THE BURDEN OF WATER, SANITATION AND HYGIENE ON PEOPLE LIVING WITH HIV/AIDS IN KIBERA SLUM

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The burden of water, sanitation and hygiene on people living with HIV/AIDS in Kibera sum

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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This thesis has been submitted for examination with my approval as University Supervisors.

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DEDICATION

This thesis is dedicated to my mother, Monica Sylvester and my late father Charles Aketch Donde for providing a conducive environment and unlimited support throughout my studies. It is also dedicated my friend Eric Inda for all the support and effort that he provided in my studies.

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ACRONYMS AND ABREVIATIONS

AIDS   Acquired Immuno Deficiency Syndrome

ARV   Antiretroviral

HIV   Human immunodeficiency virus

MSF   Medicine SanFronteers

SPSS   Statistical Package for Social Sciences

UNICEF   United Nations Children Education Fund

WHO   World Health Organization

DEFINITION OF TERMS

Diarrhea: The condition of having three or more loose or liquid bowel movements per day

Mortality: Measure of the number of deaths (in general, or due to specific cause) in a population, scaled to the size of that population, per unit time.

Morbidity: Diseased state, disability, or poor health due to any cause. The term may be used to refer to the existence of any form of disease, or to the degree that the health condition affects the patient.

Etiology: Refers to the causes of diseases or pathologies.

Epidemic: Occurs when new cases of a certain disease, in a given human population, and during a given period, substantially exceed what is expected based on recent experience.

Antimicrobials: Substances that kill or inhibits the growth of microorganisms such as bacteria, fungi or protozoans. Antimicrobial drugs either kill microbes (microbiocidal) or prevent the growth of microbes (microbiostatic).

Replacement feed: Formula milk given to babies or infants to replace the breast milk.

Sanitation: The provision of facilities and services for the safe disposal of human urine and faeces.

Household: Those who dwell under the same roof and compose a family, belonging to the house and family; domestics, household furniture; household affairs.

Intervention: Describing and monitoring health events through ongoing and systematic collection, analysis, and interpretation of health data for the purpose of planning, implementing, and evaluating public health activities.

ABSTRACT

HIV transmission is often perceived as a consequence of human behaviors: unprotected sex, injection drug use, sharing needles. While transmission risk behaviors are, in fact, necessary for HIV-infection, it is important to note that these behaviors occur in context, that they are "conditioned by their environment." In the context of poverty, malnutrition, high prevalence of co- infections with other infectious diseases, and overburdened health systems, individuals may be more susceptible to acquiring HIV and less able to cope with HIV-related illnesses, both physically and economically. The study presented is to determine the burden of water, sanitation and hygiene on people living with HIV/AIDS in Kibera slum. The research design utilized was cross sectional study design and 369 respondents were interviewed and 10 water samples were collected for bacteriological analysis. The study showed that 95% (n = 350) of the respondents had access to municipal water supply. The bacteriological analysis of the water samples from water sources showed that all the drinking water were contaminated and samples had as high as over 180 most probable number of coliforms. Secondary contamination was noted since all households water samples had over 180 most probable number of coliforms. The households were spending 33% of their total monthly income on drinking water with some households spending as high as 62% of their total income. There was high prevalence (62%) of diseases caused by taking contaminated water and living in poor environmental conditions. There was poor sanitary conditions in place as showed by 84% (n = 308) of the respondents who did not have hand washing facilities that allows running water, 20% (n = 74) had their food displayed in

the open and uncovered, 87% (n = 322) did not have standard sanitary bins present in the latrines / toilets and 61% (n = 225) did not have waste storage bins at their household. The study reported that 84% of the respondents practiced taboos, beliefs and cultures that affected the water quality and sanitation measures. Logistic regression analysis was employed to predict the probability that a respondent living with HIV/AIDS in Kibera slum would be infected with diseases related to taking contaminated water and living in poor environmental sanitary conditions. The predictor variables showed a significant partial effect: Employing a 0.05 criterion of statistical significance; respondent's household drinking water treatment behavior (X^2

=4.589, df = 1, p<0.001), taboos, beliefs and cultures that affects water quality and environmental sanitation measures (X^2 = 11.232, df = 1, p = 0.032), availability of standard sanitary bin in the respondent's latrine (X^2 = 14.838, df = 1, p<0.001) and presence of waste storage bin at household level (X^2 = 23.942, df = 1, p<0.001). A test of the full model versus a model with intercept only was statistically significant, x^2 (5, N = 369) = 73.912, p < .001. The study concluded that due there was low levels of environmental sanitary measures coupled with taboos, beliefs and cultures that affected sanitation measures in place. Safe drinking water was therefore inaccessible to a majority of participants indicating a high risk of opportunistic diseases and high economic burden. The study concluded that there is need for the integration of environmental sanitation measures and water quality management issues in HIV/AIDS management and treatment coupled with proper treatment of drinking water supplied by the county governments and health education at the household level

CHAPTER ONE

INTRODUCTION

1.1.Background of the Study

Water constitutes about 70% of the earth's total mass and all life is dependent on water. Water not only plays vital roles in the maintenance of the body's homeostasis but also serves as a very essential component of life (Addo, Addo, & Langbong, 2013). Water can also be injurious if its source is not free from contaminations and impurities. Inadequate sanitation is a major cause of disease worldwide and improving sanitation is known to have a significant beneficial impact on health both in households and across communities. It is estimated that less than 10% of all sewage is treated worldwide before it is discharged into the receiving environment and it is estimated that throughout the world, there are 2.6 billion people living without basic sanitation, almost 40% of the world's population. In the less developed countries of the world, 80% of all ailments are attributed to inadequate supplies of water and sanitation facilities. This includes the effects of drinking contaminated water or water acting as a breeding ground for vectors of diseases (Addo et al., 2013; Bourne, Pilime, Sambo, & Behr, 2013a).

Unhygienic practices practiced by communities include unsafe human excreta disposal, unsafe solid and liquid waste disposal and unsafe drinking water. Unhygienic practices affect quality of life, education and development and in many cases, can result in diseases, which place an additional financial and health burden on families as well as lead to exposure and increased risks to personal safety (Enujiugha and Oluwole, 1994; Bourne *et al.*, 2013b). The impact of

unhygienic practices on the health of the community and others downstream, is extremely serious as witnessed by the 1.5 million cases annually of diarrhea in children under the age of five and cholera outbreaks. Other health problems associated with unsafe hygienic practices are diarrheal diseases, intestinal infections, polio, typhoid, bilharzias, malaria, worms, eye infections, skin diseases and increased risk for bacteria, infections and diseases for people with reduced immune systems due to HIV/ AIDS (Colvin et al., 1998).

Water is related to disease in various ways. It serves as a route of transmission such as cholera; a breeding site of a stage of the lifecycle of the infective agent such as malaria; a harbor for the carrier of the infective agent such as schistosomiasis. In recognition of the critical role of water and sanitation in the quality of life of human populations, there is concerted effort, globally and locally to put in place various programs to eradicate the backlog of people without access to safe water and sanitation. In spite of the collaborative efforts to eradicate the backlog of people without access to water and sanitation, a marked inaccessibility still exists in most developing countries. According to the UNICEF/WHO in their Joint Monitoring Program for Water Supply and Sanitation (JMPWSS) in the year 2000, 1.1 billion people globally were without access to an improved water supply (amounting to 2 out of 10 persons) with 700 million of these residents in Asia and nearly 290 million in Africa and 2.4 billion people were without access to improved sanitation which means 4 out of 10 persons (WHO/UNICEF, 2012).

Urbanization rates in sub-Saharan Africa are very high. While the annual population growth rate was estimated to be 2.8% between 1980 and 1997, the proportion living in urban areas in the same region increased from 19% in 1970 to 32% in 1997. In Kenya, the population growth rate between 1980 and 1997 was 3.4% annually, while the proportion of the population living in urban areas increased from 10% in 1970 to 30% in 1997 and that most of these new settlers moved into the already crowded slums areas. The rate is fastest in Africa where urban population

is expected to be more than double from 294 million in the year 2000 to 742 million by the year 2030 and most of these will be slum dwellers (Muoki et al., 2008).

Poor planning coupled with great influx of people has resulted in large informal settlements also known as slums in Nairobi and other urban centers in Kenya. The informal settlements are characterized by high population densities, poor housing structures, lack of basic services such as water, sanitation and health facilities. As a result of the growing number of urban dwellers within the slums, many are living below the poverty line of K shs. 1,254 per month. Poverty excludes people from benefits of healthcare systems. Diseases related to the unsanitary living environments, lack of water, childbirth problems and illnesses such as diarrhea, vomiting, typhoid, worm infections, common colds, coughs and malaria are often common in these slums (Muoki *et al*., 2008a). Dietary intake and diarrheal disease incidences are potential sources of malnutrition. The population data supplied by the Nairobi Water Supply Company showed that the population has risen from 65,000 in 1940 to over two million people today. To access safe and adequate water in the slums is a serious problem. Informal settlements do not have piped water and residents have to walk long distances to fetch water from vendors or kiosks whose hygienic standards are equally questionable. In addition to insufficient water supply, there have been numerous complaints that the Nairobi City Council does not treat the water it supplies to the residents to the required WHO standards raising fears about the spread of water borne diseases such as typhoid and cholera (Muoki *et al*., 2008).

 The human immunodeficiency virus (HIV) is a retrovirus that infects cells of the immune system, destroying or impairing their function. As the infection progresses, the immune system becomes weaker, and the person becomes more susceptible to infections. The most advanced stage of HIV infection is acquired immunodeficiency syndrome (AIDS). It can take 10-15 years

for an HIV-infected person to develop AIDS; antiretroviral drugs can slow down the process even further. HIV is transmitted through unprotected sexual intercourse (anal or vaginal), transfusion of contaminated blood, sharing of contaminated needles, and between a mother and her infant during pregnancy, childbirth and breastfeeding (Kamminga and Schuringa, 2005; Talman, 2010).

At a glance, the issue of HIV/AIDS and water and sanitation would appear to bear very little relation to each other. HIV/AIDS is a global-scale pandemic that is transmitted between people primarily through sexual contact, while water is a renewable natural resource of which the availability depends on a variety of geographic and climatic factors. However, closer inspection of the features that characterize the spread of HIV/AIDS and its implications for individuals, communities and societies reveals several significant linkages with water as HIV/AIDS and water and sanitation reflect some of the often unanticipated effects of the pandemic on society. These have long-term implications for effective water resource management and the provision of wholesome water supplies and acceptable sanitation to communities. Inadequate water supply and sanitation facilities exacerbate the risk and vulnerability environment for HIV/AIDS through increased risk of HIV infections, faster progression from HIV infection to onset of AIDS, difficult environments for proper treatment of HIV and increased socio-economic impacts of AIDS. Illness and death associated with AIDS, in turn, undermine sustainable water and sanitation services by weakening or destroying human capacity (skills, knowledge, labour), depleting control and access to other key assets, constraining options for productive activities, reducing participation in community activities, increasing time needed for reproductive and caring activities. HIV/AIDS has a great link and impact on the provision and sustainability of water and sanitation services (UN-HABITAT, 2006).

1.2. Statement of the problem

Due to rural-urban migration, the number of slums in Kenya's capital Nairobi is increasing uncontrollably because of the population increase. It is estimated that 60% of Nairobi residents live in unplanned squatter settlements which lack adequate and quality water supplies and sanitation facilities (Addo et al., 2013; Wolfgang, Veronique, Bernard, Arsène, & Valentin, 2013). Overpopulation in this area leads to few water supplies, lack of garbage collection, excreta disposal, drainage, and electricity supply. Thus the levels of sanitation in this area are reduced next to zero (Nordberg, Oganga, Kazibwe, & Onyango, 1993). The lack of sanitation facilities is considered a big problem by the residents in Kibera slums, but it is very difficult to improve the situation because of several related issues (UN HABITAT, 2008). First, there is hardly any space for latrines; the compounds are built up to capacity and available empty spaces are becoming encroached. Secondly, latrines are considered the responsibility of the landlord in this area, and because the landlord usually does not live in the area, s/he is not interested in improving the latrine situation (Umande Trust, 2007).

Due to lack of adequate and quality water supplies and sanitation facilities coupled with overcrowding, leakages, lack of sewerage systems and poor garbage disposal facilities great pressure is exerted on water quality. The quality of water is also affected further by possible post collection contamination between the sources and household. Contaminated water has been associated with occurrence of disease outbreaks particularly in communities living in areas with poor hygiene and sanitation such as Kibera slum. It is estimated that about 10 million people in developing countries die annually from water borne infections, 50% of whom are children under the age of five years (Coker and Adefoso, 1994). Studies have also indicated that diarrhea cases have been on the increase in Kibera slum resulting in use of enormous amounts of antimicrobial agents and some pathogens develop resistance. This may lead treatment problems in the future

which will even be more sever in people with weakened immune system such as people living with HIV/AIDS.

The Kibera slum in Nairobi, Kenya, constitutes a high-risk environment for HIV due to poverty, unemployment, substance abuse and a high frequency of women being involved in commercial sex work. Accurate data on the prevalence of HIV/AIDS in Kibera are lacking but it is estimated to be higher than 14%. Significantly higher than in the rest of Kenya (Umande Trust, 2007).

Despite the Kenyan commitment towards ensuring sanitation for all, little progress has been made; therefore it's important to establish the burden that poor drinking water quality, sanitation and hygiene have on people living with HIV/AIDS especially in informal settlements. A study conducted to determine the Prevalence of intestinal parasites among HIV patients in Baringo, Kenya revealed that there was high prevalence of intestinal parasitic infections which were waterborne protozoa with few helminthes (Kipyegen and Odhiambo, 2012). The People with advanced stage of HIV infection are vulnerable to secondary infections and malignancies that are generally termed as opportunistic infections. Opportunistic infections are common complications of HIV infection and other AIDS defining conditions that rarely cause harm in healthy individuals (Saidu et al., 2009). This study with Kipyegon and Odhiambo (2009) showed that poor environmental sanitation coupled with poor drinking water quality was a contributing factor to the opportunistic infections affecting people living with HIV/AIDS and therefore a need to explore more on the extent of this burden to this population.

1.3.Justification

This study aims to determine the burden of water, sanitation and hygiene on people living with HIV/AIDS in Kibera slum since inadequate sanitation, water supply and poor hygiene practices is associated with increased exposure to infectious diseases such as diarrhea, cholera, malaria,

bilharzia, worm infestations, eye infections and skin diseases (Kyobutungi, Ezeh, Zulu, & Falkingham, 2009). Those at greatest risk of waterborne diseases and inadequate sanitary infections are infants and young children, people who are debilitated and the elderly, especially when living under unsanitary conditions.

The information generated from this study will form the baseline on the need to study the impacts of water quality and sanitation amongst people living with HIV/AIDS. The study will identify gaps that are present in the water supply system and sanitation in relation to their association with HIV/AIDS management and treatment hence help the health care professionals to handle the problems of opportunistic infections in people living with HIV/AIDS. The study will help in the improvement of sanitary conditions in the area of study with the view of reducing the burden of all sanitary illnesses present in the area. The information generated will be used by the water supply companies in monitoring water quality along the water supply systems in the slums to ensure that the drinking water meets the international standards for safe drinking water. The government policy makers will be informed on the impact of water quality and sanitation on the people living with HIV/AIDS hence help in the integration of water quality and sanitation issues in the current and future policies dealing with HIV/AIDS management and treatment. The people living with HIV/AIDS in Kibera slum will be informed on water quality and sanitation issues and their burden on health hence help them in adoption of the most appropriate measures to ensure adequate sanitation and drinking water quality. The findings generated will be useful to public health professionals in future areas of disease surveillance and outbreaks control.

1.4.Research Questions

1. What is the level of accessibility of safe drinking water by the people living with HIV/AIDS?
2. Is there an association between water quality, socio-cultural factors and the environmental sanitation and occurrences of opportunistic infections in people living with HIV/AIDs?
3. What is the level of environmental and sanitation measures put in place by the people living with HIV/AIDS in this community?
4. What are the socio-cultural and economic factors associated with water quality and sanitation affecting the people living with HIV/AIDS?

1.5. Objectives

1.5.1. Broad Objective

To determine the burden of water, sanitation and hygiene on people living with HIV/AIDS in Kibera slum with the view of improving the management of HIV/AIDS.

1.5.2. Specific Objectives

1. To establish the level of accessibility of safe drinking water by the people living with HIV/AIDS
2. To determine the association between water quality, environmental sanitation and the occurrence of opportunistic infections in people living with HIV/AIDS
3. To determine the level of environmental and sanitation measures put in place by the people living with HIV/AIDS in this community.
4. To establish the socio-cultural and economic factors associated with water quality and sanitation affecting the people living with HIV/AIDS.

LITERATURE REVIEW

2.1. Background

Environmental problems associated with unsafe hygienic practices include dispersed and diffuse pollution of water sources resulting in the water and fecal disease cycle for communities with untreated water supplies and increased downstream water treatment costs. The national cost of lost productivity, reduced educational potential and curative health care due to unsafe hygienic practices is substantial. Investing in adequate sanitation can lead to adoption of safer hygienic practices which will consequently lead to reduced morbidity and mortality, increased life expectancy, increased general health conditions and well-being of people as well as savings in health care costs (Phaswana-Mufuya & Shukla, 2005).

2.2 Water Quality and Related Infectious Diseases

Human development and population growth exert many and diverse pressures on the quality and quantity of water resources and on access to them. Nowhere are the pressures felt so strongly as at the interface of water and human health. Infectious, water-related diseases are a major cause of morbidity and mortality worldwide. Although a significant proportion of this immense burden of disease is caused by 'classical' water-related pathogens, such as typhoid and cholera, newly-recognized pathogens and new strains of established pathogens are being discovered that present important additional challenges to both the water and public health sectors. Between 1972 and 1999, 35 new agents of disease were discovered and many more have re-emerged after long periods of inactivity, or are expanding into areas where they have not previously been reported. Amongst this group are pathogens that may be transmitted by water.   Understanding why

pathogens emerge or re-emerge is fundamental to effective water resource management, drinking-water treatment and delivery, and has become a priority for many national and international organizations. It is also important to be able to gauge the risk from any emerging disease. The perceived severity of risk and significance of an emerging infectious disease may be so far removed from reality that there is potential for inappropriate allocation of resources. This can have repercussions for countries at all stages of development. Investigating important emerging issues in water and infectious disease and communicating discoveries create unique challenges, which are addressed by an initiative being taken by the World Health Organization and collaborators (WHO, 2003).

An estimated 1.2 billion people worldwide do not have access to safe drinking water and almost 2.2 million children under the age of 5 years die each year in developing countries due to diarrheal diseases associated with fecal contaminated water. The main reason for these mortality rates is the absence of water-treatment infrastructures, which leaves rural communities and slums with no other choice than to collect water for domestic purposes from untreated sources such as rivers, boreholes and springs. In addition, the water-storage containers used in these rural households are often not cleaned and are exposed to fecal contamination due to children who put their hands into the water, unhygienic handling of the water-storage containers, the use of dirty utensils to withdraw water, dust, animals, birds and various types of insects (Muoki et al., 2008b; Wolfgang et al., 2013).

The discharge of wastes from municipal sewers is one of the most important water quality issues world-wide. It is of particular significance to sources of drinking-water. Municipal sewage contains human feces and water contaminated with these effluents may contain pathogenic (disease-causing) organisms and, consequently, may be hazardous to human health if used as

drinking-water or in food preparation. Fecal contamination of water is routinely detected by microbiological analysis. It is impractical to attempt the routine isolation of pathogens because they are present in relatively small numbers compared with other types of micro-organism (Mugambi & Bery, 2013). Moreover, there are many types of pathogen and each requires a unique microbiological isolation technique. The approach that has been adopted is to analyze for indicator organisms that inhabit the gut in large numbers and are excreted in human feces. The presence of these indicator organisms in water is evidence of fecal contamination and, therefore, of a risk that pathogens are present. If indicator organisms are present in large numbers, the contamination is considered to be recent and/or severe. The indicator organisms to be analyzed include total coliforms, thermotolerant (faecal) coliforms and Faecal streptococci (Bartram & Pedley, 1996).

Water is essential to sustain life, and a satisfactory (adequate, safe and accessible) supply must be available to all. Improving access to safe drinking-water can result in tangible benefits to health. Every effort should be made to achieve drinking-water that is as safe as practicable. Safe drinking-water, as defined by the Guidelines, does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. Those at greatest risk of waterborne disease are infants and young children, people who are debilitated and the elderly, especially when living under unsanitary conditions. Those who are generally at risk of waterborne illness may need to take additional steps to protect themselves against exposure to waterborne pathogens, such as boiling their drinking-water. Safe drinking-water is required for all usual domestic purposes, including drinking, food preparation and personal hygiene. The World Health Organization provides guidelines that are applicable to packaged water and ice intended for human consumption. However, water of higher quality may be required for some special purposes, such as renal dialysis and cleaning of contact lenses, or

for certain purposes in food production and pharmaceutical use. Diseases related to contamination of drinking-water constitute a major burden on human health. Interventions to improve the quality of drinking-water provide significant benefits to health (WHO, 2011).

2.3 Environmental Sanitation and Related Infectious Diseases

Poor water quality and lack of access to improved sanitation continue to pose a major threat to human health. Burden of disease analysis suggests that lack of access to safe water supply, sanitation and hygiene is the third most significant risk factor for poor health in developing countries with high mortality rates (WEDC, 2005). Diarrhea is one of the diseases associated with unsafe water supply, sanitation and hygiene and is a major cause of childhood morbidity in sub-Saharan Africa (Addo and Langbong, 2013).

The leading cause of death in all provinces in South Africa is HIV and AIDS, followed by diarrheal diseases (recognizing that the two may also overlap). Inadequate sanitation, water supply and poor hygiene practices increase exposure to infectious diseases, especially diarrhea. Water is essential for health, hygiene and sanitation. Young children are particularly vulnerable to illnesses that are associated with poor water quality, such as diarrhea and cholera. Poor sanitation compromises safety and nutritional status, and is associated with diarrhea and other diseases. Adequate sanitation aims to prevent the spread of disease and promote health through safe and hygienic waste disposal. Good sanitation is essential for a safe and healthy childhood. It is very difficult to maintain good hygiene without water and toilets. Poor sanitation is associated with diarrhea, cholera, malaria, bilharzia, worm infestations, eye infections and skin diseases. These illnesses compromise nutritional status. The use of open areas and bucket toilets is also likely to have consequences on water quality in the area, and to contribute to the spread of diseases (Bourne et al., 2013a).

2.4 Linkage Between Water Quality, Environmental Sanitation and HIV/AIDS

HIV transmission is often perceived as a consequence of human behaviors: unprotected sex, injection drug use, sharing needles. While transmission risk behaviors are, in fact, necessary for HIV-infection, it is important to note that these behaviors occur in context, that they are "conditioned by their environment." HIV/AIDS flourishes in conditions of underdevelopment— food insecurity, poverty, social inequity, unequal power relations between the genders, poor access to health services and substandard infrastructure. People living in sub-Saharan Africa face myriad risks that burden them with a host of diseases. In the context of poverty, malnutrition, high prevalence of co- infections with other infectious diseases, and overburdened health systems, individuals may be more susceptible to acquiring HIV and less able to cope with HIV-related illnesses, both physically and economically (Kamminga & Schuringa, 2005).

Human immunodeficiency virus is one of the greatest challenges facing mankind. People with advanced stage of HIV infection are vulnerable to secondary infections and malignancies that are generally termed as opportunistic infections. Opportunistic infections are common complications of HIV infection and other AIDS defining conditions that rarely cause harm in healthy individuals (Saidu et al., 2009). Diarrhoeal diseases are a major cause of morbidity and mortality in low and middle income countries, annually resulting in the death of 4.9 out of every 100 children aged less than 5 years in these countries. This problem is even made worse if the children are infected with human immunodeficiency virus which weakens their developing immune system even further. In HIV+ mothers, if no antiretroviral drugs are being taken, breastfeeding for two or more years can double the risk of the baby becoming infected to around 40%. But if the mother opts to breast-feed, she and her child must adhere 100% to ARV's

throughout the breastfeeding time. But percentage of HIV+ breastfeeding mothers accessing ARV's in developing countries is only 59%. Replacement feeding is the only 100% effective way to prevent mother-to-child transmission of HIV after birth, but the risk of infant mortality from other illnesses such as diarrhoea must be taken into account. It is advised that replacement feeding could take place where it is "acceptable, feasible, affordable, sustainable and safe." This calls for proper access to clean and sanitary environment for the preparation and storage of replacement feed. Access to safe and adequate water is therefore an integral part of the reduction of infant morbidity and mortality in under-fives to HIV infected women (Fewtrell et al., 2005; Mnongya, 2011).

CHAPTER THREE

METHODOLOGY

3.1. Location of the study Site

The study was conducted in Kibera informal settlement located 5 km from the Nairobi Centre Business District and is composed of 12 villages (One village holds approximately 100,000 people), each varying in topography, culture, ethnicity and religious make up. Physical area around 250 hectares. It is densely populated with over 2000 people per hectare. This brought a total of approximately 500,000 people. This meant that an average of 1500 people lived on the equivalent of a football field. Half of the population is under the age of 15 and 80% of the youths are unemployed (Chemuliti, Gathura, Kyule, & Njeru, 2002). Due to limited financial resources and time the study did not cover the entire Kibera population and only 6 villages were covered (Umash, Mashimoni, Gatwekera, Lindi, Kisumu Ndogo and Kambi Muru).

Map of Kibera Slum in Nairobi County

3.2. Research Design

This was cross sectional study design which utilized quantitative data collection technique.

3.3. Study population

The study population were adults living with HIV/AIDS in Kibera Slum. The population in this slum area is transient (Amnesty International, 2009); and the HIV prevalence rate is likely to fluctuate greatly. However, Some sources estimate the adult HIV prevalence rate in Kibera to be around 14%, significantly higher than in the rest of Kenya (Umande Trust, n.d.).

In Kenya, it is estimated that 60% of Nairobi residents live in unplanned squatter settlements (such as Kibera slum) which lack adequate and quality water supplies and sanitation facilities. Although some of these areas are served by a water distribution network, overcrowding, leakages, lack of sewerage systems and garbage disposal facilities exert great pressure on water quality (Chemuliti et al., 2002). It is from this prevalence that formed the sampling frame for the study.

3.4. Inclusion Criteria

- People living with HIV/AIDS who were 18 years and above
- The people living with HIV/AIDS whose households were within the area of study that is Kibera informal settlement all stood a chance of being sampled for the study.
- The respondents who had the ability to consent individually and signed the written consent form that were provided to them.

3.5. Exclusion Criteria

- Those who did not give their consent to the investigator to administer the questionnaire and collect the water samples.
- Participants who had participated in the answering of the questionnaire once were not allowed to participate for a second time.
- The people who were very sick and were unable to consent individually were not allowed to take part in the study.

3.6. Sample size determination and sampling procedure

The following sampling formula (Fisher, 1998) was used;

$$N_O = \frac{t^2 * P(1-p)}{m^2}$$

This was based on;

N, required sample size

t, confidence Interval level at 95% (a standard value of 1.96)

 P, Estimated prevalence of people living in unplanned squatter settlements in Nairobi (60%)

  m, Margin error at 5% (standard value of 0.05)

Therefore;

$$N_O= \frac{1.96^2 * (0.6)(1-0.6)}{(0.05)^2}$$

$$=\frac{1.96^2 * 0.6*0.4}{(0.05)^2} = 369$$

$$= 369$$

The study, therefore, focused on 369 respondents (62 respondents from each village of the 6 randomly selected villages). There are12 villages in Kibera slum and each village had at least 3 HIV/AIDS support groups that comprised of about 30 members each. The study recruited participants through a three stage cluster sampling method from the entire study area. Six villages were randomly sampled from the 12 villages in Kibera slum, 3 HIV/AIDS support groups were then randomly selected from each of the 6 randomly selected villages and then 62 respondents were randomly selected from the three HIV/AIDS support groups randomly selected in each village. Four water samples from households for bacteriological analysis were collected randomly from the respondent's households and 6 community water samples were purposively collected from the public water supply sources that were being used by majority of the respondents and taken to the National Public Health Laboratory in Nairobi for bacteriological analysis.

3.6.1. Procedure for bacteriological analysis

Ten water samples were collected for bacteriological analysis of the drinking water which was done at the government National Public Health Laboratory in Nairobi; Six water samples were collected from the community water supply sources from purposively selected villages and 4 water samples were collected from the randomly selected respondent's households who got their water from the 6 selected community water supply source. The household water samples were collected from the drinking water storage containers in the households.

The membrane-filtration (MF) method of bacteriological analysis of water was used where, a minimum volume of 10 ml of the sample was introduced aseptically into a sterile membrane filter of pore size 0.45mm. Using a funnel and vacuum system the sample was drawn through the membrane filter. All indicator organisms (*Escherichia coli*, fecal *Streptococci*) if present were retained on or within the filter, which was then transferred to enriched lactose media in a Petri dish. Following a period of resuscitation, during which the bacteria was acclimatized to the new conditions, the Petri dish was transferred to an incubator at a temperature of 44.5^0 C for 24 hours to allow the replication of the indicator organisms. Visually identifiable colonies were formed and counted, and the results expressed in numbers of "colony forming units" (CFU) per 100 ml of original sample (Bartram & Pedley, 1996).

3.6.2. Data collection methods and tools

A questionnaire (Appendix A1) was developed and used to interview respondents who gave their consent by signing the informed consent form after all the information pertaining the research was disclosed to them as contained in the informed consent form. The main issues captured included relationship between the socio demographic factors, socio economic factors, socio cultural factors, environmental sanitation factors and accessibility of clean safe drinking water by people living with HIV/AIDS. The socio demographic factors captured were sex, age,

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religion, marriage and level of education. The socio economic factors included the relationship between the level of income, employment and the occurrence of water and environmental health related infections. The possible social cultural factors that lead to the occurrence of infections such as sharing of latrines between the adults and children, the hygienic practices as influenced by culture such as use of water in latrines instead of tissue papers and Perceived causes of co-infections by the community. The environmental sanitation factors included how wastes are managed, fecal disposal, personal hygiene such as management and disposal of sanitary pads, storage of drinking water. The accessibility of the safe drinking water which included the water treatment methods adopted at the households, water storage practices, accessibility of the treated water if not being treated at home and sources of water.

An observation checklist (appendix A2) was used to observe water supply system practices and sanitary conditions and hygienic practices such as households with toilets/pit latrines and hand washing facilities.

Water sampling technique was utilized (Appendix 3) where 10 water samples were collected from the study area for the bacteriological analysis using membrane-filtration method (Bartram & Pedley, 1996). Indicator organisms for water quality were analyzed, 6 water samples from the purposively selected water supply points each from a purposively selected village in Kibera and 4 water samples from the households selected randomly.

3.6.3. Validity

Validity of the study instrument and data collected were ensured by considering all the necessary factors. The data collection instruments were pre-tested within a small sample of 15 respondents living with HIV/AIDS in Kibera slum to ensure that the data collection tools would collect the accurate and precise data that they were intended to measure.

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3.6.4. Reliability

This was taken into account by pre-testing the instrument of study and comparing the study with other previous ones conducted in the same area of study (Millicent, 2016). This ensured that the data collection instruments produced consistent results hence the collection of the required data. Data collectors were also trained to ensure that the data collected was reliable.

3.7. Data Management

The data collected using questionnaire and observation checklist was cleaned to remove any deviants and mistakes. It was sorted, coded and quality control checks performed. The data entry was then done in SPSS version 20 and processed. An appropriate method for data sorting was decided upon based on the independent and dependent variables.

3.7.1. Data Processing and Analysis

Computer based software Statistical Package for Social Scientists version 20 was utilized for analyzing the data collected using structured questionnaires and observation checklist using 95% confidence interval. Data collected using these tools were verified and transformed into codes then entered into a database using a predefined format. The bacteriological analysis of water results from the membrane-filtration method were expressed in numbers per 100ml of water and compared with World Health Organization established guidelines for safe drinking water quality. Descriptive statistics and quantitative statistics such as frequencies, percentages and averages were used to summarize the data. Chi square statistics was used to determine the association between socio- demographics and independent variables. Logistic regression analysis was

employed to predict the probability that a respondent living with HIV/AIDS in Kibera slum would be infected with diseases related to taking contaminated water, poor hygienic practices and living in poor environmental sanitary conditions given the explanatory variables: respondent's household drinking water treatment behavior, taboos, beliefs and cultures that affects water quality, hygiene and sanitation measures, availability of standard sanitary bin in the respondent's latrine and presence of waste storage bin at household level. The results was presented in graphs and tables.

3.8.0. Data presentation and dissemination

Data collected using the questionnaire, observation checklist and results of bacteriological analysis of water were presented in form of tables, graphs and charts. The report was disseminated through meetings with public health officers of Kibra Sub County, workshops and other relevant forums in the sub county and in the county level. The final report was published after approval by Jomo Kenyatta University of Agriculture and Technology.

3.9. Ethical Consideration
The ethical clearance for the study was obtained from ethical review committee at Kenyatta National Hospital-University of Nairobi (P114/03/2015). The consent form (appendix A3) was translated to Kiswahili before presented to respondents for them to give their consent before the study questionnaire was administered and water samples collected. Illiterate respondents were assisted by a translator of their choice where necessary or a literate member of the household was opted in on his or her behalf. All the questionnaires and water samples did not have any of the respondents' detail that could be used to identify them to ensure confidentiality. The research assistants signed confidentiality agreement to ensure that they did not disclose any information that they came across during the study that would cause any harm to the respondents. The people

living with HIV/AIDS whom were found to be very sick were counseled and linked to treatment through the CHWs whom were selected as the research assistants.

CHAPTER FOUR

RESULTS

4.1. Introduction

This chapter presents the results of the structured interview, observation checklist and bacteriological analysis of the drinking water samples. Section one presents social demographics gathered through the structured interview and describes distribution of respondents by age, sex, marital status, occupation, health insurance ownership, level of education and income. Level of accessibility of safe drinking water gathered through structured interview, observation checklist and bacteriological analysis of drinking water is presented in section two and describes the water

quality and barriers to accessing safe drinking water that exists in Kibera slum among people living with HIV/AIDS. Section three looks at the opportunistic infections caused by taking contaminated water due to unsanitary conditions and the burden of these infections with regards to frequency and treatment cost. Section four presents the various environmental hygiene and sanitation measure put in place by the people living with HIV/AIDS and section five shows the presence of various socio-cultural and economic factors associated with water quality and sanitation.

4.2. Social Demographics of the study population

4.1.1 Distribution of the study population by age

The table in the next page shows that 368 respondents reported their age with the mean age of the 39.83 years, the youngest being 18 years old and the oldest 68 years old. The age distribution was normal with majority of the respondents being around 38 years old with the median age of 38 years.
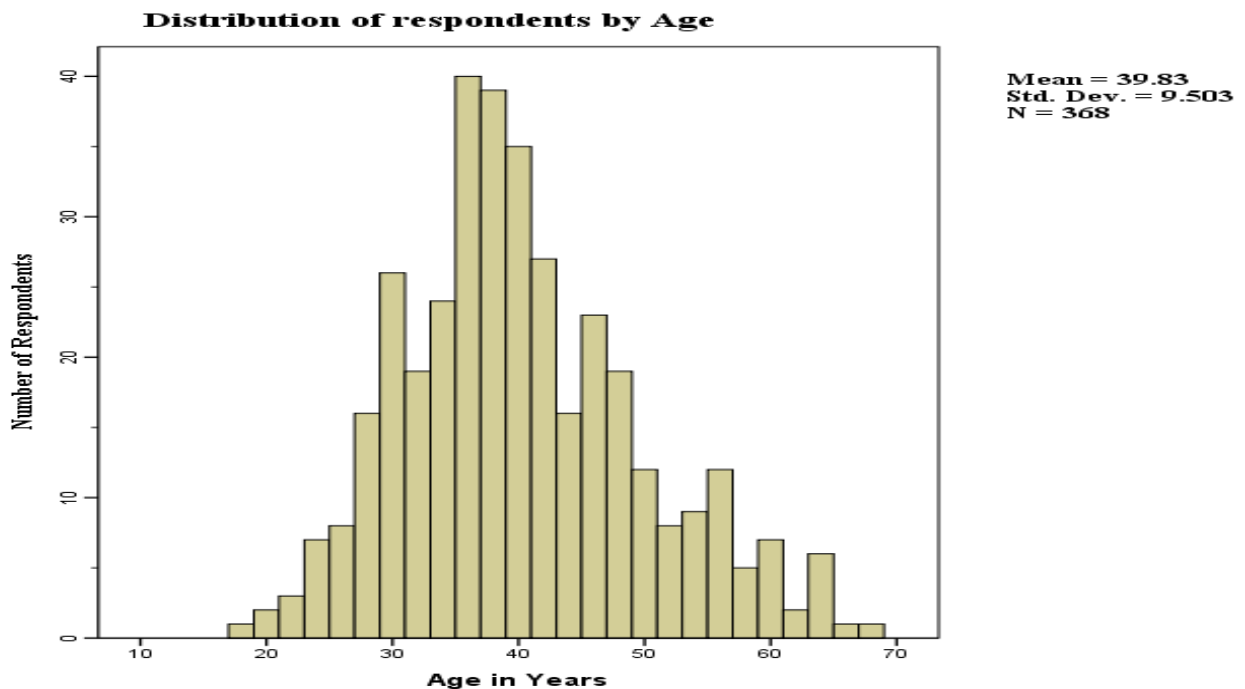
Figure 4.1: Age distribution of respondents living with HIV/AIDS in Kibera Slum

4.1.2. Distribution of the study population by Sex, marital status, occupation and health insurance ownership

The study showed that 29.8% (n=110) of the respondents were male and 70.2% (n=259) female. Therefore, more female living with HIV/AIDS in Kibera slum were recruited in the study than male. Sixty percent of the respondents were married, 28% were single and 12% were divorced. In terms of occupation status; majority of the respondents (54%) were unemployed while 46% were employed. The study also revealed that 72% of the people living with HIV/AIDS in Kibera slum did not have access to health insurance cover including the National Hospital Insurance Fund cover (**Table 4.1**). Gender of the respondents showed a strong evidence of relationship with health insurance ownership (chi square = 53.75, df = 2, p<0.001); Male were more likely own the insurance cover than female.

Table 4.1: Social Demographics; Sex, marital status, occupation and health insurance ownership

	Category	**Frequency**	**Percent**
Sex	Male	110	29.8
	Female	259	70.2
Marital Status	Married	222	60
	Single	102	28
	Divorced	45	12
	Unemployed	198	54

Occupation	Employed	168	46
Health Insurance Ownership	No	267	72
	Yes	95	26
	Don't Know	7	2

4.1.3. Distribution of respondents living with HIV/AIDS in Kibera slum by Education Status

The distribution of HIV/AIDS respondents in Kibera slum by their highest education level revealed that 9.8% (n=36) of the respondents never went to school, 1.6% (n=6) had their highest education level as nursery/pre-unit/kindergarten, 22% (n=81) reached primary school but never completed that level and 24.2% (n=89) completed primary school as their highest level of education. Eighteen percent reached secondary school but never completed while 20.1% (n=74) reached the secondary school and completed, a small proportion of 2.7% (n=10) got to college/tertiary level of education but never completed while a very small proportion of 1.4% (n=5) completed the college/tertiary level of education.

Table 4.2: Distribution of respondents living with HIV/AIDS in Kibera by education level

Respondents highest level of education	Number of Respondents	Percent
None/never went to school	36	9.8
Nursery/pre-unit/kindergarten	6	1.6
primary (incomplete/no certificate)	81	22.0
primary (certificate/complete)	89	24.2

secondary (No certificate/incomplete)	67	18.2
secondary/ 'A' level (certificate/complete)	74	20.1
college/tertiary (no certificate/incomplete)	10	2.7
college/tertiary (certificate/complete)	5	1.4
TOTAL	**368**	**100**

4.1.4 Income Distribution of Respondents

The respondents had monthly median income of Kenyan Shillings 3000, most of the respondents were unemployed and the respondent earning the highest monthly income was Kenyan shillings 40 000. The income distribution was skewed to the left showing that most of the population was unemployed with majority of those employed having an income earning less than Kenyan shillings 10000 per month.

Distribution of Respondents Income

Mean = 4029.86
Std. Dev. = 4937.823
N = 365
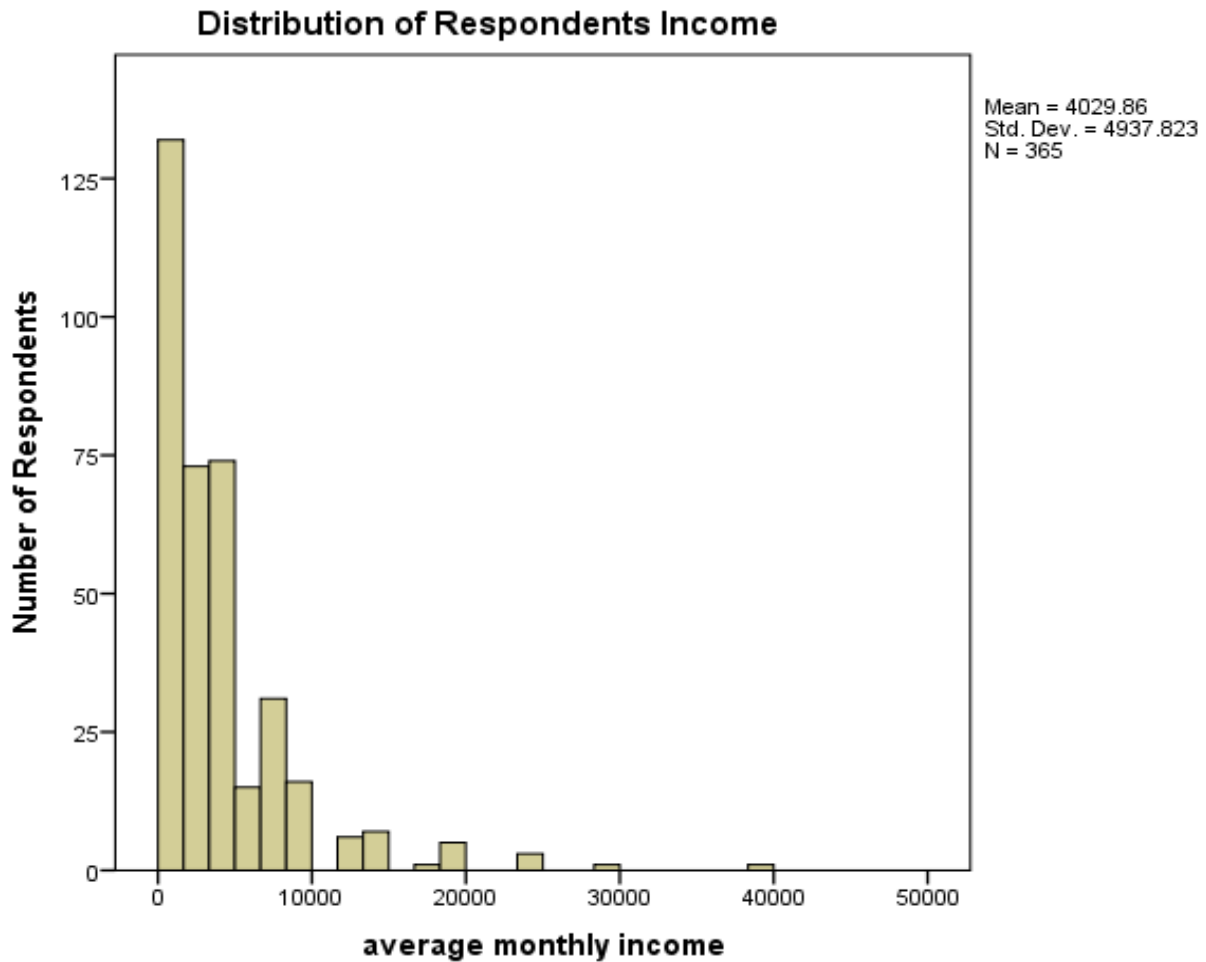
Figure 4.2: Income Distribution of respondents living with HIV/AIDS in Kibera Slum as at August, 2015.

4.3. Level of Accessibility of Safe Drinking Water

The study observed that the respondents living with HIV/AIDS in Kibera slum had various

sources of drinking water; 48% were using piped water with standby tap, 45% were using piped

water that was being stored in storage tank before being distributed, 3% used underground water

sources such as boreholes and hand dug well, 3% were using water from roof catchment (rain

water) and 1% were using surface water (**Figure 4.3**).
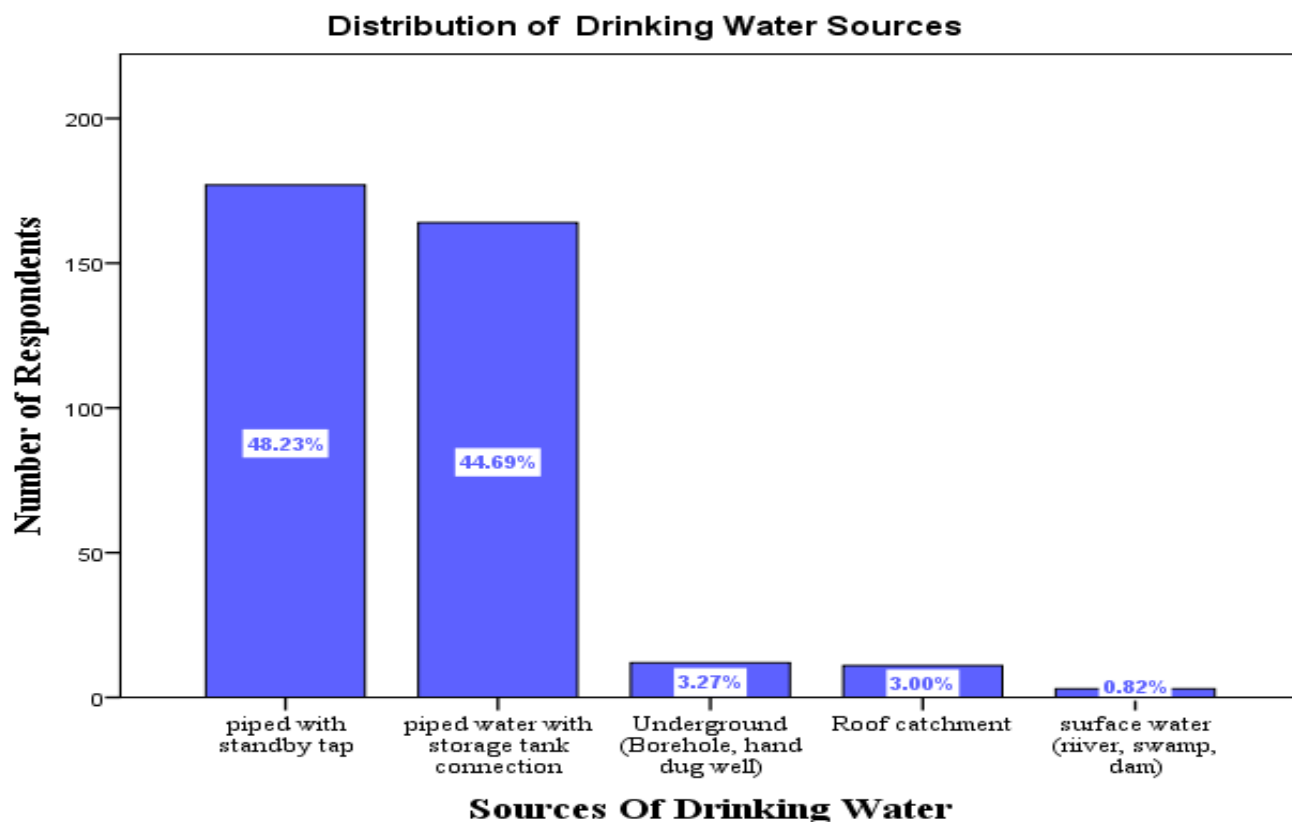
Figure 4.3: Observed sources of drinking water used by the respondents

The study showed that 55% (n = 203) of the respondents got their household drinking water from municipal piped water directly, 39.8% (n = 147) got their water from water kiosk, 3.8% from borehole, 1.1% (n = 4) roof catchment and 0.3% (n = 1) never reported their household water source.

Table 4.3: Household Sources of Drinking Water for respondents living with HIV/AIDS in Kibera

Water Source	Number of Respondents	Percent
Missing	1	0.3
Water Kiosk	147	39.8

Piped Water	203	55
Borehole	14	3.8
Roof catchment	4	1.1
Total	**369**	**100**

The study showed that water was available to 34.4% (n = 127) respondents at their source once or twice a week, while 30.9% (n = 114) reported that water was usually available at their source, 19.2% (n = 71) water was available at their source several hours per day and 13.8% (n = 51) reported infrequently of water availability to their water source.

Table 4.4: Availability of Drinking Water to the household source

Availability of Water	Number of Respondents	Percent
Missing	6	1.6
Usually available	114	30.9
Several Hours per Day	71	19.2
Once or Twice a week	127	34.4
Infrequently	51	13.8
Total	369	100

The study showed that 87% of the respondents had their water sources located less than 2km from their households. However, 13% had their water sources located more than 2km from their households especially during the water shortage days.

Distance of water source from the household
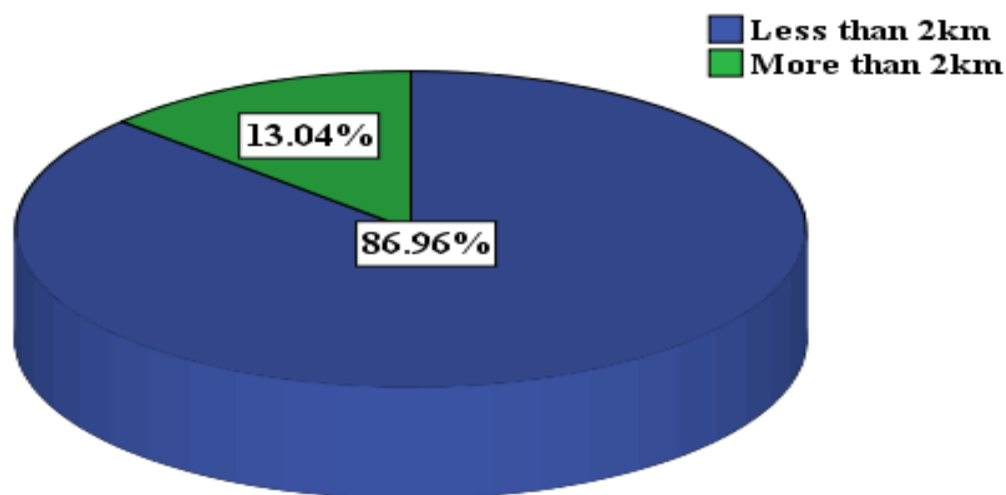
Figure 4.4: Distance of Water Source from the household

The study showed that 96% of the respondents normally transport their drinking water on foot, 2.2% used hand held drawn carts especially during water shortage days while 1.9% used bicycle (**Table 4.5**).

Table 4.5:   Mode of Transporting Drinking Water from Source to the household

Mode of Transport	Number of Respondents	Percent
Hand Drawn Carts	8	2.2
Bicycle	7	1.9
On Foot	354	95.9
Total	369	100

The study revealed that 82% of the respondents believed that drinking water drawn from the public water sources was treated. However, 18% of the people living with HIV/AIDS in Kibera slum believed that the drinking water was not being treated (**Figure 4.5**).

Treatment of Drinking water at the source
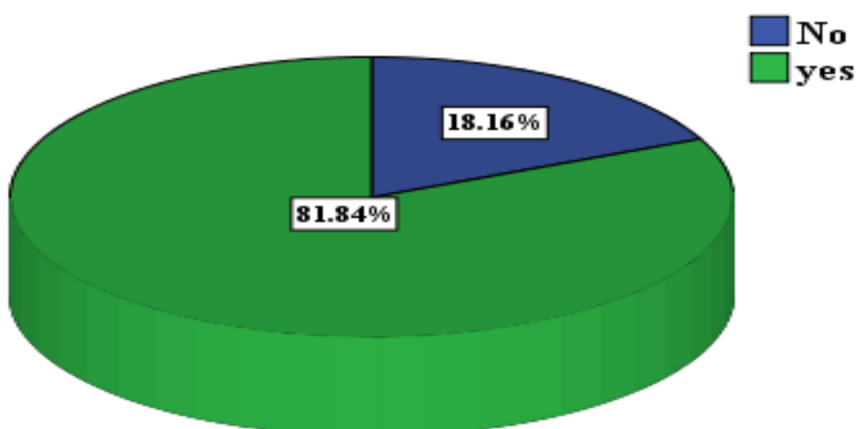
Figure 4.5: Treatment of the Household Drinking Water at the source

The study revealed that the people living with HIV/AIDS in Kibera slum employed various water treatment methods in their households (**Table 4.6**); 41% boiled their drinking water before taking it, 35% used chemicals to treat the water, 2.7% filtered their water, 1.4% used solar disinfection method, 0.5% used sedimentation method and 0.5% used the three pot system.

Table 4.6: Methods of water treatment used at the household level to treat water by respondents living with HIV/AIDS in Kibera Slum at August 2015.

Water Treatment Method	Number of Respondents	Percent
Boiling	154	41.7
Chemical Use	129	35.0
Water Filter	10	2.7
Sedimentation	2	0.5
Three pot system	2	0.5
Sodis	5	1.4
None	67	18.2
Total	369	100

The study showed that the average time taken by the respondents while going to get water from the household, to the water source and back was approximately 24 minutes.
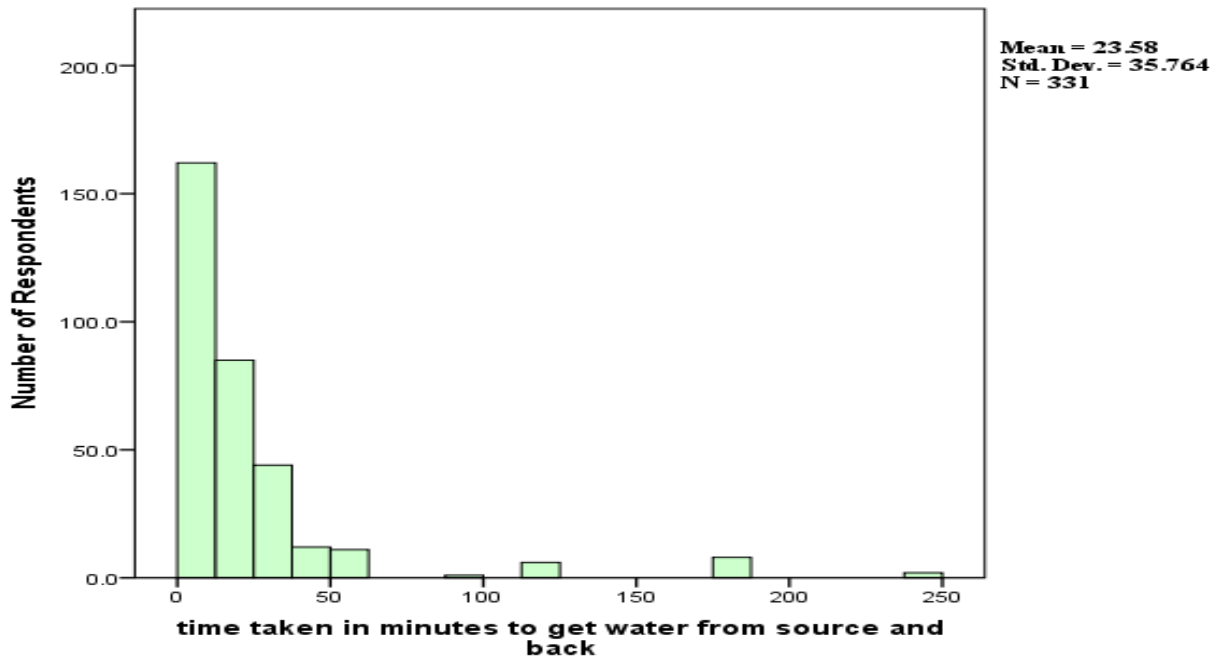
Figure 4.6: Average Time Taken to get Water from the household to the source and back to the household by the respondents living with HIV/AIDS in Kibera Slum as at August, 2015.

It was revealed that the mean size of the household of the respondents was approximately 5 people with the largest household comprising of 10 people and the smallest comprising of one person. Most household's sizes were comprised of 4 people (**Figure 4.7**).
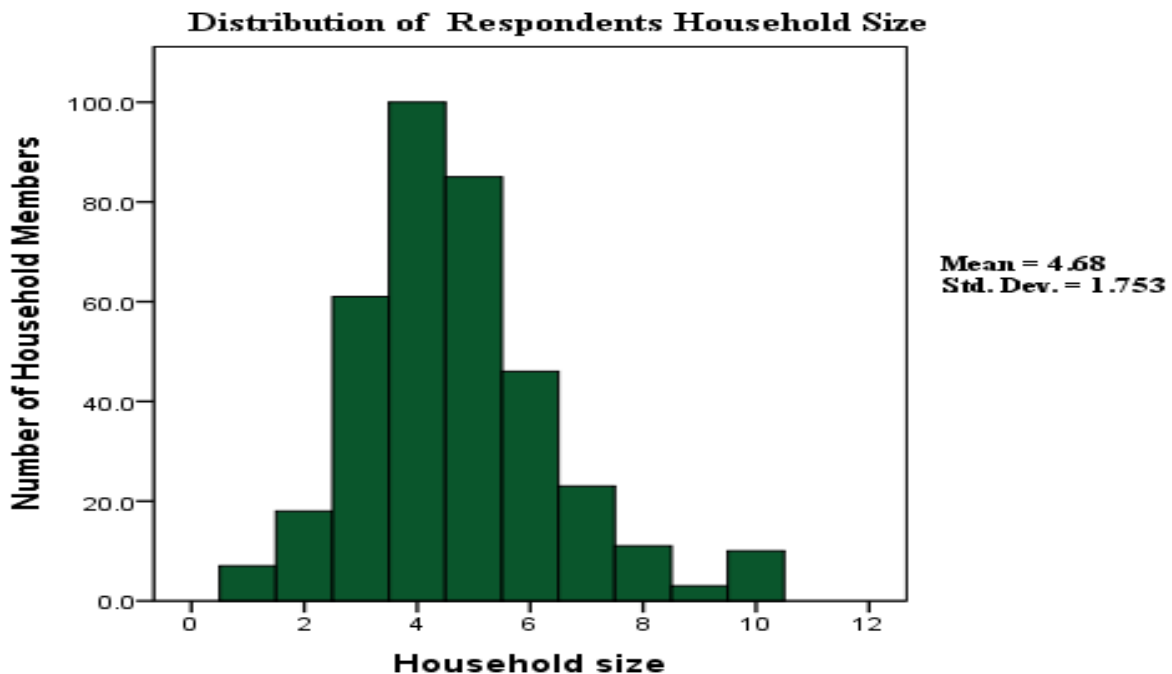
Figure 4.7: Average number of household size of the respondents living with HIV/AIDS in Kibera Slum as at August, 2015.

The number of days that the drinking water was stored by the households from the day in which it was fetched from the public water source was recorded. It was reported that the households stored their drinking water for approximately 4 days with majority of the respondents reporting that they store their drinking water for a maximum of 2 days. However, some of the respondents stored their drinking water for about 60 days (**Figure 4.8**).
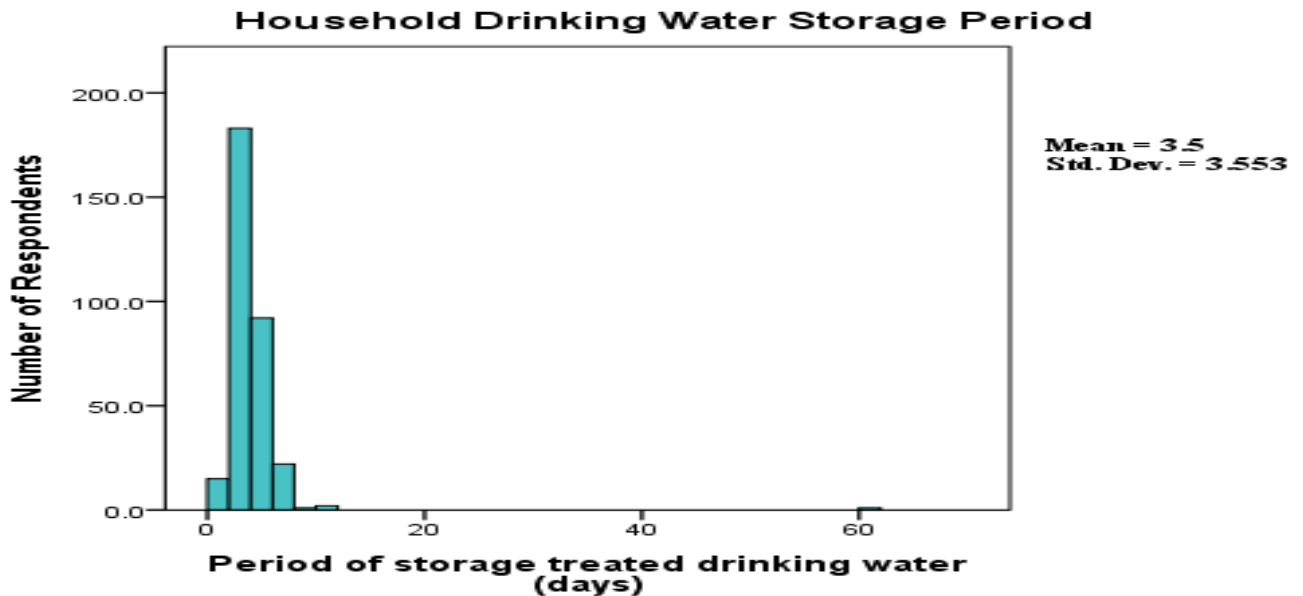
Figure 4-8: Average number of days the households of the respondents living with HIV/AIDS in Kibera Slum stored their drinking water as at August, 2015.

It was noted that an average household uses a mean of 133 liters of water per day with the highest consuming households using 820 liters of water per day and the least consuming households consuming 5 liters of water per day. However, most households used 80 liters of water per day (**Figure 4.9**).
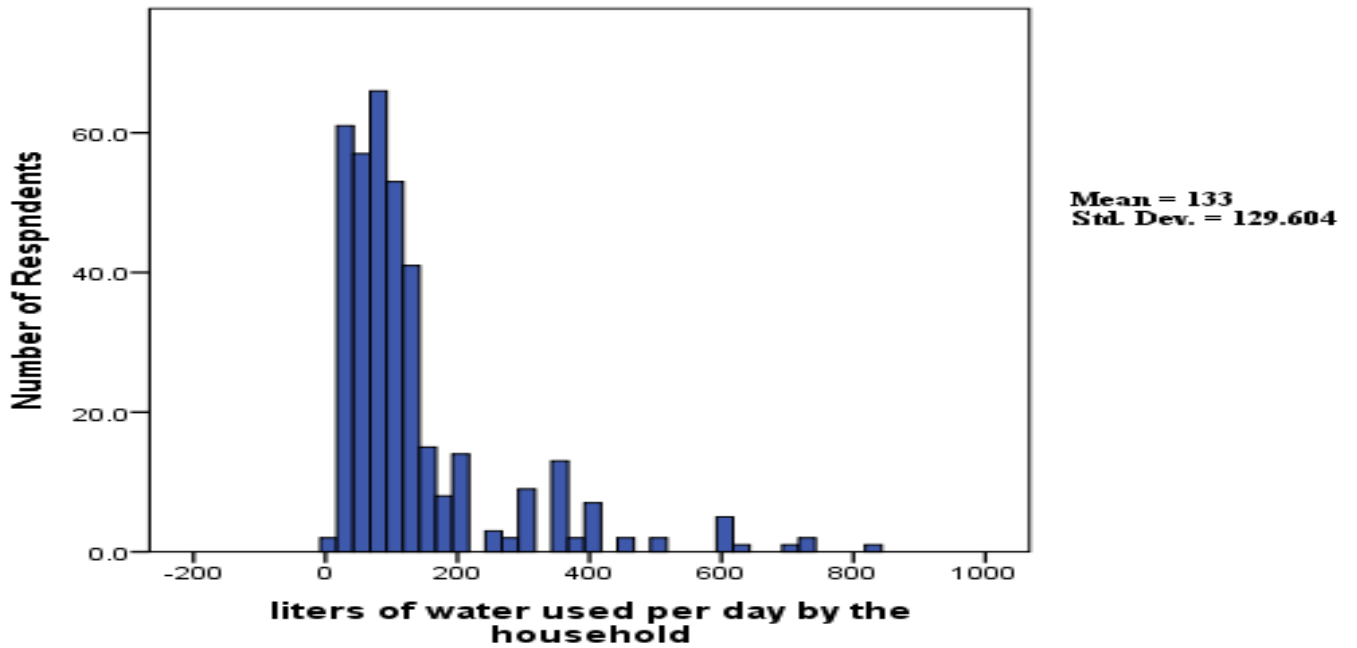
Figure 4.9: Average liters of water used per day by the households of the respondents living with HIV/AIDS in Kibera Slum as at August, 2015.

The drinking water was being charged by the vendors using a standard 20-liter jerry can which was being charged at mean cost of 5 (std1.622) Kenyan Shillings. However, some of the respondents were being charged the highest cost of Kenyan shillings 10 per 20 liter jerry can.
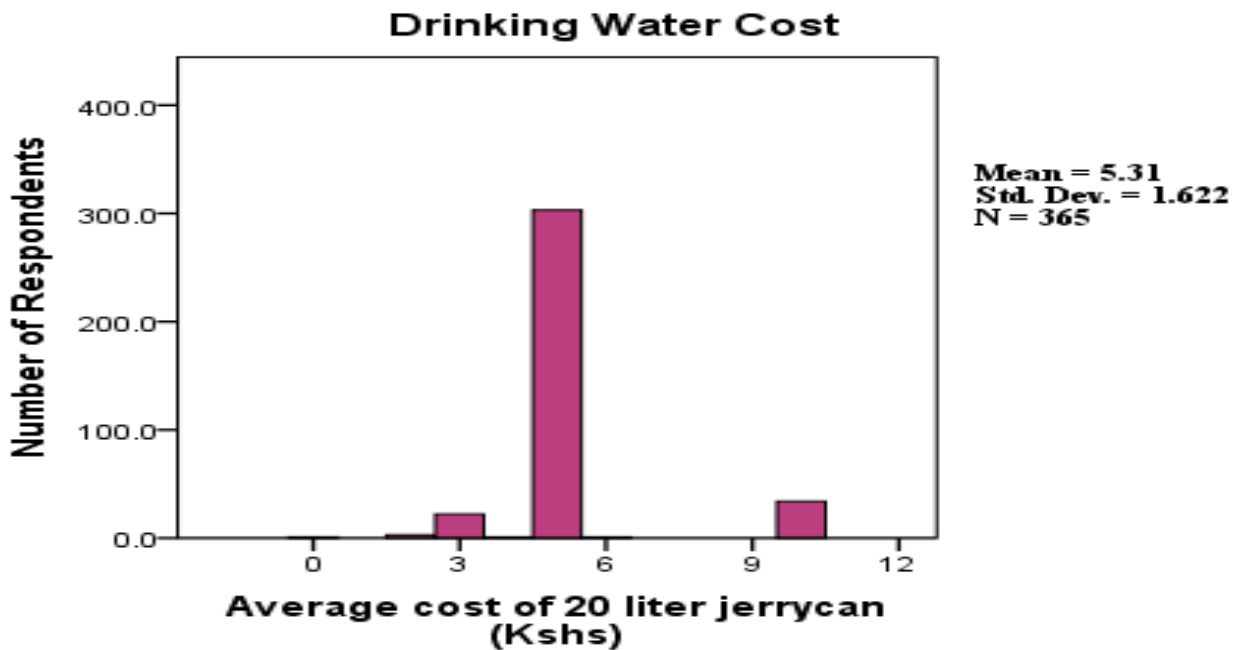
Figure 4.10: Average cost of 20 liters jerry can of water used by the households of the respondents living with HIV/AIDS in Kibera Slum as at August, 2015

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4.2. 1. Bacteriological Analysis of Drinking water

The results of bacteriological analysis of the community water sources showed that the drinking water contained coliforms per 100 milliliters of treated water that were high and varied significantly per village ; Lindi B village and Gatwekera village had their community water supply sources highly contaminated with over 180 total coliform count per 100 ml of treated water. Kisumu Ndogo A village public water supply source had 90 total coliform count per 100 ml of treated water.   Two samples were collected from Umash village and they recorded different level of contamination, the one sample collected at stand-by tap had 35 total coliform count per 100 ml of treated water. The other from stand-by tank had 3 total coliform count per 100 ml of treated water and therefore was suspicious and repeat treatment and pretest for the water was advised. Water from Kambimuru A village was collected from public supply tap with suspected contamination from pit latrine, it had 20 total coliform count per 100 ml of treated water (**Table 4.7**).

Table 4.7: Bacteriological analysis of drinking water samples from public water supply system in Kibera Slum

VILLAGE	SOURCE OF SAMPLE	EXACT SITE SAMPLE WAS TAKEN	SOURCE OF POLLUTION	TOTAL COLIFORM COUNT PER 100ML OF TREATED WATER
KambiMuru A	Public Supply	Tap from mains	Pit latrine	20
Kisumu Ndogo A	Public Supply	Tap from mains	None	90
Lindi B	Public Supply	Pipe from mains (no tap)	Pipe submerged into waste water	>180
Umash	Public Supply	Stand by tap	Pit latrines	35
Gatwekera	Public Supply	Pillar tap	Water pipes submerged into waste water drink line	>180
Umash	Public Supply	Stand by tank	Nearby filled pit latrines	3

The other four water samples were collected from the households that did draw their drinking water from the previously sampled community water sources. A household located in Kisumu Ndogo A which drew its water from a public supply storage tank and stored the water in a jerry can had its drinking water having over 180 total coliform count per 100 ml of treated water. A household located in Lind B village which got its water from public supply and stored it in a 20 liter jerry can had over 180 total coliform count per 100 ml of treated water. A house located in Umash village which got its water from a public storage tank and stored it in 100 liters super drum in the household had over 180 total coliform count per 100 ml of treated water. A household in Gatwekera village which got its water from public supply and stored in a 20 liter jerry can had over 1800 total coliform count per 100 ml of treated water and 6 total number of *Escherichia coli* per 100 ml of treated water. These waters were unsatisfactory for human consumption unless further treated (Klein, Jones, Hawkes, & Downing, 1972).

Table 4.8: Bacteriological analysis of drinking water samples from household storage containers in Kibera Slum

VILLAGE	SOURCE OF SAMPLE	EXACT SITE SAMPLE WAS TAKEN	ARE THERE ANY SOURCE OF POLLUTION	TOTAL COLIFORM COUNT PER 100ML OF TREATED WATER
Kisumu Ndogo A	Storage tank	Jerry can for drinking water	None	>180
Lindi B	Public Supply	20 liter jerry can	None	>180
Umash Village	Storage tank	100 liters super drum	None	>180
Gatwekera	Public Supply	Drinking water storage container (20 liters jerry can)	None	>1800

4.4. Occurrence of Opportunistic Infections

The study showed that in the last 12 months more than half of the sampled population (62%) had

suffered from diseases caused by poor environmental and sanitation that exist in their

environment and taking contaminated drinking water.

The environmental, sanitary and hygienic diseases that were reported by the respondents that

infected them in the last 12 months; Diarrhea 32% (n =119), malaria 30% (n = 111),

tuberculosis 21% (n = 76), Pneumonia 20% (n = 74), dermatitis 14% (n = 51),conjunctivitis 3%

(n = 12), scabies 2% (8), dysentery 1% (n = 4) and worms 1% (n = 3) (**Table 4.9**). The study

showed strong evidence of relationship between the occupation status of the respondent and

occurrence of diseases due to poor environmental sanitation and contaminated water (chi square

= 18.009, df = 2, p< 0.001).

Table 4.9: Poor Environmental sanitation and contaminated water related diseases suffered by the respondents living with HIV/AIDS in Kibera Slum in the last 12 months as at August 2015.

Disease	Occurrence	Frequency	Percent
Diarrhea	Yes	119	32.2
	No	250	67.8
Pneumonia	Yes	74	20.1
	No	295	7.9
Tuberculosis	Yes	76	20.6
	No	293	79.4
Malaria	Yes	111	30.1
	No	258	69.9
Dermatitis	Yes	51	13.8
	No	318	86.2
Conjunctivitis	Yes	12	3.3
	No	357	96.7
Intestinal worms	Yes	3	0.8
	No	366	99.2
Dysentery	Yes	4	1.1
	No	365	98.9
Scabies	Yes	8	2.2
	No	368	97.8

Table 4.10: Logistic Regression predicting disease outcome from explanatory variables.

Variable	B	SE	Wald X^2	P	OR
Constant	-1.312	0.353	13.809	<0.001	0.269

Drinking Water treatment at household level
    Didn't treat their Drinking water
    (Base = Treated their drinking water)
	-0.655	0.306	4.589	0.032	0.519

Taboos, Cultures and Beliefs
    Yes
    (Base = No)
	1.105	0.330	11.232	0.001	3.018

Display of Food, uncovered in the household
    Present
 	
    (Base = Absent)
	0.349	0.346	1.017	0.313	1.418

Standard Sanitary Bin Present in the Latrine
    Absent
 	
    (Base = Present)
	2.058	0.534	14.838	<0.001	7.832

Presence of waste storage bin at household level
    Absent
 	
    (Base = Present)
	1.257	0.257	23.942	<0.001	3.514

-2LL   415.951

X^2 = 73.912, df = 5, p<0.001

Nagelkerke R^2 25%

Hosmer & Lemeshow test   P = 0.561

Classification accuracy   73%

The table shows the logistic regression coefficient, Wald test, and odds ratio for each of the predictors. Overall a majority of respondents (62%) suffered from diseases related to taking contaminated water and living in poor environmental sanitary conditions. Logistic regression analysis was employed to predict the probability that a respondent living with HIV/AIDS in Kibera slum would be infected with diseases related to taking contaminated water and living in poor environmental sanitary conditions. The predictor variables were: respondent's household drinking water treatment behavior, taboos, beliefs and cultures that affects water quality and sanitation measures, availability of Standard Sanitary bin in the respondent's latrine and Presence

of waste storage bin at household level. A test of the full model versus a model with intercept only was statistically significant, x^2 (5, $N = 369$) = 73.912, $p < .001$.

It was evident that Of the 369 respondents interviewed 39% self-reported to know someone who had HIV/AIDS in that community and died due diseases caused by taking contaminated water or living in poor sanitary environment. However, 61% did not know any person who died due to the sanitary conditions they live in or because of taking contaminated water (**Figure 4.11**).
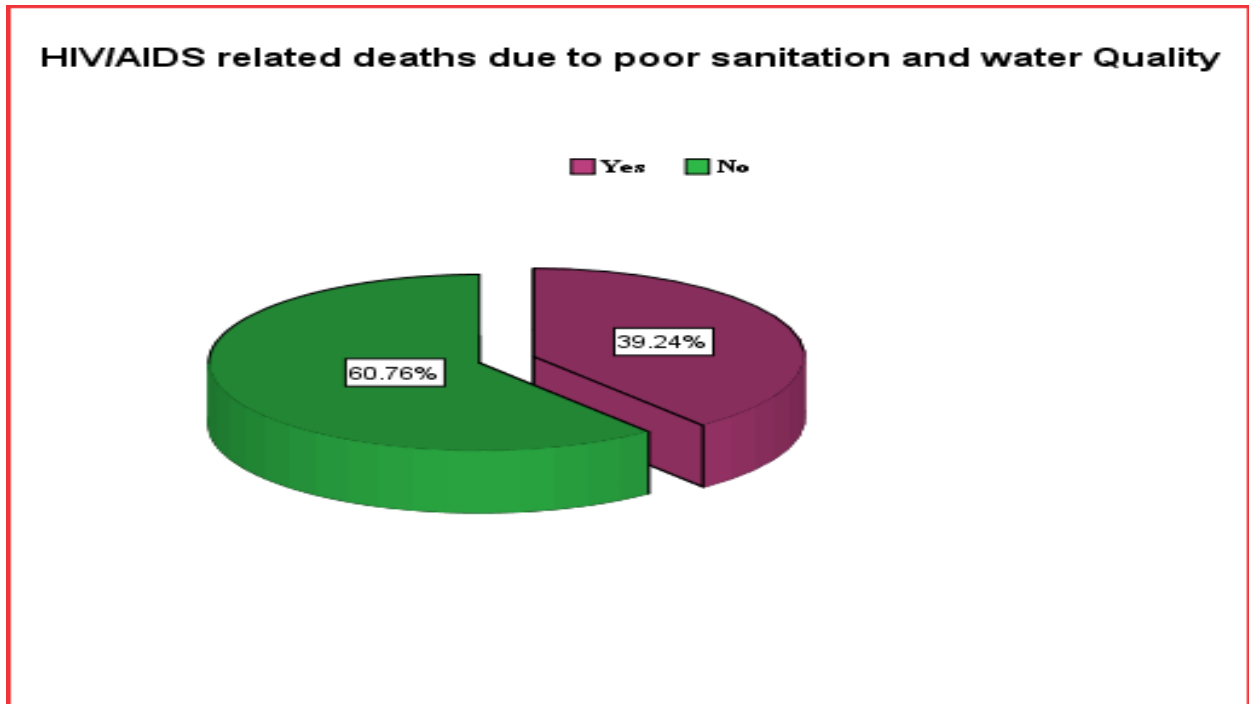
Figure 4.11: Self-reported HIV/AIDS mortality due to Poor Environmental sanitation and water related diseases that occurred in the last one year as reported as at August, 2015.

The study revealed that 94% of the people living with HIV/AIDS in Kibera slum who suffered from the diseases caused by taking contaminated water and poor environmental sanitation went to the health facilities to seek treatment and care. However, 6% of them never went to any health facility for treatment (**Figure 4.12**).
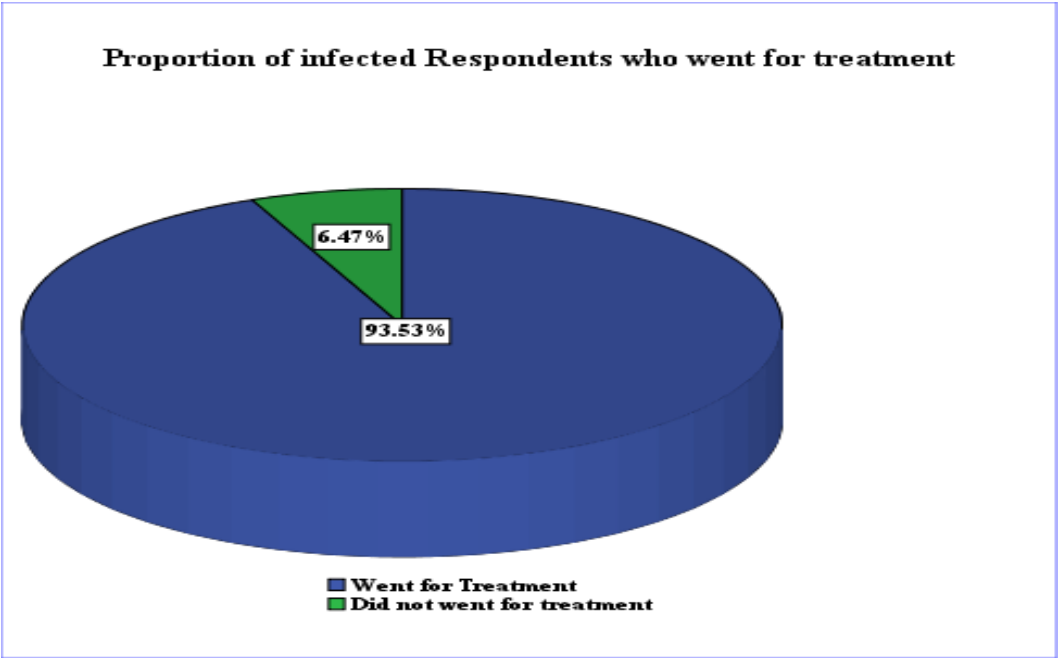
Figure 4.12: Accessibility of Treatment of the environmental and water related diseases.

The study showed that there was distribution in terms of the health facilities that the respondents who were infected went to in order to seek care and treatment; 54% went to the government health facilities, 35% went to the faith based health facilities or non-governmental organization health facilities, 7% went to private medical clinics, 4% went to private medical centers and 1% went to nursing homes for care and treatment (**Figure 4-13**).
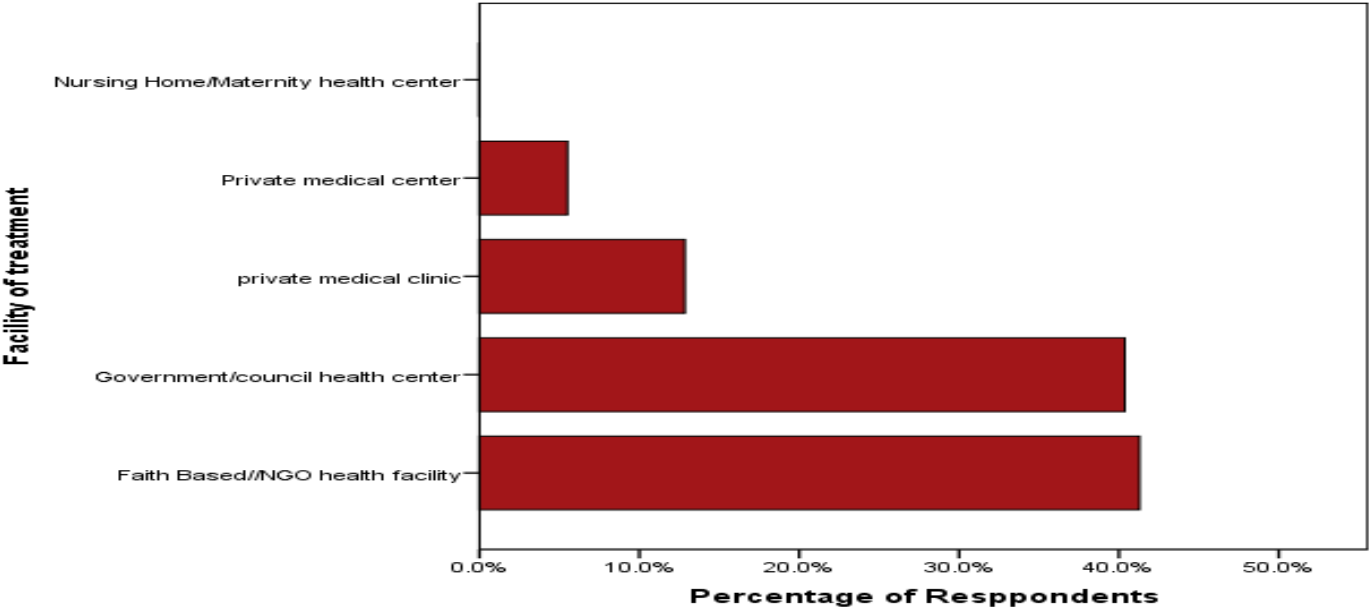
Figure 4.13: Facilities of treatment by the respondents who suffered from Environmental sanitation and water related diseases in the last one year as at August, 2015.

The study revealed that more than half (58%) of the respondents who reported that they had suffered from the infections related to poor environmental conditions and contaminated water were infected more than once in the last 12 months as at August 2015; Only 42% (n = 91) of them were infected at least once in the last 12 months, 27% (n = 58) were infected at least twice, 20% (n = 43) at least three times, 9% (n = 20) at least four times, 2% (n = 4) more than four times in the last one year (**Table 4.11**).

Table 4.11: Frequency of occurrences of Environmental sanitation diseases and water related diseases to the respondents living with HIV/AIDS in Kibera Slum in the last 12 months as at August 2015.

Frequency of Occurrence of the Disease	Number of Respondents	Percent
At least Once	91	42
At least Once Twice	58	27
At least Three times	43	20
At least Four Times	20	9
More than Four Times	4	2
Total	**216**	**100**

The study sowed that the average treatment cost for the infections for those who were infected and seak treatmnet was Kenyan Shillings 1125. Majority of the respondents were being treated for free (mode = 0). The highest cost of treatment reported by the respondents was Kenya Shillings 69000.
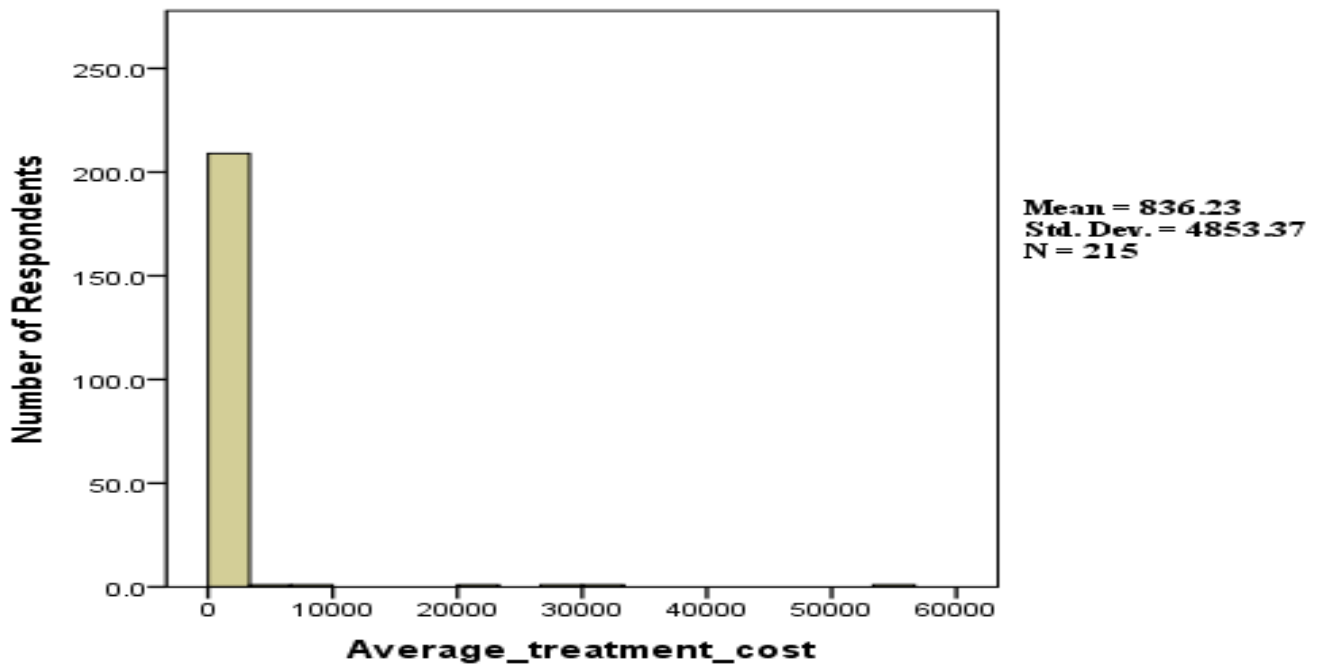
Figure 4.14: Average treatment cost of the respondents who suffered from Environmental sanitation and water related diseases in the last one year as at August, 2015.

4.5. Environmental, Hygiene and Sanitation Measures put in place by the people living with HIV/AIDS in Kibera Slum

It was noted that there was adequate accessibility to pit latrines/ toilets by this population. Huge proportion 90% had access to pit latrines / toilets either the public commercial owned or privately owned by the landlord/land lady of the houses that they were renting. However, 10% of the respondents did not have access to the pit latrines at all (**Figure 4.15**).

Accesibility of Pitlatrine/Toilet by Households

Yes
No

10.38%

89.62%
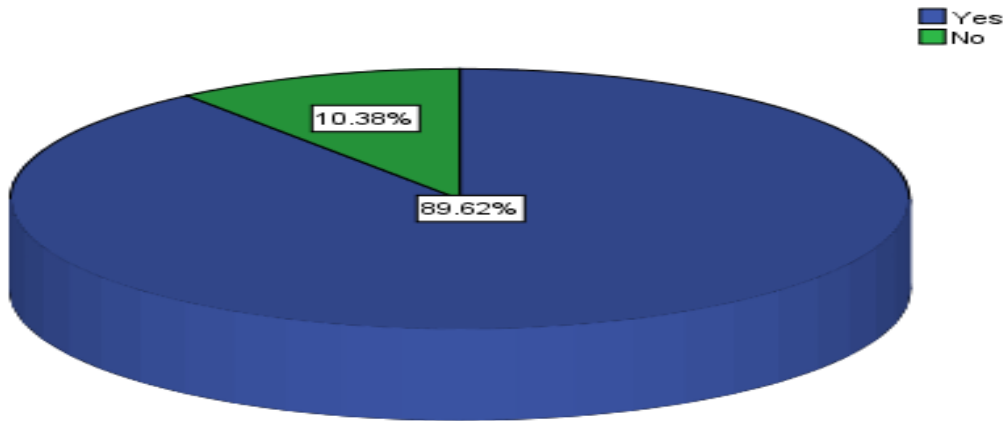
Figure 4.15: Proportion of the respondents who had access to pit latrines / toilets

The study showed that the cost of pit latrines usage per visit varied depending on the private owner of the pit latrine or toilet and its location. Fifty one percent of the respondents had access to pit latrines for free since it was included in their rent , 35% of the respondents were paying between 1 - 5 Kenyan Shillings, 13% of the respondents were paying between 6 -10 Kenyan Shillings while 1% were paying over Kenyan Shillings 7 and over (**Figure 4.16**). It was noted that the choice of pit latrine or toilet to use by the respondents was dependent on the cost per visit and had no relationship with occupation status of the respondents (chi square = 19.129, df = 12, p = 0.085).
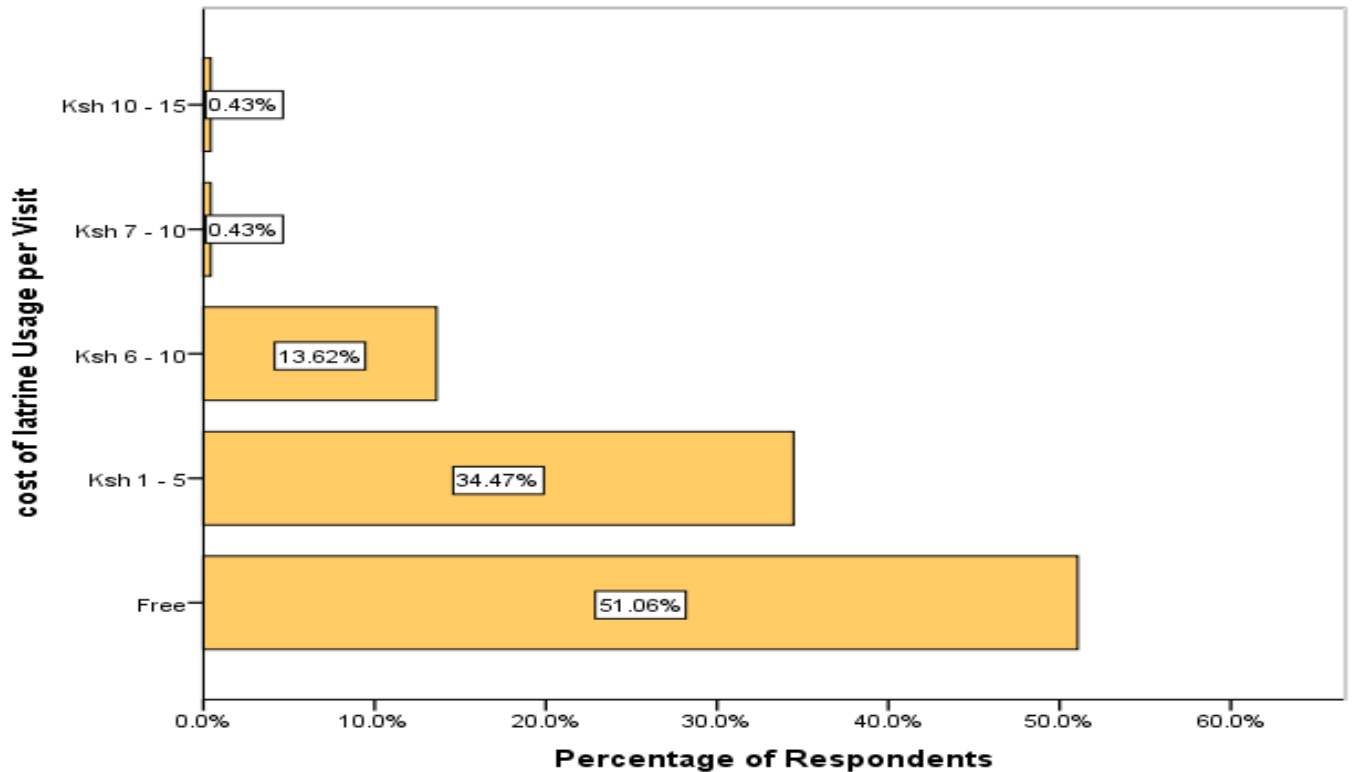
Figure 4.16: Cost of pit latrine / toilet usage per visit by respondents who had access to pit latrines / toilets as at August, 2015.

The study show that almost every person in this population was practicing hand washing behavior 99% (n = 364) with only 1% (n =2) reported not to practice hand washing. However, despite the high proportion of the respondents (99%) reporting to practice hand washing behavior they did not wash their hands at all the critical points; 71% (260) washed their hands before cooking while 29% (108) did not, 94% (344) of the respondents washed their hands after using the pit latrine / toilet while 6% (25) did not, 71% of the respondents did not wash their hands after changing the baby while only 29% (107) did wash their hands after changing the baby, 90% (331) of the study population washed their hands before eating while 10% did not. It was reported that 76% (280) of the respondents did not wash their hands after cleaning the sick and only 24% (89) were practicing hand washing after cleaning the sick. The respondents also reported that 85% (312) of them did not wash their hands before giving the sick medicine and only 15% (57) were practicing hand washing before giving the sick person medicine (**Table 4.12**).

Table 4.12: Hand Washing Practices by the respondents living with HIV/AIDS in Kibera Slum as at August 2015.

Hand washing	Occurrence	Frequency	Percent
Do you always wash your hands	Yes	364	99
	No	2	1
Wash hands before cooking	Yes	260	71
	No	108	29
Wash hands after visiting pit latrine/toilet	Yes	344	94
	No	25	6
Wash hands after changing the baby	Yes	107	29
	No	261	71
Wash hands after/Before eating	Yes	331	90
	No	38	10
Wash hands after cleaning the sick	Yes	89	24
	No	280	76
Wash hands Before giving the sick medicine	Yes	57	15
	No	312	85

The household water storage practices by the respondents were observed and recorded; Of the 329 respondents interviewed, most respondents (66.8%) stored their drinking water in a clean bucket with a lid, 19.9% in a clean bucket with a tap plus a lid, 6.6% stored their drinking water in uncovered bucket, 2% stored their drinking water in a dirty bucket without a lid, 6.64% used narrow necked container with tight fitting lid and a tap and 1.66% of the respondents used unclean bucket plus a tap and a lid to store their drinking water. The study showed a strong evidence of relationship between the occupation status of the respondents and the household drinking water storage practices (Chi Square = 30.667, df = 10, p = 0.001). (**Figure 4.17**)
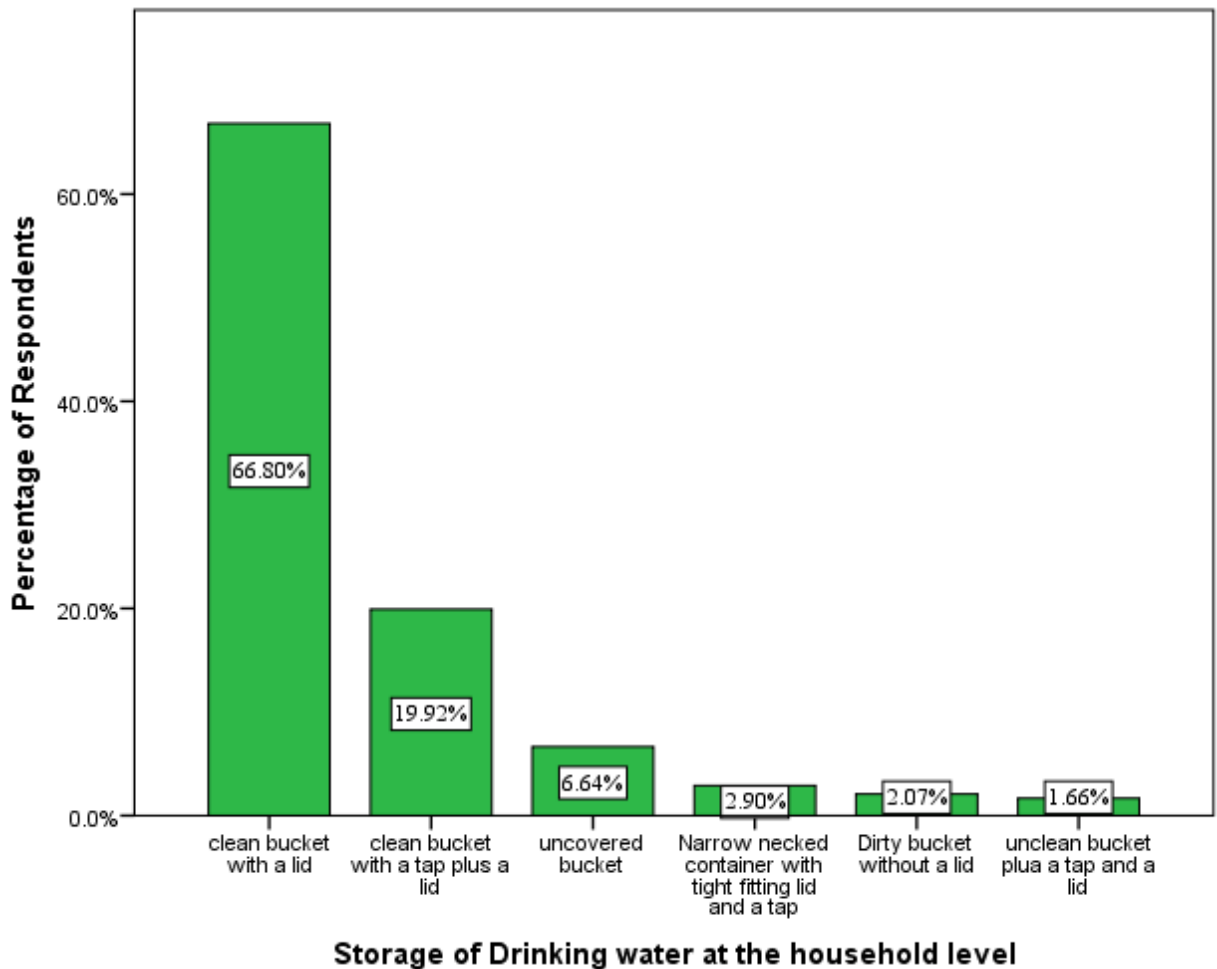
Figure 4.17: Household Drinking Water storage practices by respondents as at August, 2015.

The study observed the various environmental sanitation and hygienic measures put in place by the people living with HIV/AIDS in Kibera slum. It was observed that high proportion of the respondents did not have hand washing facilities that allows running water 84% (n = 308), 20% (n = 74) of the respondents had their food stored unhygienic with food being displayed in the open and uncovered, 87% (n = 322) of the respondents living with HIV/AIDS did not have standard sanitary bins present in the latrines / toilets to help with disposal of sanitary towels and 61% (n = 225) did not have waste storage bins at their household.

Table 4.13: **Environmental sanitation measure put in place by the respondents living with HIV/AIDS in Kibera Slum as at August 2015.**

Observation	Occurrence	Frequency	Percent
Hand washing Facilities that allows running water	Yes	58	16
	No	308	84
Display of Food that is uncovered at the household	Yes	74	20
	No	295	80
Standard Sanitary bin present at the latrine/toilet	Yes	47	13
	No	322	87
Waste storage bin present at the household level	Yes	144	39
	No	225	61

4.6. Socio-Cultural and Economic Factors Associated with Water Quality and Sanitation

The study reported that there were taboos, beliefs and cultures that were being practiced in this population that affected the water quality and sanitation measure put in place. 84% of the respondents reported to be practicing beliefs, cultures and taboos that had impact on the water quality and environmental sanitation measures that are put in place. However, 16% of the respondents did not hold or practice these taboos, beliefs and cultures (**Figure 4.18**).

Taboos, beliefs and cultures that affects water quality and sanitation measures in place
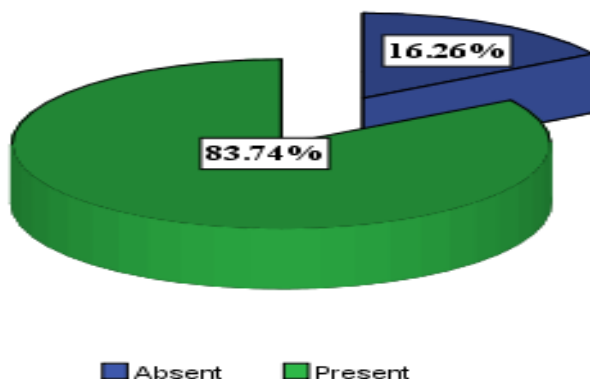
Figure 4.18: Taboos, beliefs and cultures that affect water quality and environmental sanitation measure put in place by respondents.

Of the respondents interviewed, more than half (59%) believe that drinking water is blessed by God and therefore it cannot cause infections. However, 41% of the respondents did not hold onto this belief (**Figure 4.19**).
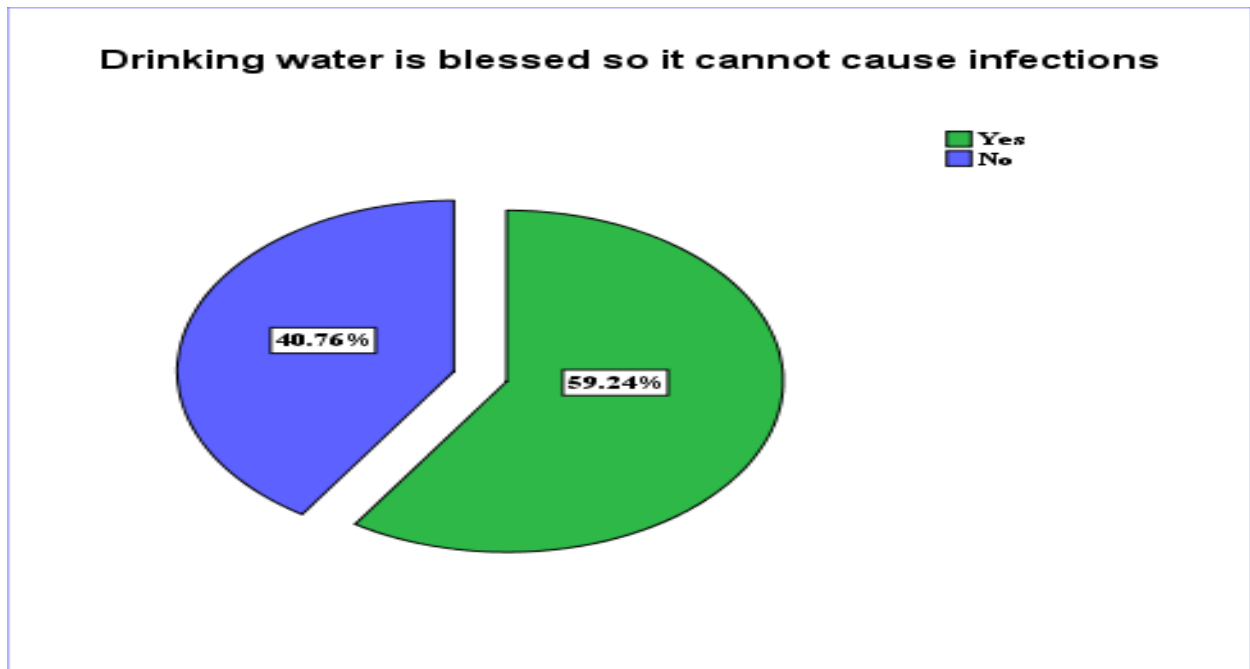
Figure 4.19: proportion of respondents believing that Drinking water is blessed and so it cannot cause infections

The study showed that of all the 329 respondents interviewed, 36% of them believed that the mother in law and son in law should not share a pit latrine or toilet whatsoever. However, 63% did not hold into these belief (**Figure 4.20**).
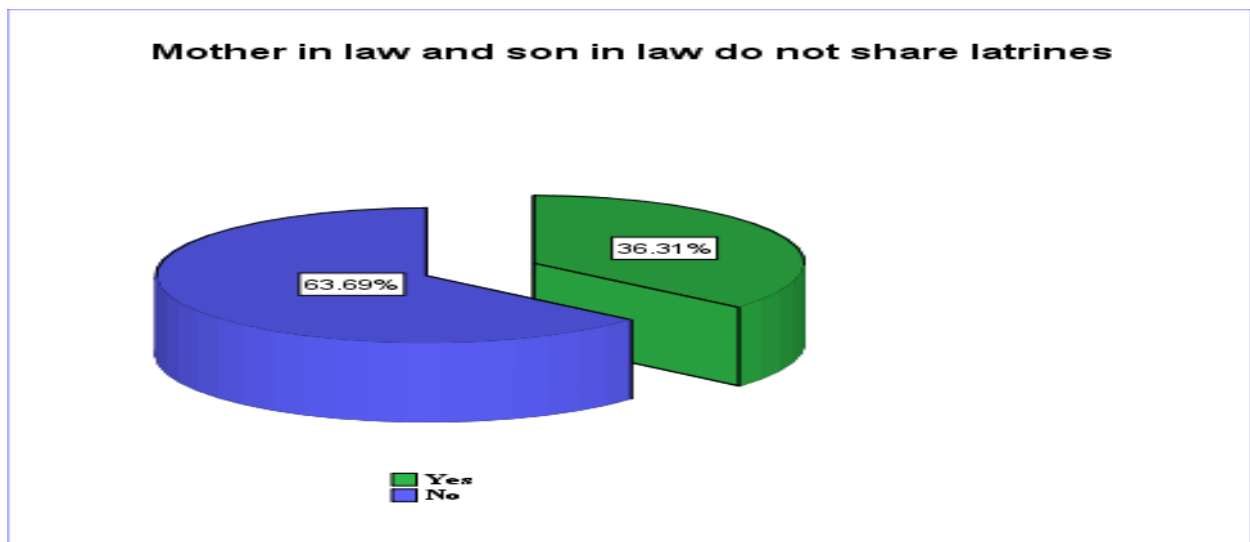
Figure 4.20: proportion of respondents believing that Mother in law and son in law do not share latrines.

The study showed that 24% of the respondents believed that feces of children are not infectious and therefore no need for hand washing after changing the baby. 76% of the respondents did not have such a belief (**Figure 4.21).**
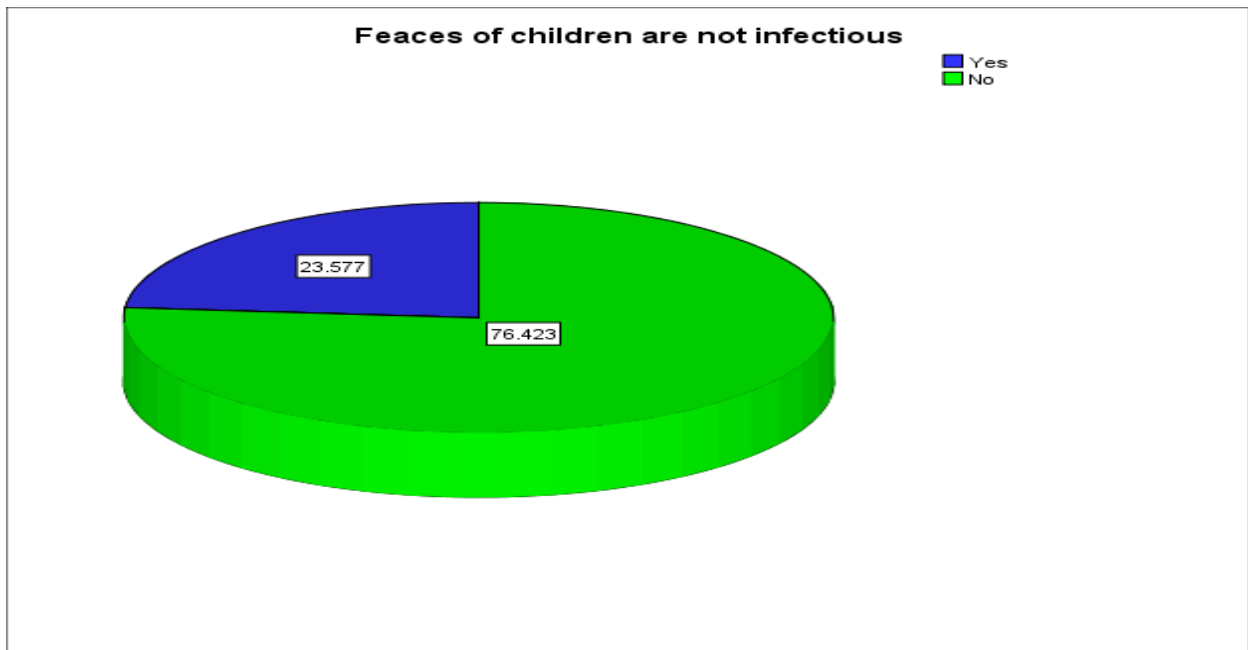
Figure 4.21: proportion of respondents believing that feces of children is not infectious.

Thirty nine percent of the respondents believed that garbage should not be disposed of at night as this will mean that the household blessings are being disposed off. However, 61% of the respondents differed with this kind of practice (**Figure 4.22**).
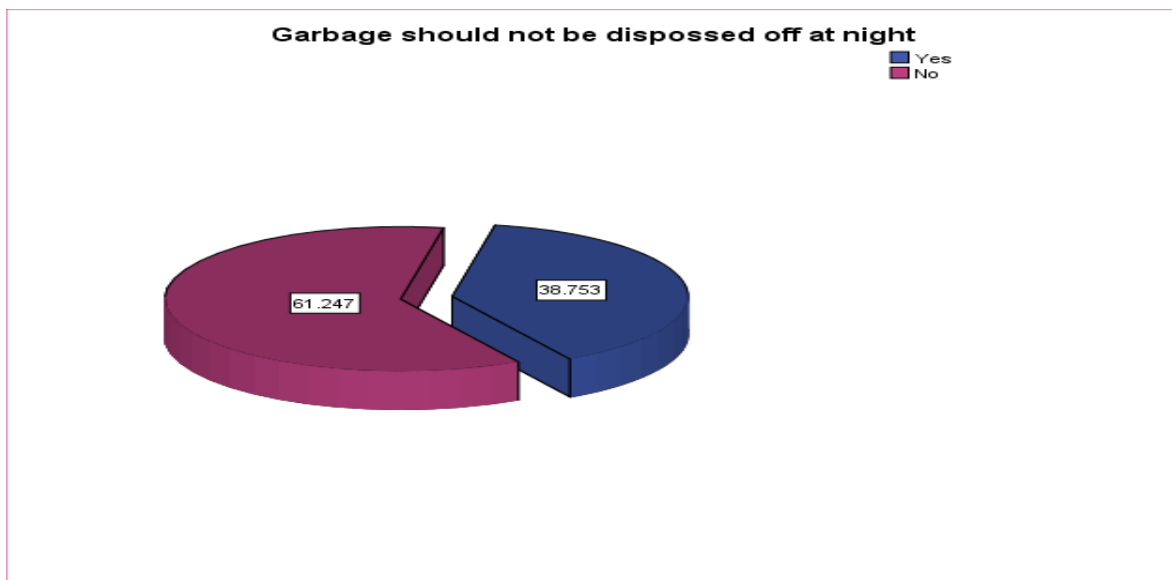
Figure 4.22: proportion of respondents believing that garbage should not be disposed off at night.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1. Discussion

5.1.1. Introduction

The study recruited 369 respondents living with HIV/AIDS in Kibera informal settlement. The mean age of the respondents who reported their age was 39.8 years with the youngest being 18 years old and the oldest respondent being 68 years old. The majority of the respondents were 38 years old. The study recruited twice more female respondents than male respondents. Univariate analysis indicated that men living with HIV/AIDS were significantly more likely to be infected with diseases caused by taking contaminated water and living in poor sanitary and unhygienic conditions than were female.

There was a huge disparity in the level of education of the respondents living with HIV/AIDS in Kibera informal settlement. Most the respondents in this population were educated as can be seen by more than half reporting to have gone past primary school. Therefore, this population is educated to take any form of health education measures that might be deemed necessary to help them deal with their health needs such as environmental sanitation, importance of safe drinking water and personal hygiene practices.

The distribution of the marital status of the respondents showed that majority of the respondents living with HIV/AIDS were married, followed by those who were single while and finaly divorced ones in that order. This was in line with (Kyobutungi et al., 2009) who reported the same results.

As in agreement with other studies (Lunchbowl Network, 2013; Pascal, Peggy, & Mwende, 2009) on the employment status, this study revealed that majority of the people living with HIV/AIDS in Kibera informal settlement were unemployed. This high level of unemployment was not being influenced by one's gender as it was evident that there was no association between gender and occupation status. The income distribution of the employed population was not normally distributed with people living with HIV/IDS earning a median monthly income of Kenyan Shillings 3000 with few people earning the highest income of Kenyan shillings 40000. Majority of the employed population was earning a monthly income of less than Kenyan Shillings 10000. Based on the median income (Kshs 3000) and taking a 30 days month period, the employed proportion (46%) of the people living with HIV/AIDS in Kibera informal settlement were having a daily income of Kshs 100 and therefore living below 1 US Dollar per day. This was in agreement with (Lunchbowl Network, 2013; Muoki, Tumuti, & Rombo, 2008a).

Despite 46% of this population being employed and earning a monthly median of Kenyan Shillings 3000 the uptake of health insurance cover to protect them against hospital treatment cost was very low. The study showed that 72% of the people living with HIV/AIDS in Kibera slum did not have access to health insurance cover including the National Hospital Insurance Fund that is being provided by the government of Kenya at a subsidized price to help in medical cover. The small proportion of this population whom did not own a health insurance did so because they did not know what health insurance cover is or its importance despite living with HIV/AIDS and prone to opportunistic infections.

It was evident that one's gender affected their ability to own health insurance cover, this was because the study showed a strong evidence of relationship between gender of the respondents and ownership of health insurance. (Guay, 2004) noted that culturally, men are regarded as

bread winners. In the face of global economy downturn particularly in a developing country like Kenya, it is not surprising that the cost of treatment is of much concern to the males.

There was a strong evidence of relationship between occupation status of people living with HIV/AIDS and the diseases caused by taking contaminated water and living in poor sanitary and unhygienic conditions with most respondents who were employed being infected than the unemployed. The employed population mostly work as manual casual laborers that consists of constructing expensive new apartments, repairing roads, digging trenches, working in factories or working with cars and machines in Nairobi. The work is strenuous and many Kibera residents will walk two or three hours each way to reach construction sites. Once there, they are unprotected by any kind of labor laws or safety regulations. When injuries occur, compensation is almost never considered (Higgins, 2012). Therefore, the nature of employment of this population impacts their health negatively and the effect is even severe if the individual is HIV seropositive.

5.1.2. Level of accessibility of safe drinking water

In terms of distribution, there were adequate water supply sources for the residents of Kibera slum. This was because the study showed that there were 5 major sources of drinking water ; piped water from the Nairobi County government water supply with standby tap, piped water from the Nairobi County government stored in a storage tank before distribution, underground water sources such as boreholes and hand dug wells, water got from roof catchment during rainy season and then stored and surface water sources such as river.

In terms of accessibility of the water sources it was reported that majority of the people living with HIV/AIDS in Kibera informal settlement were getting their drinking water from the municipal piped water. The county government supplies water to the water kiosks who store

their water in tanks and sell them to the population during water shortage days. The availability of water at the sources was varied as water was available during specific days of the week making water kiosks more valuable as they store water and sell it even during the days when water was not there; only a third drinking of all water sources had water available throughout the week. These findings agreed with agreed with (Addo et al., 2013)

There was a significant relationship between the occupation status of the respondents and the water source that the household was using. This relationship was caused by the water cost that were being charged by the water vendors whom sold the drinking water using a standard 20 liter jerry can at five Kenyan Shillings . However, some of the vendors were charging as high as Kenyan Shillings 10 per 20 liters' jerry can especially during water shortage days. Keeping in mind that only 46% of the people living with HIV/AIDS were employed with a median income of Kenyan Shillings 3000 per month. This means a daily income of Kenyan Shilling 100.

It was also noted that an average household in this community uses a mean of 133 liters of water per day with the highest consuming household using 820 liters of water per day and the least consuming household using 5 liters of water per day with most households using 80 liters of water per day. In terms of water expenditure and using the average cost of 20 liters jerry can (Ksh 5) and the median monthly income, this means that an average household was spending Kenyan Shillings 33.25 per day on water. This household was therefore spending 33% of their total monthly income on water.

The highest consuming household which was using 820 liters of water per day was therefore spending Kenyan Shillings 205 per day on water. Such a household was therefore earning more than the median income of Kenyan Shillings 3000 per month. If the household was earning Kenyan Shillings 10000 which majority of the employed population was earning as the

maximum monthly income, this would mean that they have a daily income of Kenyan Shillings 333.33 and spending Ksh 205 of this income daily on water. This household will therefore be spending 62% of their total income on water.

The majority of the population who were consuming 80 liters of water per day were spending a significant amount of Ksh 20 per day. This proportion of the community was therefore spending 20% of their total monthly income in purchasing water (using the monthly median income of Ksh 3000).

The water cost was therefore very expensive and taking a big proportion of the income of this population and based on this, the sanitary conditions was highly likely to be compromised factored in that other high priority household needs such as food, clothing, education, and rent were also dependent on the same income. The household quality of life will therefore be affected. This was in agreement with (Akatch, Kasuku, & Silvester, 2002; Omungo, 2008) on the burden of water on slum dwellers.

Just like (Addo and Langbong, 2013) distance was not a factor to determine the accessibility of safe drinking water as majority of the respondents (87%) had their water sources located less than 2km from their households and only 13% of the respondents reported that they had to travel more than 2km to look for water during water shortage days. This population was transporting their water from the water source to the households by foot using small containers that could be carried by hand. However, some were using hand drawn carts and bicycles to transport water from the source to their households especially during water scarce days. These containers used by the majority of the residents have been reported to be the source of contamination of drinking water between the water source and household (Chemuliti et al., 2002).

Eighty two percent of the people living with HIV/AIDS believed that the water they were purchasing expensively from the 5 public water sources was treated and therefore safe for human

consumption with only few reporting that the water was not safe for human consumption and household water treatment methods was necessary before consumption. Despite majority of the respondents thinking that the water from the source was safe for drinking they still employed various water treatment methods at household levels before drinking the water such as boiling their drinking water before taking it, using chemicals, filtering drinking water, solar disinfection, sedimentation and the three-pot system. Out of all these water treatment methods the most preferred water treatment method being boiling and chemical treatment.

To determine the safety of the drinking water both at the source and in the households the study collected 10 water samples for bacteriological analysis; six drinking water samples were collected from community water supply sources and 4 water samples were collected from the randomly selected respondent's households who got their water from the 6 selected water sources. The bacteriological analysis of the water sources showed that the water from these water sources were contaminated and unsatisfactory for human consumption. The waters were heavily contaminated at the source, unsafe for human consumption and requires further treatment before consumption. These results confirmed the findings from (Muoki and Rombo, 2008b). The defective water supply system and inadequate environmental sanitation were the potential source for contamination of the water sources (Chemuliti et al., 2002).

The four water samples collected from households in the same villages with where the community 6 water source samples were collected showed a significant secondary contamination of water at household level which were higher than the source contamination level. The waters were unsatisfactory for human consumption unless further treated.

This showed that despite the public water supply system being poorly treated by the municipal water supply using mainly chlorine, the water still gets contaminated along the supply system due to leakages and bursts, at the community water supply points due to poor storage, between

the source and the final consumption point due to severe contamination caused by the consumers' personal sanitation measures in terms of sterility of equipment used to draw water, transport and storage. Their unhygienic behavior such as not washing hands after visiting toilets and latrines would lead to contaminating the water with fecal matter when they get into contact with water storage equipment or equipment used to draw water from the source.

The vendors storage tanks if not properly maintained will also result into water contamination. The water distribution network which is mainly through plastic pipes and passing through unsanitary environments such as ditches, crude dumping sites and near pit latrine makes the water to be contaminated before the water gets to the consumers. These findings are in line with World Health Organization publication (WHO, 2003) which noted that despite the treatment of source water and the use of chlorine disinfectant, contamination of piped water supply continues to occur, without necessarily causing large easy-to-recognize outbreaks, through leaks, or at other vulnerable parts of the system, and during maintenance work. Once in the system, bacteria, fungi and protozoa can attach to the inner surfaces of the pipes and some may grow to produce bio films. It also noted that chlorine is the most widely-used drinking-water disinfectant in public water supply systems and in most homes. However, it has some limitations in the sense that although chlorine is effective against most vegetative bacteria and viruses when used at the normal concentration for treatment, it will not inactivate Cryptosporidium oocysts. Furthermore, chlorine has a very limited effect upon pathogens growing in bio films. So while its use reduces overall risks, it changes the relative impact of different pathogens (WHO, 2003).

5.1.3. Burden of poor environmental sanitation and contaminated drinking water

Just like the findings from (Akinbo and Omoregie, 2010; Kipyegen and Odhiambo, 2012), this study showed that in the last 12 months more than half of the sampled population (62%) living with HIV/AIDS had suffered from diseases caused by poor environmental and sanitation

measures that exist in their environment and taking contaminated drinking water. The environmental and sanitation diseases that were reported by the respondents that infected them in the last 12 months as at August 2015 included; diarrhea, malaria, tuberculosis, Pneumonia, dermatitis, conjunctivitis, scabies, dysentery and intestinal worms.

The study showed strong evidence of relationship between the occupation status of the respondent and occurrence of diseases due to poor environmental sanitation and contaminated water. This relationship was also reported by (Akinbo and Omoregie, 2010). The high occurrence of the water related infections such as diarrhea, dermatitis, scabies, conjunctivitis, dysentery and intestinal worms was due to the people living with HIV/AIDS taking contaminated drinking water or coming into contact with water that was contaminated with the disease-causing pathogens. These results were in agreement with (Kyobutungi et al., 2009) who reported that HIV/AIDS was major contributor to burden of poor health among residents of Nairobi Slums. These results were also in support of the findings from (Fewtrell et al., 2005; Laurent, 2005).

In this survey, it was evident that the drinking water sources were contaminated beyond human consumption since the bacteriological analysis of the samples taken from these water sources showed that the least contaminated water source at Umash village had total coliform count of 3 with the highest contaminated water sources from the two villages (Gatwekera and Lindi 'B') had over 180 total coliform count. These are waters were not safe for human consumption. The water contamination was further increased at the household level as shown by water samples which were picked from the households drinking water storage vessels and analyzed for bacterial contamination. The bacteriological analysis showed that the water samples from households had increased contamination levels than they were at the source with all the samples reporting over

180 total coliform count. Of much more concern was the sample that was collected from Umash village standby tank water source and had 3 total coliform count but after the water was drawn from this water source and taken to the respondent household and stored in a 100 liters super drum water storage vessel, the total coliform count increased to over 180 total coliform count. (Potgieter, Becker, & Ehlers, 2009) found the same results in South Africa.

The World Health Organization guideline values for bacteriological quality of drinking water requires that treated water entering distribution system must not have any detectable E. *coli* or thermotolerant Coliform bacteria in any 100-ml sample and the total coliform bacteria must not be detectable in any 100-ml sample. Therefore, these waters were not suitable for human consumption. The results showed a similar trend with (Chemuliti et al., 2002; Laurent, 2005; WHO/UNICEF, 2012).

The other diseases that infected this population such as malaria, tuberculosis, Pneumonia and scabies are associated with poor environmental sanitation measures in place such as poor housing, poor environmental management and poor hygienic practices which were evident in this population where these infections were reported; almost all the people living with HIV/AIDS did not have hand washing facilities that allows running water both at the latrines and in the house, some had their food displayed in the open and uncovered therefore making it easy for flies and rats to gain access to the stored food, more than half did not have standard Sanitary bin present at the latrine for disposal of sanitary pads and other latrine/toilet related wastes and more than half did not have waste storage bin at household level. The unhygienic behavior could be seen by the hand washing practices of this population where a third never washed their hands before cooking, two thirds never washed their hands after changing the baby, more than half never washed their hands after cleaning the sick and two third never washed their hands before giving

the sick medicine hence the occurrence of the infections in the 62% of this population. Similar findings were found by Muoki and Rombo in Mukuru slum in Nairobi Kenya when they found out that personal hygiene and environmental hygiene were correlated with the occurrence in infections in under-fives (Muoki et al., 2008a).

Piped water system do offer great benefits to the population being served. However, the potential for disseminating pathogens is greatly increased if the water source protection mechanism and rudimentary treatment systems are breached. Piped distribution without adequate treatment can spread contamination to large populations. The relationship between the occurrence of water related infections and environmental sanitation is outlined clearly by WHO where it stipulates that water safety management relies largely on identifying hazards and ensuring that adequate control measures are available. The proper management of excreta through the use of appropriate sanitation acts as the primary barrier to prevent the spread of pathogens in the environment. Environmental management is very key to control of infections. Therefore simple sanitary measure put in place such as proper waste disposal mechanisms and proper food storage would help in the infections prevention as was reported by (WHO, 2003).

The burden of the poor environmental sanitation and taking contaminated water could further be seen in people living with HIV/AIDS in Kibera Slum who self- reported a mortality of 39% of people they know of the similar HIV/AIDS status. Apart from the self- reported high mortality rate, study revealed that more than half of the respondents who reported that they had suffered from the infections related to poor environmental conditions and taking contaminated water were infected more than once in the last 12 months. This supports the study conducted by (Kyobutungi et al., 2009).

The median monthly income of the people living with HIV/AIDS in this population was Kenyan shillings 3000 and the average treatment cost for the infections for the respondents infected due to taking contaminated water or due to poor environemntal sanitation was Kenyan Shillings 1125 for those who paid their medical bills. This is about 38% of their total monthly income for the employed population (46%) and 72% of the people living with HIV/AIDS in Kibera slum did not have acccess to health insurance cover including the National Hospital Insurance Fund. Therefore , most respondents had to pay for the treatment out of pocket. Majority of the health facilities in Kibera slum were offering treatment for free to the people living with HIVAIDS with government health centers where 53% of the population attended and Faith based health faciility (35%) as the most preffered hospital faclities. The free medical treatment has enabled the unemployed (54%) population to get access to health services but to limited number of infections. Therefore, there is more pressure in these health facilties due to diseases caused by poor sanitary environments and taking contaminated water by the people living with HIV/AIDS just as was reported by (Akatch and Silvester, 2002).

Overall a majority of respondents (62%) suffered from diseases related to taking contaminated water and living in poor environmental sanitary conditions. Logistic regression analysis was employed to predict the probability that a respondent living with HIV/AIDS in Kibera slum would be infected with diseases related to taking contaminated water and living in poor environmental sanitary conditions. The predictor variables were: respondent's household drinking water treatment behavior, taboos, beliefs and cultures that affects water quality and sanitation measures, availability of standard sanitary bin in the respondent's latrine and presence of waste storage bin at household level. A test of the full model versus a model with intercept only was statistically significant. The model was able to correctly classify 79% of those who self-reported to have been infected with diseases related to taking contaminated water and poor

environmental sanitation and 63% of those who did not self-report to be infected, for an overall success rate of 73%.

Employing a 0.05 criterion of statistical significance; respondent's household drinking water treatment behavior, taboos, beliefs and cultures that affects water quality and environmental sanitation measures, availability of standard sanitary bin in the respondent's latrine and presence of waste storage bin at household level had significant partial effects to the occurrence of diseases related to taking contaminated water and living in poor environmental sanitary conditions.

The odds ratio indicates that when holding all other variables constant, respondents who didn't treat their drinking water at the household level were 0.52 times less likely to be infected with the diseases related to taking contaminated water and living in poor sanitary conditions than those who treated their drinking water, the people living with HIV/AIDS who had taboos, beliefs and cultures that affects water quality and sanitation measures were 3.01 times more likely to be infected with diseases related to taking contaminated water and living in poor environmental sanitation than those who never uphold such taboos, beliefs and cultures, the respondents who didn't have standard sanitary bin in their latrines were 7.832 times more likely to be infected than those who have the bin in their latrines and those who never had waste storage bins for waste disposal in their individual household were 3.514 more times likely to be infected than those who had the waste disposal bins at the household level. It was also evident that poor storage of food such as storing food that is uncovered at the household is associated with 1.418 more times of development of the diseases related to taking contaminated water and living in poor sanitary conditions than those who covered their food well during storage. However, this relationship in food storage and occurrence of the infection was not statistically

significant. Therefore, more people who reported to treat their drinking were infected than those who never treated their water. This showed that the water was being contaminated at the household treatment point. Water quality, environmental sanitation and taboos, beliefs and cultures that affects water quality and sanitation measures are significantly associated with occurrence of diseases related to taking contaminated water and living in unsanitary conditions, (Fewtrell et al., 2005).

5.1.4. Level of Environmental and Sanitation Measures

There was adequate accessibility to pit latrines/ toilets by this population. High proportion had access to pit latrines / toilets either the public commercial owned or privately owned by the landlord/land lady of the houses that they were renting. Only a small proportion of the respondents did not have access to the pit latrines at all. Despite the high proportion of this population having access to pit latrine, most of these latrines were privately owned and therefore they had to pay per visit for them to use the latrines / toilets. The cost of pit latrines usage per visit varied depending on the private owner of the pit latrine or toilet and its location; almost half of the respondents had access to the pit latrines for free since it was included in their rent and therefore they did not have to pay per visit, a third of the respondents were paying between 1 - 5 Kenyan Shillings, a third of the respondents were paying between 6 -10 Kenyan Shillings, while very few were paying between 10 - 15 Kenyan Shillings. It was noted that the choice of pit latrine or toilet to use by the respondents was dependent on the cost per visit set by the owner of the latrine or toilet and had no relationship with occupation status of the. Therefore, employment status did not play a role in the latrine choice but the cost set by the owner of the pit latrine / toilet did.

The study showed that almost every person in this population was practicing hand washing behavior. However, despite the high proportion of the respondents reporting to practice hand washing behavior they did not wash their hands at all the critical points required to prevent infections; a third did not washed their hands before cooking, more than half of the respondents did not wash their hands after changing the baby, a third of the respondents did not wash their hands before eating. It was reported that more than half of all respondents did not wash their hands after cleaning the sick especially the HIV/AIDS patients under the home-based care and two thirds of them did not wash their hands before giving the sick medicine

The households were using various methods and equipment to store their drinking water. Despite all the water storage methods and equipment used by the people living with HIV/AIDS only 4% of the population stored their water in required safe and hygienic manner in a narrow necked container with tight fitting lid. This is the method that makes drinking water difficult to contaminate especially by user while drawing water from the container and children cannot contaminate the water easily due to its narrow neck. The study showed a strong evidence of relationship between the occupation status of the respondents and the household drinking water storage practices. The employment status played a role in determining the drinking water storage since various methods and equipment used will have to be purchased and maintained hygienically and the cost of such equipment varies greatly. Therefore, affordability of the safe water storage equipment played a role in determining the choice in water storage equipment (Kremer & Zwane, 2007).

It was observed that huge proportion of the respondents did not have hand washing facilities that allows running water, almost two thirds of the respondents had their food stored unhygienic with food being displayed in the open and uncovered, two third of the respondents living with HIV/AIDS did not have standard sanitary bins present in the latrines / toilets to help with

disposal of latrine/toilet related wastes and more than half did not have waste storage bins for their household. There was poor Environmental and Sanitation Measures put in place in this community and it is estimated that the household waste forms 61% of the total waste generated in the city (Ali, Gumbe, Mohammed, & Nathan, 2010).

5.1.5. Socio-Cultural and Economic Factors Associated with Water Quality and Sanitation

The study reported that there were taboos, beliefs and cultures that were being practiced in this population that affected the water quality and sanitation measure put in place. Two third of the respondents reported to be practicing beliefs, cultures and taboos that have impacts on the water quality and environmental sanitation measures that are in place. These socio cultural and social economic factors that affected the water quality and environmental sanitation included the belief that drinking water is blessed by God and therefore it cannot cause infections if taken without treatment, one third of the respondents believed mother in law and son in law do not share latrines or toilets, one third of the respondents believed that feces of children are not infectious and therefore no need of washing hands after changing the baby and another one third of the respondents believed that garbage should not be disposed off at night as this will mean throwing away blessings. However, a small proportion of the respondents did not hold or practice these taboos, beliefs and cultures. This findings support the study done in Nigeria by (Olawoye & Awoyemi, 2002), whom noted that factors such as accessibility, education, culture and socio-economy have strong influence on toilet availability and utilization. Therefore, the traditional beliefs and cultures will play an important role in issues relating to water quality, environmental sanitation and hygiene and on the relationship between these factors and the outcome of diseases related to them.

5.1.6. Study Limitations

The study was not able to collect data from all the villages in Kibera slum due to financial constraints and limited study time frame. The water samples were not collected from all the households and community water sources also due to limited finances to carry out water sampling and analysis.

5.2. Conclusions

1. The safe drinking water was inaccessible to most people living with HIV/AIDS in Kibera slum. Defective water delivery system and inadequate sanitary measures in place were the potential source of contamination for water sources while sterility of the storage equipment and scoops were the source of contamination for household drinking water stored as was revealed by the bacteriological analysis.

2. The people living with HIV/AIDS in Kibera slum are over burdened with diseases caused by taking contaminated water and living in unsanitary environments coupled with poor hygiene status. There was an association between water quality, environmental sanitation and the occurrence of infections related to taking contaminated water and living in poor environmental sanitary conditions in people living with HIV/AIDS in Kibera slum.

3. There was low levels of environmental and sanitation measures put in place by the people living with HIV/AIDS in Kibera slum. This was showed by poor water storage practices, lack of adequate hand washing facilities, unsanitary food storage behaviors and lack of standard sanitary bins for waste disposal both at the household level and in the latrines.

4. There were taboos, beliefs and cultures that were being practiced that affects the water quality and sanitation measure put in place. Majority of the respondents practiced beliefs,

cultures and taboos that had impacts on the water quality and environmental sanitation measures that were put in place by people living with HIV/AIDS in Kibera slum.

5. Taking contaminated water and living in unsanitary environment led to high economic burden to people living with HIV/AIDS in Kibera slum. The high economic burden could be seen clearly on the financial effect that it causes with regards to high treatment cost. Most respondents did not have health insurance cover and had to pay for the hospital bills out of pocket. This is huge financial expenditure burden to the population which was already over burdened with HIV/AIDS and cost of drinking water and it will go along way to affect the quality of their life and other sector of develeopment such as education and their investment capacity.

5.3. Recommendations

1. The Municipal water supply company in Nairobi should ensure that they treat their drinking water to the required standards established by the WHO with frequent monitoring of the water supply system to check for any malfunctioning that might result in water contamination. This include doing routine chemical and bacteriological analysis of the water samples taken at the various points along the system. These analyses should be able to detect the new emerging water related pathogens that are known to cause high morbidity and mortality in the immune compromised populations. This will ensure safe accessibility of drinking water to this population.

2. There is need for the integration of environmental sanitation measures and water quality management issues in HIV/AIDS management and treatment. The study showed that

there was high prevalence of diseases related to water and environmental sanitation and most of these cases ending up in the public health facilities hence putting more pressure on already over stretched facilities. The cost of the treatment is also taking a huge chunk of income of the people living with HIV/AIDS thereby drugging them much deeper into poverty and misery. The households were spending as high as 62% of the total monthly income on water. Therefore, the water, sanitation and hygiene measures should be incorporated into HIV/AIDS management protocol to help with the reduction of such pressure.

3. The government should ensure that water is supplied to this population using the means that will provide safe drinking water and lower the cost of water to the community such as removing the middle men (water vendors) who hike the water costs or constructing Community Ablution Blocks.

4. The public health professionals should do a lot of health education on the importance of good sanitation and water quality at the household level. Teach the community on the viable water treatment methods in details, water storage methods that are safe and on the effect of uploading certain beliefs, cultures and taboos that affect water quality and sanitation.

REFERENCES

Addo, H. O., Addo, K. K., & Langbong, B. (2013). Sanitation and its impacts on the bacteriological quality of water: A study in three communities in Ghana. *African Journal of Food, Agriculture, Nutrition and Development*, *13*(5), 8258–8272.

Akatch, O., Kasuku, S., & Silvester, O. (2002). Informal Settlements and the Role of Infrastructure: The case of Kibera, Kenya. *African Journals Online*, *14*(1).

Akinbo, F. O., Okaka, C. E., & Omoregie, R. (2010). Prevalence of Intestinal Parasitic infctions among HIV patients in Benin City, Nigeria. *African Health Sciences*, *1*, 1–6. https://doi.org/10.3402/ljm.v5i0.5506

Ali, A. A., Gumbe, L. O., Mohammed, A. H., & Nathan, N. (2010). Nairobi solid waste management practices: Need for improved public participation and involvement. *Tanzania Journal of Forestry and Nature Conservation*, *80*.

Amnesty International. (2009). The unseen majority: Nairobi's two million slum-dwellers. Retrieved September 22, 2015, from http://www.amnesty.org/en/library/asset/AFR32/005/2009/en/3b6e7351-8e08-4b61-

Bartram, J., & Pedley, S. (1996). Chapter 10 - Microbiological Analyses. In *A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes*.

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Bourne, Pilime, N., Sambo, M., & Behr, A. (2013a). Food Hygiee and Sanitation in infants and young children: a paediatric food-based dietary guideline. *East Africa Medical Journal*.

Bourne, Pilime, N., Sambo, M., & Behr, A. (2013b). Food hygiene and sanitation in infants and young children: a paediatric food-based dietary guideline. *S Afr J Clin Nutr*, *1*(3), 156–164.

Chemuliti, J. K., Gathura, P. B., Kyule, M. M., & Njeru, F. M. (2002). Bacteriological Qualities of Indoor and Out-door drinking water in Kibera Sun-Location of Nairobi, Kenya. *East Africa Medical Journal*, *79*.

Coker, A. O., & Adefoso, A. . (1994). The changing patterns of compylobacter jejuni/coli in Lagos, Nigeria after ten years. *East Africa Medical Journal*, 71:437-440.

Colvin, M., ABDOOL, KARIM, S. ., CONNOLY, C., HOOSEN, A. A., & NTULI, N. (1998). HIV infection and asymptomatic sexually transmitted diseases in a rural South African Community. *International Journal of STD and AIDS*, 9:548-550.

Enujiugha, V. N., Balegh, E., & Oluwole, A. F. (1994). Occurence oof pathogens in two public water distribution systems in Western Nigeria. *Nigeria Food Journal*, 12:74-78.

Fewtrell, L., Kaufman, R. B., Kay, D., Enamoria, W., Haller, L., & Colford, J. M. J. (2005). Water, Sanitation and Hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta analysis. *Lancet Journal of Infectious Disease*, 5:42-55.

Fisher, L. D. (1998). Self-designing clinical trials. *Statistics in Medicine*, (17), 1551–1562.

Guay, A. H. (2004). Solving the problem for underserved populations. *Journal of American Dental Association*, 1599–1605.

Higgins, A. (2012). FINDING ONE'S PLACE IN KIBERA. Retrieved from http://matadornetwork.com/change/finding-ones-place-in-kibera/

Kamminga, E., & Schuringa, M. W. (2005). HIV / AIDS and water , sanitation and hygiene. In *Royal Tropical Institute*.

Kipyegen, C. K., Shivairo, R. S., & Odhiambo, R. O. (2012). Prevalence of intestinal parasites among HIV patients in Baringo, Kenya. *The Pan African Medical Journal*, *13*, 37. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3542804&tool=pmcentrez&rendertype=abstract

Klein, L., Jones, E., Hawkes, H. A., & Downing, A. L. (1972). *RIVER POLUTION2. CAUSES AND EFFECTS* (5th ed.). London: Butterworths and Co (Publishers) Ltd.

Kremer, M., & Zwane, A. P. (2007). *Cost-Effective Prevention of Diarrheal Diseases : A Critical Review*. *Agriculture*.

Kyobutungi, C., Ezeh, A., Zulu, E., & Falkingham, J. (2009). HIV/AIDS and the health of older people in the slums of Nairobi, Kenya. *BMC Public Health*.

Laurent, P. (2005). Household drinking water systems and their impact on people with weakened immunity with the participation of M . Visser and J . F . Fesselet MSF-Holland public health department. *East Africa Medical Journal*, (February), 1–72.

Lunchbowl Network. (2013). Facts and information about Kibera. Retrieved September 22, 2015, from http://www.lunchbowl.org/the-kibera.html

Millicent, M. (2016). *Factors influencing sanitation practices in Kibera urban informal settlements in Nairobi- Kenya*.

Mnongya, L. M. (2011). Dilemma of choice between breastfeeding and replacement feeding among hiV positive mothers in Tanzania. *International Breastfeeding Journal*, *19*(2), 9–12.

Mugambi, E., & Bery, R. (2013). Promoting healthy hygiene and sanitation practices for people living with HIV and AIDS. In *36th WEDC International Conference, Nakuru, Kenya, 2013* (pp. 1–4).

Muoki, M. A., Tumuti, D. S., & Rombo, G. O. (2008a). Nutrition and public hygiene among children under five years of age in Mukuru slums of makadara division, Nairobi. *East Africa Medical Journal*.

Muoki, M. A., Tumuti, D. S., & Rombo, G. O. (2008b). Nutrition and public hygiene among children under five years of age in mukuru slums of makadara division , Nairobi. *East Africa Medical Journal*, *85*(8), 386–397. Retrieved from http://www.ajol.info/index.php/eamj/article/viewFile/9656/31071

Nordberg, E., Oganga, H., Kazibwe, S., & Onyango, J. (1993). Rapid assessment of an African district health system. Test of a planning tool. *The International Journal of Health Planning and Management*, *8*(3), 219–233.

Olawoye, R. A., & Awoyemi, A. O. (2002). An Assessment of the Availability and Utilization of Toilet Facilities at Alanamu Ward, Ilorin, Kwara State, Nigeria. *Sahel Medical Journal*,

5(4).

Omungo, R. (2008). Kenya: Slum dwellers struggle to access clean water. *Global Information Network*. Retrieved from http://search.proquest.com.ezproxy.library.wisc.edu/docview/457568219?accountid=465%5Cnhttp://sfx.wisconsin.edu/wisc?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=unknown&sid=ProQ:ProQ:pqrl&atitle=KENYA:+SLUM+DWELLERS+STRUGGLE+TO+ACCESS

Pascal, Peggy, & Mwende, E. (2009). A garden in a sack: Experiences in Kibera, Nairobi. *Urban Agriculture Margazine*, (21), 38–40.

Phaswana-Mufuya, M., & Shukla, N. (2005). Factors that could motivate people to adopt safe hygienic practices in the Eastern Cape Province , South Africa. *African Health Sciences*, *5*(1), 21–28.

Potgieter, N., Becker, P. J., & Ehlers, M. M. (2009). Evaluation of the CDC safe water-storage intervention to improve the microbiological quality of point-of-use drinking water in rural communities in South Africa, *35*(4), 505–516.

Saidu, A. S., Bunza, M. D. A., Abubakar, U., Adamu, T., Ladan, M. J., & Fana, S. A. (2009). A survey of opportunistic infections in HIV seropositive patients attending major hospitals of Kebbi state, Nigeria. *Bayero Journal of Pure and Applied Sciences*, *2*(1), 70–74.

Talman, S. B. and A. (2010). Interactions between HIV / AIDS and the Environment. *University of Washington*.

Umande Trust. (n.d.). The Right to Water and Sanitation in Kibera in Nairobi, Kenya.

Umande Trust. (2007). Submission to the United Nations Committee on Economic, Social and Cultural Rights On the Occasion of Pre-Sessional Working Group Discussion Kenya Right to Housing and Water (Article 11(1)), *11*(November), 1–49. Retrieved from http://www2.ohchr.org/english/bodies/cescr/docs/info-ngos/cohrekenya39.pdf

UN-HABITAT. (2006). HIV / AIDS checklist for water and saniation projects. *UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME*.

UN HABITAT. (2008). *The State of African Cities: A framework for addressing urban challenges in Africa.*

WEDC. (2005). The HIV/AIDS Millenium Development Goal. *East Africa Medical Journal*.

WHO. (2003). Emerging Issues in Water and Infectious Disease. *East Africa Medical Journal*.

WHO. (2011). *Guidelines for Drinking Water Quality* (Vol. 4).

WHO/UNICEF. (2012). Progress on Drinking Water and Sanitation. *WHO/UNICEF Joint Monitoring Programe for Water Supply and Sanitation*, (February), 1–4. https://doi.org/978-924-1503279

Wolfgang, Y. T., Veronique, M., Bernard, Y. O., Arsène, S. M., & Valentin, H. P. (2013). Effects of poor sanitation on public health : Case of Yopougon town (Abidjan). *African Jurnal of Environmental Science and Technology*, *7*(March), 87–92. https://doi.org/10.5897/AJEST12.058

APPENDICES

THE BURDEN OF WATER, SANITATION AND HYGIENE ON PEOPLE LIVING WITH HIV/AIDS IN KIBERA SLUM   (KNH/ERC/RR/323)

APPENDIX A1-QUESTIONNAIRE

INVESTIGATOR: ……………………………………

AREA CODE: …………………………………………………

A. SOCIO DEMOGRAPHIC DATA
1. Age………………………..

2. Sex ;   male ☐   female ☐

3. What the highest level of educations?

   None/never went to school ☐

   Nursery/pre-unite/Kindergarten ☐

   Primary(incomplete/no certificate) ☐

   Primary (certificate/complete) ☐

   Secondary(No certificate/incomplete) ☐

   Secondary/'A' level (certificate/complete) ☐

College/Tertiary (no certificate/incomplete) [ ]

College/Tertiary (certificate/complete) [ ]

4. Marital status.   1.Single [ ]   2.married [ ]   3.divorced [ ]

5. What is your religion

    Catholic [ ]   Muslim [ ]   No religion [ ]

6. Occupation: Employed [ ]   Unemployed [ ]

7. Average monthly income………………………

8. Residential area ……………………………

9. Do you have any of the health insurance coverage scheme such as NHIF or chama that pays the hospital bill for you while you are sick?   YES [ ]   NO [ ]

Accessibility of safe drinking water

10. What is the source of drinking water for the household?

    Water Kiosk [ ]

    Piped water [ ]

    Borehole [ ]

    Roof catchment [ ]

    Dam [ ]

    River [ ]

    Others……………………………………………………………………..

11. How frequently is water available to this source?

    Usually available [ ]

    Several hours per day [ ]

    Once or twice a week [ ]   infrequently [ ]

    Other (specify)……………………………………………………

12. Distance to water Source?

    Less than 2km [ ]   More than 2km [ ]

13. How long does it take to go there get water and come back? (Minutes)…………………….

14. What is the mode of transportation of water for the household use from the source?

Drawn Carts [ ]

Bicycle [ ]

On foot [ ]

Vehicle [ ]

Animals (Donkey) [ ]

15. Do you treat your drinking water?

Yes [ ]   No [ ]

16. If YES, which method do you use to treat your water?

Boiling [ ]

Chemical use [ ]

Water filter [ ]

Sedimentation [ ]

3 pot system [ ]

Screening [ ]

Sodis [ ]

None [ ]

Others [ ]

17. How many household members are living here?......................................

18. How long does the treated water stored for drinking? (report in Days) ....

19. How many liters of water does the household use per day? …………………….

20. How much does 20 liter jerry can of water cost? …………………………………

Occurrence of opportunistic Infections

21. Have you suffered from any of the following diseases in the last 12 months?

Diarrhea [   ]

Pneumonia [   ]

Tuberculosis [   ]   Dysentery [   ]

Malaria [   ]   Scabies [   ]

Dermatitis [   ]   NONE [   ]

Conjunctivitis [   ]

Intestinal warms [   ]

22. Do you know of anyone who was living with HIV/AIDS in this community and died in the last

one year (12 months) due to any one of the mentioned diseases?   YES [   ]   NO [   ]

23. How many deaths do you know..........................

24. If **Yes** to **Question 21**, were you treated?   Yes [   ]   No [   ]

(If NO go to 31)

25. If **Yes** to **Question 24**, where were you treated? ....

26. Was this a…

Govt/council health center [   ]

Private medical clinic [   ]

Private medical center [   ]

Faith Based/NGO health facility [   ]

Nursing Home/Maternity health center [   ]

Other (specify)………………………………………………….

27. What is the approximate distance from that facility (where you were treated) from the household?

Less than 1km [   ]   3-4 km [   ]

1-2 km [   ]   4-5km [   ]

[   ]   76

2-3 km

28. How many times have you suffered from the above named disease in the last 12 months?

Once ☐   3 times ☐   More than 4 times ☐

Twice ☐   4 times ☐

29. How much did the treatment of the disease cost you? ………………………………….

30. On average, How much time did you spend going there, being attended to and coming back?

Hours……………….

Minutes……………………..

31. What was the MAIN reason for not seeking care? (*Skip if Question 24 is NO*)

Self-care ☐

Lack of money ☐

Lack of time ☐

Lack of trust in provider ☐

No providers at the facility ☐

Distance to health facility ☐

No Drugs at facility ☐

Not a serious condition ☐

Provider's attitude ☐

Faith/Religion does not allow ☐

ENVIRONMETAL SANITATION AND CULTURAL BELIEFS

32. Do you have latrine/toilet for the household use? (*What type, Refer to observation check list*)

Yes ☐

No ☐

33. If **Yes** to **Question 32**, how much do you pay for the latrine per visit?

Free ☐

Ksh 1-5 ☐   Ksh 7-10 ☐   Ksh above 20 ☐

Ksh 6-10 ☐   Ksh 10- 15 ☐

34. If **NO** to **question 32**, why?

The distance is far from the household ☐

No space to construct ☐

Latrine is dilapidated ☐

Landlord/landlady has not provided ☐

35. When do you always wash your hands? (*Do not read the list but choose all that apply*)

Before cooking ☐

After visiting latrine/toilet ☐

After changing the baby ☐

Before eating ☐

After cleaning the sick person ☐

Before giving a sick person medicine ☐

36. What are the taboos, beliefs and cultures that affects water quality and sanitation measures in

this community?

People believe that drinking water is blessed so it cannot cause any infections even if not

treated ☐

The mother in law do not share latrines with the son in law ☐

The feces of the children are not infectious ☐

The garbage should not be disposed off at night since it would mean throwing away

blessings. ☐

THE EFFECT OF WATER, SANITATION AND HYGIENE ON PEOPLE LIVING WITH HIV/AIDS IN KIBERA SLUM   (KNH/ERC/RR/323)

APPENDIX A2: HOUSE HOLD OBSEVATION CHECKLIST

1. What is the Source of water for the household?

    - Piped with standby tap ☐

    - Surface water (river, swamp, dam) ☐

    - Underground (borehole, hand dug well) ☐

    - Roof catchment ☐

    - Piped water with Storage tank connection ☐

2. How many pit latrines available per house hold…………………………………..

3. Is there hand washing facilities that allows running water in the household or at the latrine?

    Present ☐   absent ☐

4. Is there food displayed in the open and uncovered at household level?

    Present ☐   absent ☐

5. Is the drinking water stored hygienically at the house hold level?

- Clean Bucket with a lid ☐

- Clean Bucket with a tap plus lid ☐

- Unclean bucket with tap plus lid ☐

- Uncovered bucket ☐

- Dirty bucket without a lid ☐

- Narrow necked container with tight fitting lid and a tap ☐

6. Is Standard sanitary bin provided within the latrine room? YES ☐ NO ☐

7. Is there availability of waste storage bin at the household level? YES ☐ NO ☐

THE EFFECT OF WATER, SANITATION AND HYGIENE ON PEOPLE LIVING WITH HIV/AIDS IN KIBERA SLUM   (KNH/ERC/RR/323)

APPENDIX A3:   CONSENT FORM (ENGLISH)

General Introduction:

Good morning/afternoon. My name is ………………………………………….. and me and my colleagues are visiting households to ask individual some questions about water quality and sanitation on people. The aim is to understand the issues around the quality of water, sanitation and their effects on people living with hiv/aids.

You are invited to take part in a research study. Before you decide whether to participate, you need to understand why the research is being done and what it would involve. Please take time to read or listen as I read the following information. You may talk to others about the study if you wish. Please ask me if there is anything that is not clear, or if would like more information. When all your questions have been answered and you feel that you understand this study, you

will be asked if you wish to participate in the study, and if yes to sign this informed consent form. You will be given a signed copy to keep.

Purpose of the study:

The purpose of the study is to learn more about the effects of water quality and sanitation on people living with HIV/AIDS in the Kibera slum. The outcome of the study will be used for academic purpose and also in the improvement of water supply, management of HIV/AIDS and sanitation in this community. I would therefore like to talk to you about the water quality and sanitation in this community.

Study procedure:

The interview with you will last 10-30 minutes. Your participation in the study is voluntary. You may refuse to answer any question, and you may choose to stop the interview at any time. Refusing to participate will not affect you or your family's access to benefits that may come from this study.

Risk and Discomfort:

We believe that this study safe and do not expect that you will suffer any harm or injury because of your participation in it. However, you might find that some of the questions are about private matters. You are free to ask me to stop or decline to answer any question that you are uncomfortable with.

Confidentiality:

The interview is confidential and will be conducted in private. We will not record your name or address on the form and your responses will be combined with responses from other people in

this area so that no one will be able to identify your specific responses. This form will be kept under lock and key. The information gathered will only be used for the stated purpose.

Benefits and compensation:

The benefit of participating in the study is that you will contribute to the good of your community. What you say is important and valuable and will help the health authorities and water supply companies plan better services for your community. You will, however, not receive money or reward of any kind if you agreed to be interviewed.

Voluntariness:

Your participation in this study is completely voluntary. If you decide not to participate you will not lose any benefit to which you are entitled. If you agree to participate in this study, you may end your participation at any time without penalty of loss of existing benefits to which you are entitled. If you decided to take part, you are free to skip ay questions. You are free to withdraw at any time without affecting your relationship with any health authority.

Do you have any questions?   Yes …………………..   No………………………

If you have any questions please as for Charles Aketch, Principle Investigator (+254721389737), Dr. Joseph Mutai, Co-Investigator (0725082352) and Dr. Kenneth Ngure, Co-Investigator (0722362219) or you may contact KNH/UON-ERC (0726300-9)

Would you be willing to participate in the study?

Yes………………………….. NO……………….………

(If NO thank the participant and end the study)

Statement of declaration

Respondent statement:

I have read or have been read the above considerations regarding my participation. I have been given a chance to ask any questions and my questions have been answered yo my satisfaction. I understand that the information I give will be kept private. I understand that I may withdraw from this study at any time. My withdrawal from the study or my refusal to participate will not affect me or my family from receiving medical care fom health facility. I agree to participate in this study as a volunteer.

………………………………………….   ……………………………………………

Respondent Signature   Date

THE EFFECT OF WATER, SANITATION AND HYGIENE ON PEOPLE LIVING WITH HIV/AIDS IN KIBERA SLUM   (KNH/ERC/RR/323)

APPENDIX A4:   CONSENT FORM (KISWAHILI)

Utangulizi:

Habari ya asubuhi/mchana. Jinalangu ni ……………………………………… Mimi na wenzangu Tunatembelea watu nyumbani, tunawauliza maswali kadhaa kuhusu dalili za maji na usafi ya mazingira na jinsi inavyoathiri maisha ya watu ambao wanishi na virusi vya ukimwi.

Unaalikwa kushiriki kwenye utafiti huu. Kabla ya kuamua ikiwa utashiriki ,unapaswa kuelewa lengo la utafiti huu na vile itakavyo kukuhusu. Tafadhali chukua fursa usome au usikilize ni kusomee taarifa ifuatayo. Unaweza kuwazungumzia wenzako ikiwa utataka. Tafadhali unaweza

kuniuliza ikiwa kuna jambo ambalo hauelewi au kama ungependelea maelezo zaidi. Ikiwa maswali ambayo unaweza kuwa nayo yatakuwa yamejibiwa na unahisi kuwa umepata ufahamu wa kutosha kuhusu utafiti ,basi nitakuuliza ushiriki. Kama umekubali, utaulizwa kutia sahihi kwenye fomu hii ya makubaliano baada ya kuelezewa lengo la utafiti huu. Baada ya kutia sahihi, utapewa kopi yako.

Lengo la Utafiti:

Lengo la utafiti huu ni kujifunza zaidi kuhusu usiano uliomo baina ya usafi ya maji ya kunywa na usafi wa mazingira kwa watu wanaoishi na viini vya ukimwi katika eneo hii. Matekeo ya utafiti huu utatumiwa katika masomo na pia kuimarisha usafi wa maji ya kunywa, matibabu ya ugonjwa wa ukimwi na usafi wa mazingira katika eneo hili. Naomba kama ninaweza kuongea na we kuhusu maswala ya maji ya kunywa na usafi wa mazingira katika eneo hili.

Utaratibu wa utafiti:

Mahojiano na wewe yatachukua muda wa karibu dakika thelathini. Kushiriki kwako kwa utafiti huu ni kwa hiari. Unaweza kukataa kujibu swali lolote, na pia unaweza kusismamisha mahojiano wakati wowote. Kukataa kushiriki kwenye mahojiano haitakuathiri au familia yako kupokea uzuri wowote itakayopatikana kutokana na matokeo ya utafiti huu.

Hatari na madhara:

Tunaamini kwamba utafiti huu ni salama na hatutarajii kwamba utadhihirika au kuumia kwasababu ya kushiriki. Bali, utapata kwamba baadhi ya maswali yanaguzia mambo ya kibinafsi. Una uhuru wa kutamatisha au kukataa kujibu maswali yoyote usiyojiskia huru kujibu.

Usiri:

Mahojiano haya ni ya siri na yatafanywa kwa siri. Hatutaandika jina lako au anwani yako kwenye fomu na majibu yako yatachanganywa na ya wengine wanaotoka eneo hili ili mtu yoyote asiwezejua majibu yako. Hizi fomu zitahifadhiwa kwa siri. Majibu tutakayopata yatatumiwa tu kwa lengo la utafiti huu.

Faida na Malipo:

Faida ya kushiriki kwenye utafiti huu ni kwamba utachangia kwa maendeleo ya jamii yako. Utakayoyasema ni ya maana na yatasaidia wasimamizi wa maswala ya afya na kampuni ya kueneza maji ya kunywa kupanga huduma bora kwa eneo lako. Hata hivyo, hutapokea pesa au malipo ya aina yoyote ukikubali kuhojiwa.

Kushiriki ni kwa hiari:

Kushiriki kwako kwenye utafiti huu ni kwa hiari. Ikiwa utaamua kutoshiriki hakutakuwa na madhara yeyote kwako na jamii yako. Vile vile ukikubali kushiriki kwenye utafiti huu unaweza simamisha mahojiano mahali popote na haitadhulumu haki zako. Pia, uko huru kutojibu swali lolote ambalo hutaki kujibu. Uko huru pia kusimamisha na kujiondoa kwenye utafiti wakati wowote na haitadhuru huduma ambazo unapokea kwenye kliniki au hospitali iliyo karibu na we.

Je, una maswali yoyote?   Ndio………………… La………………………….

Iwapo unamaswali zaidi, tafadhali wasilianana Charles Aketch (+254721389737), Dr. Joseph Mutai, Co-Investigator (0725082352) and Dr. Kenneth Ngure, Co-Investigator (0722362219) ama unaweza kupigia KNH/UON-ERC (0726300-9).

Ungependa Kushiriki kwenye utafiti?

Ndiyo……………………... La………………...

Usemi wa Mhojiwa:

Nimesoma/Nimesomewa maelezo yakushiriki kwangu kwa utafiti huu. Nimepewa nafasi ya kuuliza maswali, maswali yamejibiwa na nimeridhika. Ninaelewa kwamba majibu nitakayo toa yatawekwa kwa siri. Ninaelewa kwamba ninaweza kujiondoa kwa utafiti huu wakati wowote. Kujiondoa kwa utafiti au kukataa kushiriki hakutaniathiri au mtu yeyote wa familia yangu kupokea huduma za afya kwenye kituochochote cha afya.

Ninakubali kushiriki kwa utafiti huu kwa hiari.

…………………………………………… ……………………………………………

Sahihi ya mhojiwa   *Tarehe*

Investigator who conducted the informed consent:

I confirm that I have personally explained the nature and extent of the planned research, study procedures, potential risks and benefits, and confidentiality of personal information.

Name of person obtaining the consent: …………………………………………………

……………………………………………. ……………………………………………

Signature   Date