rural sanitation sector, its requirements and the nature of sanitation programmes required at the community level. He argues that obtaining the necessary skills may even be more challenging in case the CLTS and sanitation marketing approaches are combined because they require different skills and knowledge for successful implementation.

Economic impacts of poor sanitation in any community are far much expensive compared to the cost of implementing an effective sanitation program. Sanitation has not been given the priority it deserves globally due to the fact that many countries have not been able to recognize how good sanitation facilities, practices and policies can tremendously improve the socio-economic development of a nation. In Kenya, it is estimated that about KES 27 billion (USD 26 Million) are lost annually due to poor sanitation (HML, 2012; WSP, 2012). Kenya allocates between 1%-0.5% of the national GDP on sanitation investments which is way below the amount that is required to effectively realize health and welfare benefits of sanitation as well as eliminate the economic losses due to poor sanitation. In the recent years, Kenya only allocates 0.2% of GDP to sanitation which is way below the global target of 0.9% of the GDP as well as Thekwini Declaration commitment in which all African countries committed to allocating at least 0.5% of GDP to sanitation. In 2010, Kenya water expenditure represented 0.86 of GDP down from 1.10% in 2008 creating a serious challenge among the sanitation actors. There is need for the country to increase the investment allocation to sanitation hence promoting hygiene, target investments to the poorest population to address sanitation inequity.

A study conducted by the water and sanitation program in Kenya established that about 21 million Kenyans use unsanitary or shared latrines while 5.6 million people have no latrines and therefore practice open defecation which is estimated to cost Kenya USD 88 million annually yet eradicating the practice would only require building of less than 1.2 million latrines for use. The study also found out that the poorest quintile of the population is 270 times more likely to practice open defecation compared to the richest people in the population (WSP, 2012).

According to the World Bank report (2010) USD 2.7 million is lost annually due to loss of productivity attributed to sickness or time lost in the process of seeking access to healthcare. This includes the time individuals are absent from work seeking treatment or providing care for children below 5 years suffering from diarrhea or other sanitation related diseases. Sanitation has remained a low investment priority in developing countries due to the institutional fragmentations in which different elements of sanitation supply chain being is provided by different sanitation actors. This fragmentation has led to lack of proper coordination of sanitation services thus hindered joint approach to sanitation financing.

Sanitation financing has been a great challenge not only in Kenya but also globally. This has necessitated various actors to work together in providing the community with these essential services. The study identified that due to the financial challenges involved in ensuring proper sanitation in the study area, a number organization were reported to offer financial support to various actors implementing sanitation programs in the area. In Malawi, the Centre for Community Organization (CCODE) initiated an extensive sanitation financing programme in 2010 through its urban poor revolving fund which

aimed at providing sanitation loans to increase access to improved sanitation. The financing of sanitation facilities helps in overcoming the barrier of capital financing (Hunga, 2016).

In Kenya, The water Service Regulatory Board (WASREB) in collaboration with the Water and Sanitation Program (WSP) offer urban water service providers an opportunity to access medium-term finance to finance infrastructural projects aimed at improving access to water and sanitation facilities. Micro-finance institutions also play a key role in Kenya in ensuring accessibility to sanitation services especially in low-income communities. According to Mehta (2008) Micro-finance institutions in Kenya have largely focused on financing household level investment such as building of toilets and water connection as well as community shared projects. This form of financing enables the CLTS program in the community to achieve desirable results. Financial banks have also assisted to a greater extent in financing sanitation and water projects in the community. For instance, K-Rep Bank finances individuals as well as organizations investing in water infrastructure through its 'Maji ni Maisha' program to increase water security, quality as well as reduce risks associated with inadequate water supply (K-Rep, 2011).

7.7 Integrated Management of Childhood Illness (IMCI)

In many developing countries, diarrhea remains one of the leading causes of death among children below the age of five. In order to address the situation, WHO and UNICEF launched a campaign in 2009 that sought to find out why children were still dying and what could be done to reduce the deaths significantly. The study found out that Homa

Bay County has implemented the IMCI as an approach aimed at minimizing the mortality rate among children below five years. The participants indicated that health officials have undergone a number of trainings courtesy of UNICEF to help in the effective implementation of IMCI program.

The IMCI implementation in Homa Bay County has been observed to help in diarrhea management by training the staff and community members on best ways to manage diarrhea among children under five years of age. The facility and the CHEWs were deemed with the responsibility to spread the information on diarrhea management to the community members so as to enable them manage diarrhea during rainy and dry seasons.

A male CHEW number 2 from Ndhiwa said,

I think IMCI is a very good idea that needs to be adopted all through the community to help manage diarrhea especially during dry season when there is no rain water. It is the reason we train the CHVs to help us spread the information in the various village units.

Improvement of the country's health systems is the second component of the integrated management of childhood illness. The study found out that the county had invested in the improvement of its healthcare facilities in order to reduce the morbidity and mortality of diarrhea among the children below 5 years. Some participants pointed out that the county government through the ICDP 2013-2017 had planned to invest heavily in projects aimed at supporting child health service delivery that ensure that there is availability of enough drugs, effectively coordinated supervision, referral services and sophisticated health information systems though, only little has been achieved. Majority of the healthcare workers believe that if the county takes bold steps towards the improvement of the management systems and ensuring availability of drugs required to treat childhood

diseases that affect children below 5 years, the mortality rate among children due to diarrhea will significantly reduce.

Improving family and the community practices are important aspects targeted by the third component of integrated management of Childhood illnesses strategy. WHO (2009) indicates that more than 90% of diarrhea affecting children below 5 years is brought about by poor household practices adapted by individuals at family and community level. Community Integrated childhood illness strategy therefore supports the community to develop and implement community and household based interventions to increase the number of children and their caregivers practicing; breast feeding, complementary feeding, immunization and personal hygiene which are key in reducing illnesses in children below 5 years (Bhutta, Ahmed, Black, Cousens & Dewey, 2008). The study also proved that the community under study was very much aware of the necessary components of IMCI such as breast feeding and the periods of winnowing. However, it was evident from their stories that the females do not adhere to the breast feeding practices due to their busy schedule and the need to maintain their body structures. One of the male participants from FGD number 1 in Ndhiwa reported that,

The females we married are very much aware of all the necessary aspects of breast feeding as they are advised by the doctors. However, they do not breast feed as per the doctor's instructions because of their busy schedule and irregular schedule close to the household.

Implementation of the integrated management of childhood illnesses in most countries worldwide has led to a drastic reduction in the number of deaths as a result of diarrhea. This has also been linked to the development, marketing and increased use of oral rehydration therapy. The IMCI guidelines have been regarded as very important in the

management of diarrhea in children below 5 years since they assist health workers to grade the severity of dehydration correctly and take necessary steps to rehydrate the child suffering from diarrhea (Munos, Fischer and Black, 2010). Through this guidelines, healthcare providers are also able to identify cases of persistent diarrhea and make the necessary arrangements for further treatment and referral if need be.

In the study area, the training on IMCI was done by UNICEF to representative nurses from various health facilities within Homa Bay County. Implementation of this programme is estimated to reduce the under-five children mortality by two thirds as envisioned in the SDGs. Despite the enormous work that has been done to appropriately train and equip the community health workers, this action has not reached out to all parts of the county. Therefore, there is need for action aimed at reaching out to the underserved populations to provide them with essential health services that they need (WHO/UNICEF, 2012).

7.8 Summary

The chapter expresses how miserable relations have been recorded between groups working along water, sanitation and health education. Explanations on the workload on some sectors of the health care system are indicated contributing to the failure of required support to alter the behavior of the community towards management of diarrhea. A part of the chapter also discussed widely how technologies for water treatment and sanitation can be sustainable if a number of options are observed. It also outlines on aspects of socio-economic challenges and insufficient trainings to the community members and the availability of sanitation construction materials that hinder construction of sanitation facilities. The chapter explored its findings on the desire of a number of stakeholders in

the governmental and non-governmental health sector to be part of the sanitation interventions. Generally, aspects of sustainability are well explained and suggestions accumulated from the findings on how to attain it. The discussion on issues of sustainability was necessary in drawing conclusions and making recommendations that will help in improving the sustainability of sanitation interventions in the study area.

CHAPTER EIGHT

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

This chapter contains summary of the findings from the study the conclusions drawn from the study and it offers the recommendations for further action. The suggestions for further studies are equally found in the section.

8.1 Summary of findings

The study sought to explore the Impact of Household Environmental Hazards and Behavioral Practices on Children diarrhea incidences in Homabay County specifically it looked into the relationship between household environmental hazards ,household behavioral practices attributed to diarrhea , health care seeking behavior of caregivers of children facing diarrhea and lastly evaluated sustainability strategies of existing interventions aimed at curbing diarrhea morbidity .Multi stage sampling was employed to select households for the study. Structured Household questionnaire, unstructured public health officers questionnaires, FGD guides, key informants guide targeting, community extension workers, facility in-charges and sanitation products suppliers were utilized. Quantitative data obtained was analysed using the Odds Ratio (OR) as well as the correlation analysis while qualitative data was arranged into themes and some respondents were quoted verbatim.

The major findings of the study are summed up in the proceeding sections.

8.1.1 Household environmental hazards and diarrhea in children

Most respondents, 254 (81.2%) had their floors made of earth, sand and dung. Only 54 (17.3%) were observed to be made of cement. Regarding the wall material most respondents 261 (83.1%) reported their walls being made of poles and mud while 26(8.3%) were observed to have cement blocks. A Pearson moment correlation between the household economic status and the floor type in the households showed that there was a positive correlation which had statistical significance at 0.01 level (2-tailed) and 0.05 level (2-tailed). The values were between 0 and 1 in all the items. The study thus deduced that the floor type was hinged on the economic status of the households. The floor type equally affected the levels of contamination predisposing the residents to diarrhea.

A Pearson moment correlation between the household economic status and the type of toilet facility present indicated that there was a positive correlation which had statistical significance at 0.01 level (2-tailed) and 0.05 level (2-tailed). The correlations were an indication that the individual economic disposition of the households determined the type of toilet facility in place. The study area was observed to have different toilet facilities adopted by the households. Majority 116 (36.9%) reported not to have any facility hence they resort to use the bush. This predisposed the households to the risk of night soil contamination and higher diarrhea cases. There was correlation of statistical significance between the type of toilet used and the frequency for cleaning the facilities ($r = 0.752, p = .000$). This denoted the fact that in the event of toilet facilities which were cemented and with a slab they demanded higher standards in terms of hygiene and the frequency for cleaning. This was a contrast to the opposite situation of non-cemented floors with no slab which would ultimately take longer before cleaning.

Almost all 300 (95.5%) respondents reported taking between 0-1 hour in getting water from the source while only 1 (0.3%) said he takes more than 4 hours to get water from the source. The distance and period covered to and from the water source was critical to the study to help understand why some households preferred to look for alternative sources that lead to diarrhea. The FGD participants from the four areas of the study demonstrated the distance to water sources are shorter during rainy seasons but during dry seasons the distance are slightly longer. The water samples collected from the households had evidence of fecal coli forms. There was an indication of the fact that some of the water sources relied upon by the households had traces of contamination with fecal matter.

A Pearson product correlation on presence of fecal coli forms and the treatment given to water before carrying home was done. The findings on presence of fecal coli forms and the treatment given to water before carrying home had no positive statistical significance ($r = - 0.227, p = .000$). The Pearson chi-square test between the relationship between diarrhea cases in children under five years and presence of fecal matter in water samples had a $\chi^2 (1)=1.076, p=0.299$. Statistically there was thus no significant relationship between incidences of diarrhea in children aged less than five years and presence of fecal coliforms in the water samples. The incidences of diarrhea may be attributed to other dynamics other than the fecal coliforms contamination.

8.1.2. Household behavioral practices attributed to diarrhea in children

The process of water collection from the water points was reported to be mainly done by the female children under 15 years 124 (39.5%) while male children under 15 years were reported to go for water by 23 (7.0%) of the respondents. The respondents reported

cleaning their toilets in varied periods. Ninety one (46.4%) clean their toilets on a weekly basis, 60(30.7%) clean on a daily basis, while 18 (9.2%) did not clean their toilets. The process of water collection from the water points was reported to be mainly done by the female children under 15 years 124 (39.5%) while male children under 15 years were reported to go for water by 23 (7.0%) of the respondents. The respondents reported cleaning their toilets in varied periods. Ninety one (46.4%) clean their toilets on a weekly basis, 60(30.7%) clean on a daily basis, while 18 (9.2%) did not clean their toilets.

A Spearman's Rank Order correlation was run to determine the relationship between the water treatment option at the source before carrying home and the choice of the treatment method. There was correlation of statistical significance between the water treatment option at the source before carrying home and the choice of the treatment method ($r = 0.548, p = .01$).The choice of the water treatment option was influenced by individual dispositions motivated by factors pertinent to the household members carrying out the water treatment practice. The Pearson chi-square test on presence of fecal matter and the presence diarrhea incidences in the previous 2 weeks had $\chi^2 (3) = 7.802, p=0.05$. Statistically there was a significant relationship between presence of fecal matter and the diarrhea incidences in the previous 2 weeks at $\alpha = 9.81$. This was an indication that in the event of presence of fecal coli forms in the water used in the households the possibility of having diarrhea cases was thus high.

Majority 305 (97.7%) argued that they clean their drinking water containers before replacing with fresh water with 302 (96.2%) argued that failure to clean the water containers before replacing water is likely to spread diarrhea. The Pearson chi-square test on other activities taking place at water source and the incidences of diarrhea in children

under five had $\chi^2 (1) = 4.368$, $p=0.037$. Statistically there was a significant relationship between other activities taking place at water source and the incidences of diarrhea in children under five.

The connection between the amount of water fetched and that used in a household was based on the size of the household and the purpose for which the water was used within the homes. The findings were an indication that the numbers of persons living in the households affected the incidences of diarrhea mainly attributed to the handling of the water and the volumes involved owing to the populations in the households. A Pearson product correlation on the incidences of diarrhea in children under five years and the numbers of persons living in the households was done. The findings had a correlation which had statistical significance between the incidences of diarrhea in children under five years and the numbers of persons living in the households ($r = 0.014$, $p = 0.804$). 88.2% of the respondents did not have a place for washing hands and the remaining 11.8% had a place for washing hands. More than half of the respondents 196 (62.4%) reported putting the child's feces in the toilet, 77(24.5%) reported burying of the child's feces and the remaining 41(13.1%) reported throwing the feces away in open surrounding. A total of 90.4% reported cleaning the child right away regarding provision of care given to a child after defecating while the other 9.6% reported cleaning the child after sometime.

The chi-square test between care given to children after defecating and the incidences of diarrhea in the households had $\chi^2 (4) = 2.783$, $p=0.595$. Statistically there was thus a significant relationship between the care given to children after defecating and the incidences of diarrhea in the household. There was thus a relationship between the

treatments proffered to the kid after defecation and the incidences of exposure to diarrhea in the community.

A Pearson product correlation on the incidences of diarrhea in children under five years and the faeces disposal practices was done. The correlation had statistical significance ($r = 0.018$, $p = 0.754$). The faeces disposal practices directly contributed to the incidences of diarrhea by virtue of the contribution to night soil and related contamination in the households.

8.1.3 Health care seeking behaviors of caregivers of children facing diarrhea

The respondents reported getting health information from various sources. 46.2% reported getting information from CHVs/Hospital, 36% reported getting information from the radio, 13.4% got the information from a friend or relative, 1.4% got the information from the television, 1.4% mentioned books and newspapers as their source of health information, 1.0% reported getting the information from the church and the remaining 0.7% reported getting the information from the notice and billboards. A total of 94.9% acknowledged knowing diarrhea. The respondents identified a number of signs related to diarrhea. Majority 203(64.2%) reported 3-4 Unformed stools in 24 hours as a sign of diarrhea, abdominal pain was mentioned by 32%, and Vomiting by 27.5% and fever was identified by 21.5% of the respondents

The comparison between the knowledge of diarrhea and awareness of the signs of diarrhea ($\chi^2 (7) = 9.542$, $p = 0.216$). Statistically there was thus no significant relationship between knowledge of diarrhea and awareness of the signs. The children who had stool in the last 2 weeks experienced it in varied frequencies, an equal rate of 33.8% of the

respondents argued that their children experienced diarrhea at a frequency of 3 episodes per day and 3-4 per day. Twenty two percent reported a frequency of 4 episodes per day and the remaining 10.4% experienced a frequency of more than 4 times a day. The aspect of diarrhea being a health hazard to children was agreed upon by 311(99.4%) of the respondents .The respondents reported that they were aware of the best ways to prevent diarrhea.

ORS was the mostly mentioned new treatment method by 60% of the respondents, 39% reported ORS + Zinc as the current treatment method and 1.0% reported Flagyl as a new treatment. 41% of the respondents reported mixing the ORS correctly, 54.9% recorded wrong mixing of the ORS while the remaining 4.1 % reported not knowing any ways to mix the ORS. 14.3% of the respondents had ORS sachets in their homes at the moment of conducting the research while 85.7% did not have. Most of the respondents had not had the opportunity of purchasing ORS for their usage (78.1%) while (21.9%) had purchased it. Inadequacy on the part of the respondents from the study community with regard to the ability to effectively purchase the ORS solution at will.

8.1.4 Sustainability strategies of existing interventions aimed at curbing diarrhea morbidity

Appropriate technologies for household water treatment, safe storage and latrine construction will be sustainable as judged by their suitability, responsiveness, acceptability, repairs when needed, standards and cost of the options of the facilities also provide useful insight into their sustainability. The players in the sanitation industry have not built strong linkages with community members. Capacity to provide interventions

that are consistent with locally available resources and the socio-economic status of intervention target populations has also been wanting hence, impairing the sustainability.

Inter-agency relationships with local organizations to enhance integration and coordination of interventions by different groups participating in water, sanitation and health education such as local governments, stakeholders, bilateral and multilateral organizations have been dismal. This has led to duplication and failure to complement each other's efforts to the extent of having a wide geographical coverage with saturated impact. Partnerships with local sanitation providers to ensure availability of materials for construction and disinfection products have been dismal. This has compromised the sustainability of the programs carried out.

Despite the mandate of promotion to ensure a sustainable behavior change and demand creation, being charged to the county government, the public health officers are already overloaded with obligations and might fail to provide the necessary frequency of community support for suitable behavior change. Knowledge about different sanitation product amongst rural community members was very limited. Women seem to be easier to target with sanitation and hygiene messages and have a considerable influence on sanitation and hygiene related decisions. There was inadequate stakeholder support in IMCI strategy training and supportive supervision. County government as the implementing institutions would be required to sequence and coordinate CLTS and sanitation marketing. Currently there seems to be a lack of understanding for the different behavior change product component of the two approaches. Considering the economic hardship of the people coupled with lack of capacity building of the Public health officers who are key in sanitation facility construction. From the responses gathered during the

study, it was apparent that both the public health personnel, sanitation suppliers would like to be actively involved in all stages of sanitation interventions as a key predictor to sustainability.

8.2. Conclusions

8.2.1 Household environmental hazards and diarrhea

Water contamination at the source, collection, transportation and storage was the main predictor of household children under five diarrheal incidences. This was a pertinent environmental hazard that greatly affected the households exposing them to the risks of diarrhea cases. The economic status occasioning earthen floors with predisposed households to higher contamination levels leading to increased diarrhea incidences. The toilet facilities in place were equally predisposing factors leading to increased incidences of diarrhea attributed to propensity to use the bushes at the advent of having no toilets to access in the households. This ultimately occasioned night soil contamination and fecal traces in the sources of water accessed by the households. The disposition of the economic situations also determined the frequency of cleaning the toilets and in the event of latrines with no slab the toilets were not cleaned as they ought to. This occasioned great risks of contamination in the households and predisposed them to increased diarrhea incidences.

8.2.2 Household behavioral practices attributed to diarrhea

Water collection handling and storage was a household behavior practice which predisposed the occurrence of diarrhea. This was attributed to the failure to have clean sources owing to fecal contamination at the point of collection and failure to empty

storage containers and clean them regularly. Situation of poor sanitary practices which entailed defecation in the bush predisposed the occurrence of night soil and contamination of open water points like boreholes, wells and rivers. The household behavior of failure to treat the collected water at source equally aggravated the precarious situation and increased the risks and incidences of exposure to diarrhea in the children aged less than 5 years. Irregularity in cleaning the toilets was equally a pertinent factor occasioning the risk of contracting diarrhea by the children aged less than 5 years. Hand washing practices after visiting the latrine with soap was not carried out in the right manner thus accelerating the risk of increased diarrhea cases in the households. Households which were big in size had the practice of fetching a lot of water and ran the risk of failing to observe the requisite sanitary standards thus not exercising the requisite caution as regards ensuring clean water fetched at the sources and treatment before use thus increased diarrhea incidences. The practice of weaning babies from when they are six months also occasioned reduced immunity owing to lack of adequate nourishment from the breast milk. This predisposed the kids to higher incidences of diarrhea from reduced immunity and contamination in the food preparation stage.

8.2.3 Health care seeking behavior of caregivers of children facing diarrhea

Health information was available from diverse sources which ranged from hospitals, the media and personal contacts with friends and relatives. The diarrhea phenomenon was known to the respondents and they clearly identified the predisposing signs of the condition. Cases of diarrhea were confirmed in the study area with varied frequencies. Diarrhea was confirmed to be a health hazard by majority of the respondents and they were fully aware of the best way to prevent the occurrence of the condition. They

affirmed that ORS was the most acknowledged treatment method for diarrhea in the community. Modalities of mixing ORS were known by a significant number of the respondents and the sachets for ORS were available in some of the households.

8.2.4 Sustainability strategies of existing interventions aimed at curbing diarrhea morbidity

The sustainability of the appropriate technologies introduced in the local community as a measure of ensuring that the populace has options with regard to water treatment, safe storage and latrine construction practices was in question. This was occasioned by the fact that the players in the industry had not built strong linkages with the local community members. The failure to customize interventions to resonate with local needs and social economic demands has also compromised the sustainability of the projects undertaken. Failure to create interagency relationships have negatively affected the adoption of emerging technology in the realms of health assurance and risk mitigation owing to the confusion in the target markets created by the duplicity of the activities carried out. Despite the statutory provisions empowering the public health department, it has not lived to expectations as pertains to enforcing the legal provisions as a measure of risk reduction in the households within the study area. Failure to ensure that effective policing of the public health officers by the county governments is carried out has also exposed the communities to the risk of aggravated diarrhea conditions.

8.3 Recommendations

Based on findings and conclusions of the study, the following recommendations were arrived at.

8.3.1 Household environmental hazard and diarrhea

Efforts should be made by the county governments to ensure that the communities within the study area adopt current best practices as pertains to sanitation and water storage and handling and Point of Use Treatment. Mechanisms should be put in place to sensitize the local communities to put up latrines and use them in the right manner to deter occurrences of fecal coli forms in water as it happens in the event of Open defecation defecation. This will limit diarrhea incidences within the study community occasioned by fecal contamination of water sources. Public education on the essence of cleaning toilets regularly and using them in the right manner should be done.

8.3.2 Households' behavioral practices attributed to diarrhea

The Ministry of Health and development partners through the community health workers should play a proactive role in terms of engaging the community members to have them understand the essence of engaging in optimal sanitary practices. Basic regimes of hand washing with soap and cleaning the children after defection may go a very long way in reducing incidences of fecal contamination and the undue exposure occasioned by negligent behavior. Latrine utilization practices within the community coupled with sustained behavioral change communication specifically through Community Led Total Sanitation to ensure all households have latrines. This may limit the practices of open defecation and the inherent risks of contamination accruing from wrong disposal of

human waste. Basic water safety practices of treatment by chlorination and other means like boiling to ensure risk reduction at the advent of usage should be done. This may limit the occurrence of contaminants in the water thus negating incidences of diarrhea in the local community. It may also go a long way in safeguarding household livelihoods and minimizing expenditure on medical costs and time spent seeking medication. Awareness creation on the essence of breast feeding and limiting contamination in provision of food by mouth to toddlers who are yet to be weaned should equally be done. This may positively affect the immune systems of the young kids and caution them from the risk of contracting diarrhea in the tender age.

8.3.3. Household health seeking behavior of caregivers of children with diarrhea

The Health service delivery stakeholders should work towards enhancing the communities' knowledge and sustained appropriate practices on diarrhea risk reduction with enhanced danger signs identification in the aged five years and below including the notable differences between moderate and severe dehydration. This may potentiate the parents to getting the right information about the phenomenon without the undue risk of negative exposure occurring to their children without their knowledge. This is because diarrhea is known to have high morbidity and mortality rates which have in many instances affected members of the communities negatively. Provision of Zinc and ORS both at health facilities and community level should be done to ensure greater access by the populace over the counter as a measure of containing the incidences once they occur. Pharmaceutical companies marketing ORS should be sensitized on the need to educate the masses on the right volumes as pertains to the quantity of water for making the solution. Pharmacy and Poisons board should stream line and monitor activities of

chemist/drug shops particularly with regard to sale of drugs such as antibiotics and antidiarrhoeal drugs without prescription through Provider Behavior Change Communication especially on diarrheal management in children. They should go an extra mile and calibrate containers with the right measurements for the requisite volumes of water and make them readily available together as a package to ensure dilution to significant potency.

8.3.4 Sustainability strategies of existing interventions aimed at curbing diarrhea morbidity

Sustainability in study area was clearly being determined by several factors which include socio economic, cultural and technology adoption issues, which must be addressed by various implementing agencies, donors and the county government. Lack of coordination and harmonization among stakeholders, among others affects sustainability since NGO'S tend to operate with varied approaches which often cause an overlap.

Community dialogue session could be held to gather views on their preferences of latrine design in terms of cost effectiveness with regards to effective utilization life span. Further, involvement of public health personnel, Community Owned Resource persons in all phases, starting with situational analysis, design, planning and implementation should be considered as a pre-requisite engagement with county health department.

Comprehensively build capacity of health workers on IMCI as a key strategy, that is a blend of ORT, continued feeding during diarrhea, intensive care for severe rehydration, selective antibiotic therapy and medical care seeking when needed.

The players in the health sector both preventive and curative should ensure that they have provisions for forging linkages with an aim of increasing their capacities. The accrued synergy may positively affect their operations attributed to reduced competition and enhanced cross sharing of information with a view of conferring mutual benefits to the consumers of the service. This will ultimately impact positively in duplicity reduction and enhance the ability of the service providers to segment their markets and reach a wider network. The net effect would be ease in service delivery and achievement of the ideals intended by the providers. This may positively impact on the knowledge disseminated about diarrhea being positively adopted by the local populace and put into the right use thus limiting the occurrence of the condition. It may ultimately reduce the morbidity and mortality attributed to diarrhea cases in the study area.

8.4 Suggestions for Further Research

Further research on strategies to reinforce and enhance timely and efficient responses to sanitation infrastructure damage brought about by adverse weather such as floods and soil collapse should be done with a view of assessing the community preparedness for occurrence and mitigation of disasters.

Further research is needed to evaluate effectiveness of integrated environmental health interventions on a comparative basis across different settings, assess the relative levels of willingness to pay from community members on investments in improving sanitation facilities, water quality and water quantity and ascertain the level which household water transport and practices may undermine benefits of water quality improvement at source.

Further research on health workers prescription patterns in management of diarrhea with regards to IMCI should be done with a view of determining the extent to which the personnel use ORS and how they have it prescribed.

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APENDICES

APPENDIX 1

Consent for Focus Group Discussion

I am [name of the facilitator], a facilitator for this discussion about **Household Environmental Hazards and Behavioral Practices Influencing Children Diarrhea Incidences in Homabay County**. Your input and the results of this discussion will help us better understand your experiences and also contribute to future programs aimed at reducing child ill health due to diarrheal diseases and death in this community. Thank you for agreeing to participate in this discussion. The results of this research will be shared among the study partners in order to better address the needs of the community in keeping children healthy.

Today you will be participating in a group interview, which should take between 1 to 2 hours. Your participation is voluntary. If you do not wish to participate, please feel free to stop at any time. As this is a group discussion aimed at representing this community, we ask that you respond in a manner that you believe best expresses your experiences within the broader context of this community. Your responses will be interpreted as being the perceptions of this community and will be treated completely

anonymously. Taking part in this interview is your agreement to participate.

During the group interview, I will not be able to guarantee confidentiality because we will be discussing information as a group. Therefore, if you would feel uncomfortable with any of your statements being shared with others in or outside the group, please do not share them during the process.

If you would like a copy of this letter for your records, please let me know and I will provide a copy for you now. If you have any questions regarding the study, contact **Charles Nyamori**, the principal investigator at **0714 960 985**.

APPENDIX 2

Consent form for respondents

Good morning/afternoon?' My name is I am part of research team conducting a study titled **Household Environmental Hazards and Behavioral Practices Influencing Children Diarrhea Incidences in Homabay County** The purpose of the study is to explore Household environmental Hazards and Behavioral practices attributed to children under five years of age diarrhea incidence. The information generated will inform all stakeholders involved in Health intervention initiatives design appropriate strategies in the management of childhood diseases.

Procedure for the study

The study will involve asking you some questions concerning you and your child.

Benefit and risks

The result of this study is expected to improve child health in the health facilities in Homabay County. There are no anticipated risks to you and your child from this study.

Confidentiality

All the information collected will be treated in confidence and used only for purposes of this study. The dissemination of results will be by way of summarized information that will have no reference to any particular individual.

Voluntary consent

You are free to choose whether to take part in the study or not, feel free to withdraw at any time during the interview. Feel free to ask any question before or after the interview. For any issues/questions concerning your right and that of your child please contact the County Public Health Officer. For any questions concerning this study please contact Principal Investigator Charles Nyamori

Telephone: 0714 960 985

I hereby invite you to take part in the interview on the above subject. The interview will take approximately 45 minutes.

Statement of informed consent

The above information has been clearly explained to me and I have read/understood it. I do here by voluntarily agree to participate in this study.

Respondent's signature/thumb print.....

Name of research assistant eliciting consent

Signature.....

Date.....

APPENDIX 3

QUESTIONNAIRE

Sub County _____ Ward _____

Location _____ Sub location _____

Village _____

Date of Interview (dd/mm/yyyy) _____

Name of Interviewer _____

Questionnaire Code

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Kindly ask to speak to the mother of under-five child/Guardian or care take. Ensure the respondent clearly understands the purpose of the study and give consent to be interviewed.

PART A. SOCIAL DEMOGRAPHIC CHARACTERISTICS

1.1. How old were you in the last birth day

1.2. What is the highest level of education attained by the following?

(Household head/Guardian or care taker, Mother of the child)

	Household Head	Mother of U5	Caretaker/Guardian
a)No education			
b)Primary			
c)Tertiary			
d)Higher education Degree,Masters ,Phd			

1.3. What is your occupation?

- a) Business
- b) Artisan
- c) Fishing
- d) Employed
- e) No response

1.4. Does your household have the following items?

- a) Radio
- b) Television
- c) Mobile phone
- d) Bicycle
- e) Motorcycle
- f) Mobile phone

1.5. How many people live in your household?

Adults.....Children over five years.....Children Under five years.....

Total.....

1.6. What is your marital status?

- a) Single
- b) Married
- c) Divorced
- d) Widowed

1.7. Residence

- a) Rural
- b) Urban

1.8. Religion

- a) Catholic
- b) Protestant
- c) Muslim
- d) Other (specify).....

1.9. What is the birth order of the child?

- a) 1st
- b) 2nd
- c) 3rd
- d) 4th
- e) 5th +

1.10. Can you tell me, the biggest problem your family faces (Don't read to respondents)

- a) Poor health
- b) Insufficient food
- c) Lack of money to meet basic needs
- d) Unemployment
- e) Lack of access to health services
- f) Other.....

1.11. What is the most frequent disease in your community affecting children under the age of five years of age?

- a) Diarrhea
- b) HIV/AIDS
- c) Trauma(Injuries)
- d) Respiratory disease
- e) Anemia

2.0. HOUSEHOLD ENVIRONMENTAL HAZARDS

2.1. What type is your house made of (floor) Record observation?

- a) Earth , sand, dung
- b) Wood , planks , bamboo, palm
- c) Parquet, or polished wood
- d) Ceramic tiles, Terazzo
- e) Cement
- f) Other

2.2. Wall material for the House, record observation

- a) Grass
- b) Pole and mud
- c) Sun dried bricks
- d) Backed bricks
- e) Iron sheets
- f) Cement blocks

2.3. What type of fuel does your household normally use for cooking?

- a) Electricity
- b) Gas
- c) Paraffin
- d) Charcoal
- e) Firewood
- f) animal dung
- g) Other

2.4. What Kind of toilet facility do members of household usually use?

- a) Flush/Pour flush to sewer
- b) Flush pour to septic tank
- c) Flush pour to pit latrine
- d) Ventilated improved
- e) Pit latrine with slab.
- f) Pit latrine without slab/open pit
- g) No facility/bush
- h) Others.....

If No facility /bush Skip to 2.6

2.5 How often do you clean your toilet?

- a) Monthly

- b) Fortnightly
- c) Weekly
- d) Daily
- e) Others specify

2.6. What is the main source of drinking water for members of your Household?

- a) Piped water
- b) Water from open well
- c) Water from bore hole.
- d) Surface water
- e) Rain water
- f) Vendors

2.7. Who collects the water?

- a) Adult woman
- b) Adult Man
- c) Female children under 15 years
- d) Male children under 15 years
- e) Other specify.....

2.8 How long does it take to go there, get water and come back?

2.9 How far is the source/place where you get the water from?

- a) <250Metres
- b) 250-500Metres
- c) 5001-10000
- d) More than 1 Kilometer

2.10 What containers do you use for fetching drinking water? (Observe)

- a. Wide – mouthed pails
- b. Wide mouth pails with leaves
- c. Narrow mouthed clay pots
- d. Containers with lid

2.11 What treatment is given to water at the source before carrying home?

- a) Filtering by cloth
- b) Chlorinating
- c) Solar disinfection
- d) Let it stand and settle
- e) None

2.12. Why do you use this method?

- a) Cost
- b) The method is effective
- c) cheap
- d) Others....

2.13. Do you think contaminated water can spread diarrhea?

- a) Yes
- b) No

2.14. What other activities take place at the source or near the source?

- a) Cleaning water containers
- b) Washing clothes
- c) Bathing/ washing self
- d) Water animals
- a. Other

2.15. Do you always clean / empty the storage container before replacing with fresh water?

- a) Yes
- b) No
- c) If no. why?

2.16 Do you think not cleaning / emptying the water can spread diarrhea?

- a) Yes
- b) No
- c) If yes why?

2.17. How often do you replace water in the storage container?

- a) Replace water
- b) Everyday
- c) Every 2 days
- d) Every 3 days
- e) More than 3 days

2.18. How do you treat water before putting in storage vessels?

- a) Boiling
- b) Filtering
- c) Chlorination
- d) None

e) If not why?

2.19. How much drinking water drawn from the vessels

- a. By pouring
- b. By dipping

2.20. What vessels are used for water storage?

- a. Narrow mouthed
- b. Narrow mouthed with lid
- c. Wide mouthed
- d. Wide mouthed with lid

2.21. How much water do you fetch per day and how much do you use per day?

- a. Fetch number of pails/Jericans.....
- b. Use number of pails/Jericans.....

2.22. Do you think you fetch enough water for use at home per day?

- a. Yes
- b. No

2.23. If no state the reason for not being able to fetch enough water

Reasons

3.0 BEHAVIORAL PRACTICES

3.1. Do you know what diarrhea is?

- a. Yes
- b. No

3.2. If yes, what are the main signs / symptoms?

- a. 3-4 Unformed stools in 24 hours
- b. Abdominal pain
- c. Fecal agency
- d. Cramps
- e. Nausea
- f. Vomiting
- g. Fever
- h. Blood / mucus in tools

3.3. Have this child under the age of five years in your household had diarrhea in the past 2 weeks (14 days)

- a. Yes
- b. No

3.4. If yes, state the stool frequency

- a. 3 per day...
- b. 3-4 per day
- c. 4 per day
- d. Days

3.5 What do you think causes diarrhea in young children?

List

- a. Evil spirit
- b. Indigestible food
- c. Worm infection
- d. Crawling
- e. Teething
- f. Organisms entering the body
- g. Other
- h. Don't know

3.6 What do you think spreads diarrhea? (List)

- a.....
- b.....
- c.....
- d.....

3.7 Do you think diarrhea is health hazard to child's health?

- a. Yes
- b. No
- c. Other

3.8 Do you know some of the ways for preventing diarrhea?

- a. Yes
- b. No

3.9 If yes kindly mention them

- a.....
- b.....
- c.....

3.10 How did you happen to know about diarrhea, signs, mode of spread and prevention?

- a. School
- b. Radio
- c. Hospital
- d. Friends
- e. Posters/ Fliers
- f. Community Health Worker
- g. Worker
- h. Other

3.11 Do you know the new/ current treatment for diarrhea?

- a) Yes
- b) No (Go to Qn3.28)

3.12 If yes, what is the new current recommended treatment for diarrhea?

- a) ORS + Zinc
- b) ORS
- c) Salts Sugar Solution (SSS)
- d) Other (specify)

3.13 How many times (how frequent) a day should Zinc be administered to a child with diarrhea?

- a)times
- b) Don't know / cant answer

3.14 For children given ORS solution, how is it mixed?

- a) Correctly (1 sachet in 1 liter of water)
- b) Incorrectly
- c) Don't know/ can't answer

3.15 How many times (How frequent) a day should ORS solution be administered to a child with diarrhea?

- a) Every time the child has lose stool
- b) Don't know/ can't answer
- c) Other
(specify).....

3.16 How much ORS solution should be given to the child each time the child has lose stool?

- a) As much as the child can drink
- b) Don't know / cant answer
- c) Other (specify)
.....

3.17 How long should you keep the prepared ORS solution?

- a) Until it is finished
- b) Don't know/ cant answer
- c) Other (specify)
.....

3.18. Do you have any ORS sachet in the home now? (Confirm by seeing)

- 1. Yes
- 2. No

3.19 Did your child receive ORS solution in the last 2 weeks he/she suffered from diarrhea?

- a) Yes
- b) No

3.20 If *Yes*, Where did you go for the ORS sachets?

- a) Government health facility
- b) NGO health facility
- c) Drug shop health facility
- d) Drug shop / private clinic
- e) Friend / neighbor/ relative/ VHT
- f) Other
(specify).....

3.21. After how long the diarrhea started, did you seek treatment for ORS solution?

- a) Same day
- b) Next day

- c) Two days after
- d) More than two days
- e) I don't know

3.22. Do you know any danger signs related to diarrhea in a child?

- a) Yes
- b) No

3.23 If yes, what is (are) the danger signs related to diarrhea in a child?

- a) Starts to pass many watery stools
- b) Has repeated vomiting
- c) Becomes very thirsty
- d) Is eating or drinking poorly
- e) Develops a fever
- f) Has blood in the stool or
- g) Does not get better in three days

3.24. Have you ever failed to get ORS solution to treat diarrhea?

- a) Yes
- b) No

3.25. Who taught you how to mix ORS solution?

- a) Friend/ neighbor / relative
- b) Health provider
- c) Heard on radio
- d) Read instruction myself
- e) Other (specify)

3.26. Have you ever had to buy these ORS?

- a) Yes
- b) No

3.27. What water do you use to mix ORS solution?

- a) Previously boiled and cooled water
- b) Water also used as drinking water
- c) Any available water
- d) Other
(specify).....

3.28 When did you start breast feeding?

- a. Within 24 hours after delivery
- b. After 24 hours
- c. No response

3.29 How long have you breast fed your child?

- a) 0-5Months
- b) 6to 11 months
- c) 12 to 17 months
- d) After 18 months

3.30 Have you weaned your child?

- a. Yes b.No

3.31. When do you usually wash your hands?

- a) after using the toilet
- b) Before meals
- c) Before breast feeding my baby
- d) After cleaning the child who has defecated
- e) Before preparing food
- f) Other.....

3.31 How do you wash your hands?

- a) With soap and water
- b) Do not wash hands with soap and water
- c) always with water alone
- d) Sometimes with water alone
- e) No response

3.32 Is there a place for washing hands?

- a) Yes
- b) No

3.33 How do you dispose of children faeces?

- a) Buries
- b) Put in toilet
- c) Thrown away in open surroundings

3.34 What care is given to children after defecating?

- a) Cleaned right away
- b) After sometime
- c) Bottoms wiped with
- d) Water
- e) Dragged on ground
- f) Not cleaned at all Why :

3.35. What facilities do you use for defecating yourself and household members?

- a) Latrine only
- b) Bush only

3.36. If b. State why?

3.37 Do you think not using latrine can spread diarrhea?

- a) Yes
- b) No

3.38. How do you care for your hands after defecating or after helping your child defecate?

- a) Wash hands water only
- b) Wash hands with water and soap
- c) Never washes hands

3.39. Do you think young children's feces are harmful in a ways?

- a) Yes
- b) No

3.40. Where do you dispose of waste food and water?

- a) Rubbish pit
- b) Open surroundings

3.41 Do you think 1 or 2 both can spread diarrhea?

- a) Yes
- b) No
- c) Why

4.0 HEALTH SEEKING BEHAVIORS

4.1 Where do you often get health information?

- a) A friend or relative

- b) Television
- c) Community Health Volunteers
- d) Books and News papers
- e) Notice and billboards

4.2 How often are you educated on health matters or do you obtain Health information

- a) Daily
- b) Weekly
- c) Monthly
- d) Quarterly
- e) Yearly
- f) Others.....

4.3 What type of health facility is closest to this Household?

- a) Drugs shop
- b) Health Center
- c) Dispensary
- d) Private clinic Hospital
- e) Herbalist
- f) Other specify.....

4.4 Where did you seek treatment for your child/children?

- a) Drugs shop
- b) Health Center
- c) Dispensary
- d) Private clinic Hospital
- e) Herbalist
- f) Other specify

4.5 Why do you go to that place? (Refer to the place she he mentioned)

- a) Confidence that the child will be cured
- b) Services available anytime
- c) Referred by previous provide
- d) Free service
- e) Other specify

4.6 How do you get to this facility?

- a) Car/motorcycle
- b) Bicycle
- c) Walking

4.7 Some people do not seek health care at Hospitals, What do you think is their main reason

- a) Too far
- b) Long waiting time at the health facility
- c) They have no money to pay
- d) Bad experience
- e) Belief that the child will get well with time
- f) Easy to get drug from shop
- g) Other specify

4.8 What is the travel time to this facility?

- a) Less than 15minutes
- b) 15-60min
- c) 60-120 min
- d) >2hrs

4.9 Who decides whether the child should be taken for treatment?

- a) Head f household (father)
- b) Mother

Other (specify)

APPENDIX 4

PUBLIC HEALTH OFFICERS UNSRUCTURED QUESTIONNAIRE

1. How long have you been operating in this county/Sub county?

- A) 1-3 years B) 4-7years C) 8-11 years D) 12 years and above

2. What key documents in the county that outlines priorities given to water sanitation interventions.

- i.
- ii.
- iii.

3. What are the current approaches in water and sanitation interventions in the county/sub county?

- i.
- ii.
- iii.

4. Where do you see success/challenges in that approach?

- i.
- ii.
- iii.

5. What are the major challenges to latrine ownership in the county/sub county?

- i.
- ii.
- iii.

6. How can the above challenges best addressed?

- i.

- ii.
- iii.

10. Which proportion of the county budget is allocated to sanitation?

.....

11. Are there any regulations, policy elements that support private sanitation suppliers?

If yes-List them.

- i.
- ii.
- iii.

12. Is sanitation marketing part of interventions in the county/sub county?

If yes

- What are the drivers for including sanitation marketing?
- Do you already know how will be involved/ How you will monitor and manage this approach
- How do you think could sanitation marketing help to achieve the count/sub county sanitation goals?

13. How best can you describe availability of water for household use in the county?

.....
.....

14. What are the preferred household water treatment options?

.....
.....

15. What are the reasons for the options?

.....

.....
13. Are community members willing to pay for sanitation technologies?

14. What are your some of Key roles in curbing diarrhea related episodes in children under five years?

15. Have you received any capacity building initiative with focus on diarrhea episodes reduction?

A) YES

B) NO

If yes which one(s)

- i.
- ii.
- iii.

If No, what are some of the key challenges?

- i.
- ii.
- iii.

16. Do developmental partners carry out feasibility studies prior to the intervention(s)?

A) Yes B) No

If Yes, state reasons

If No, state reasons

17. In your opinion, what are the sustainability strategies of various interventions targeting prevention of diarrhea episodes?

- i.

- ii.
- iii.

18. Has the water and sanitation interventions introduced by development partners had any significant impact to the community?

- A) Yes B) No

If yes,
how?.....

.....

If No,
how?.....

.....

19. Do you have management committee in place to preside over of the health related / sanitation interventions at the community level?

- a) Yes b) No

If yes, have they been trained/which modules?

20. To what extent do members of the community actively participate in project design and implementation, with a range of groups within the community represented?

.....
.....
.....

20. To what extent do developmental partners consult/involve the Public health office in design of programmatic interventions geared towards diarrhea reduction?

.....
.....
.....

21. At what level do you want public health department to be involved in such interventions?

- A) Planning B) Implementation C) Design D) all levels

22. Why will you prefer your choice above?

- i.
- ii.
- iii.

Thank you

APPENDIX 5

INTERVIEW GUIDE FOR PRIVATE SANITATION PRODUCTS SUPPLIERS

1. Name of supplier
- Location of business Years of service.....
2. What geographical coverage area that is provided with your services?
3. How long have you been doing that business?
4. What kind of sanitation technologies do you offer?
5. What other services do you offer that support sanitation?
6. Which sanitation product /service do people prefer?
7. Where do you get your sanitation products?
8. How do people pay for your service?
9. Are you aware of any Microfinance institutions supporting community members in purchase of sanitation products?
10. Do you know about construction of the different latrines?
 - Do you provide your customers with that information?
10. Are you aware of any development partners that create demand for your sanitation products? If yes, kindly List them.
11. Did demand of sanitation technologies increase during CLTS implementation?
12. Are there any regulations or policies influence the way you are running your business
With regards to sanitation technologies?
- If yes –Which one(s)? How?
13. Do you think you need (additional) training with regards to sanitation technologies?
- If yes
 - What kind of training would you think would improve your business?
 - Why/ how?
14. What do you think are main challenges of community people in/ purchasing sanitation product?

APPENDIX 6

INTERVIEW GUIDE FOR PHARMACISTS AND DRUG SELLERS

Back ground information

Location.....Hours of operation

Position of respondent.....

1. How many people buy drugs from your enterprise
2. What common child health/treatment problems are brought to you as a pharmacist? Do you provide advice as well as medication?
3. A mother comes to you with a child with diarrhea .How do they typically describe diarrhea? What kind of questions do they ask/
4. Do mothers ask for specific medication or do they ask for advice?
5. Do you look for any special signs in children presenting with diarrhea?
6. What is the standard treatment given to children who are brought to you with acute diarrhea? And for children with chronic diarrhea?
7. Do care givers ever come back to you if diarrhea continues?
8. What are the common medicines or combinations of medicines sold for diarrhea?
What medications do you usually recommend? Why
9. How much medicine do caregivers usually buy at a given time?
10. If zinc is available: Do you ever recommend zinc treatment? How do care givers react?
11. How often do care givers come into shop/Pharmacy to purchase diarrhea treatment(weekly, Monthly, seasonally)

APPENDIX 7

FOCUS GROUP DISCUSSION GUIDE

1. What are the main illness affecting young children in this community?

Gin tuoche mage madongo mamako nyithindo e gweng' kae?

2. What are some of sources of health information and care of children for care givers in the community?

Gin kuonde mage miyude weche ngima kod ariti mag nyithindo ne jokony mag gi e kor gwenge?

3. Is diarrhea a problem in this community?

If yes How?

Be tuo diep en chandruok e gweng' kae?

Ka ee, to e yo mane?

4. Types of illnesses with loose, watery stools and a sign/symptom (types of diarrhea)

Kit tuoche mag diep

5. What are the causes of diarrhea in this community?

Gin ang'o gini makelo tuo diep e gweng' kae?

6. When a child suffers from diarrhea, what do you give him or her to eat?

Ka nyathi diewo, en ang'o mimiye mondo ocham?

Probe what food, in what quantity? Frequency? Duration

Penj chiemo mochamo, maromo nade? Kendo bang' seche/muda maromo nade?

7. What are the ways mothers use to treat diarrhea in children under five years

Probe on the use of traditional medicine, ORS, ORT

Gin yore mage ma mine tiyogo e thiedho nyithindo madiewo man e bwo higa abich?

Penj kuom joma tiyogi yore kienyeji

8. Do you seek advice/care outside the home from health professional all pharmacy when your child has diarrhea? Why or Why not?

Bende iyudo puonj/arita oko mar dala kuom jolony mag ngima kata kuonde uso yedhe seche ma nyathini diewo? Nango kata nikech ango?

9. What are the factors affecting health care seeking behavior of mothers care takers with children under five years of age

Gin weche mage ma mayango kit arita ngima mag mine man gi nyithindo mae bwo iga abich.

10. What are the children immunization trends in this community?

Probe, Are there any challenges?

En okenge mage mitimo go chanjo nyithindo e kor gweng ka?

Med penjo ka nitie pek mora mora?

11. Who are key decision makers at household level regarding child health care?

Ng'a gini ma jong'ad wach e iot e weche arita mag ngima nyithindo?

12. What is the trend of latrine ownership and Utilization?

Ere kaka usebedo ka utiyo gi chope kendo uketo/uloko gi magu?

13. What are the hand washing practices after defecation, after handling baby's faces, before feeding and eating and preparing food in the community?

Gin yore luoko luedo bila mage mutiyogo bang' pielo, bang' mulo losruok nyathi, kapok ipidho nyathi kod chiemo kod loso chiemo e gweng' kae?

14. How are child faces disposed in this community?

Ere kaka losruok mar nyithindo ipuko e gweng' kae?

15. What are the major water sources, storage and handling practices?

Gin kuonde mage madongo miyudo e pi, mikano kod okenge mitiyo godo?

16. Infant feeding practice *probe*. For how long are children breastfed, at what age (Months are children weaned)

Kuom muda marom nade ma nyithindo idhodho, e iga mane?

APPENDIX 8

KEY INFORMANT INTERVIEW GUIDE

Nurse /Facility in charge

1. Approximately how many children under five years of age are treated per month for diarrhea and dehydration? What is the under-five mortality due to diarrhoea disease
2. What are the most frequent waterborne diseases in this area? Do you notice frequency change in diarrhea episodes with seasons?
3. In the recent past in what are some of the training have you participated in that are related to diarrhea management? Who trained?
4. Have you been involved in any feasibility study focusing on diarrhea prevention and management? If yes? When and what were the Key themes of the study?
5. What are the management protocols for children with serious dehydration at the facility?
6. What diarrhea treatment practices are common in your community?

What could be the reasons to the mentioned practices?
7. What are the primary challenges in prevention and treatment of diarrhea?
8. Is there an ORT corner in the facility? How does it function?
9. How can you describe health care seeking behaviors of mothers/care takers with children under five years of age?
10. Does the clinic undertake awareness raising activities related to environmental hazards, diarrhea prevention and management (Use of ORS and Zinc).How much time is spent? What are the monitoring methods?
11. Does the facility/dispensary suffer shortage of key technical team, and what are the limitations?

APPENDIX 9

KEY INFORMANT INTERVIEW GUIDE

COMMUNITY HEALTH EXTENSION WORKERS

1. What are the top leading diseases affecting children under five years that are linked to household environmental hazards?
2. What key policies and strategic guide lines being used to ensure appropriate Household environment that will curb children diarrhea morbidity?
3. How do you ensure that sanitation intervention policies /strategic guidelines are implemented to the later?
4. What is the county government doing to curb child diarrhea incidences?
5. At what level are communities involved in sanitation projects?
6. Which are some of the key development partners involved in sanitation interventions? What are they exactly involved in and for how long?
7. Have the approaches led to linkages/collaboration with other programs, developmental partners and stakeholders.
8. Is there any challenge with aces and utilization of water at household level?
9. What changes have been brought about by the linkages in Health and sanitation?
10. To what extent have households built and maintained hygienic latrines
11. What evidence is there that households will/ are moving up sanitation ladder
12. Are materials available to maintain and upgrade latrines?
13. What are the health seeking behaviors of community members with regards to children diarrhea?

APPENDIX 10

OBSERVATION CHECKLIST

1. Proper cleanliness of hands and utensils
2. Proper handling of water
3. Household water treatment technology/options
4. Latrine is being utilized
5. Adequate cleanliness of latrine
6. Adequate cleanliness of household compound
7. Adequate measures adopted for food covers and fly nuisance(Latrine covered)
8. Adequate measures for proper management of solid waste, household and wastewater

APPENDIX 11

INSTITUTIONAL ETHICS REVIEW COMMITTEE (IEREC) APPROVAL



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Institutional Ethics Review Committee (IERC)

MMU/COR: 403009(vol. 1)

26th October, 2015

Charles Orora Nyamori

Registration No. CDM/H/02/13

Masinde Muliro University of Science and Technology

P. O. Box 190-50100

KAKAMEGA

Dear Orora,

RE: Ethical Approval to Conduct Research

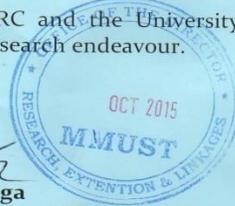
The IERC received your proposal titled "*Impact of Household Environmental Hazards and Behavioral Practices on Children Diarrhoea Incidences in Homabay County, Kenya*" for review. Having reviewed your work, the committee has given ethical clearance for you to conduct research as proposed.

On behalf of IERC and the University Senate, my congratulations. We wish you success in your research endeavour.

Yours faithfully


Prof. F.K. Matanga

Chairman, Institutional Ethics Review Committee



Copy to:

- The Secretary, National Bio-Ethics Committee
- Vice Chancellor
- DVC (PR&I)
- DVC (A & F)
- DVC (A&SA)

APPENDIX 12

RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. CHARLES NYAMORI ORORA
of MASINDE MULIRO UNIVERSITY OF
SCIENCE & TECHNOLOGY, 228-40105
Kisumu, has been permitted to conduct
research in Homabay County
on the topic: **IMPACT OF HOUSEHOLD
ENVIRONMENTAL HAZARDS AND
BEHAVIOURAL PRACTICES ON CHILDREN
DIARRHOEA INCIDENCES IN HOMABAY
COUNTY, KENYA**
for the period ending:
4th November, 2016

Permit No : **NACOSTI/P/15/8622/8555**
Date Of Issue : **6th November, 2015**
Fee Received : **ksh 2000**




Applicant's
Signature


Director General
National Commission for Science,
Technology & Innovation

APPENDIX 13

RESEARCH APPROVAL

