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**CAREGIVERS' HYGIENE AND SANITATION CONDITIONS ASSOCIATED  
WITH NUTRITION STATUS OF CHILDREN 6-59 MONTHS IN KIANDUTU  
INFORMAL SETTLEMENT, KIAMBU COUNTY, KENYA**

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UNIVERSITY**

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*Caregivers' hygiene and  
sanitaion conditions*



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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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**DEDICATION**

This work is dedicated to: my daughter Claire Wanjiku, my husband Dr. Geoffrey Wambugu, my parents Mr. and Mrs. Mwangi and all my friends who made the whole study process a success.

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## TABLE OF CONTENTS

<b>DECLARATION.....</b>	<b>ii</b>
<b>DEDICATION.....</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>iv</b>
<b>TABLE OF CONTENTS .....</b>	<b>v</b>
<b>LIST OF TABLES.....</b>	<b>x</b>
<b>LIST OF FIGURES .....</b>	<b>xi</b>
<b>ABBREVIATIONS AND ACRONYMS.....</b>	<b>xii</b>
<b>OPERATIONAL DEFINITION OF TERMS.....</b>	<b>xiii</b>
<b>ABSTRACT.....</b>	<b>xv</b>
<b>CHAPTER ONE: INTRODUCTION.....</b>	<b>1</b>
1.1 Background of the study .....	1
1.2 Problem statement.....	4
1.3 Justification of the study .....	5
1.4 Research Questions .....	5
1.5 Study hypothesis .....	6
1.6 Research objectives .....	6
1.6.1 Broad objective.....	6
1.6.2 Specific objectives.....	6
1.7 Significance and anticipated output .....	7
1.8 Limitation of the study .....	7
1.9 Delimitation of the study.....	7
1.10 Conceptual framework .....	7
<b>CHAPTER TWO: LITERATURE REVIEW.....</b>	<b>10</b>
2.0 Introduction .....	10
2.1 Overview of Water, Sanitation and Hygiene .....	10
2.2 Knowledge on Water, Sanitation and Hygiene among caregivers.....	12
2.3 Practices on Water, Sanitation and Hygiene among Caregivers.....	14
2.3.1 Hygiene practices in households .....	15
2.3.2 Handwashing among caregivers.....	17

2.3.3 Sanitation practices in households.....	18
2.3.4 Water source and treatment in households .....	20
2.4 Overview of the nutrition status in children.....	22
2.5 Association between WASH conditions among caregivers and nutritional status in children.....	24
2.6 Summary of Literature Review .....	27
<b>CHAPTER THREE: MATERIALS AND METHODS .....</b>	<b>29</b>
3.0 Introduction .....	29
3.1 Study design .....	29
3.2 Study variables .....	29
3.2.1 Dependent variable .....	29
3.2.2 Independent variables .....	29
3.3 Study location.....	30
3.4 Target Population .....	31
3.5 Inclusion criteria.....	31
3.6 Exclusion criteria.....	31
3.7 Sampling technique .....	31
3.8 Sample size determination .....	32
3.9 Data Collection Instruments.....	33
3.9.1 Household Questionnaire .....	33
3.9.2 Focus Group Discussion (FGD) Guide .....	33
3.9.3 Key Informant Interview (KII) Guide .....	34
3.10 Pretesting of the Data Collection Tools .....	34
3.11 Validity and Reliability of Data Collection Tools .....	34
3.11.1 Validity .....	34
3.11.2 Reliability .....	35
3.12 Data collection techniques .....	35
3.12.1 Demographic and Socio-economic Data .....	35

3.12.2 Knowledge on WASH among the caregivers.....	35
3.12.3 WASH Practices among the caregivers.....	36
3.12.4 Nutritional status among the children.....	36
3.12.5 Qualitative Data.....	37
3.13 Data analysis .....	37
3.14 Logistical and Ethical Consideration .....	38
<b>CHAPTER FOUR: RESULTS .....</b>	<b>40</b>
4.0 Introduction .....	40
4.1 Socio-demographic characteristics of the respondents .....	40
4.1.1 Demographic Characteristics of the caregivers .....	41
4.2 Level of knowledge on WASH among the caregivers.....	43
4.2.1 Knowledge on water treatment methods .....	43
4.2.2 Diseases that can be transmitted by poor WASH conditions.....	44
4.2.3 Importance of handwashing.....	44
4.2.4 Prevention of diarrhoea disease.....	45
4.2.5 Symptoms of worm infestation in children .....	46
4.2.6 Caregivers' WASH knowledge level .....	47
4.3 Caregivers' WASH Practices.....	49
4.3.1 Source, Storage and Treatment of Drinking Water .....	49
4.3.2 Household Sanitation.....	52
4.3.3. Handwashing Practice among the Caregivers .....	56
4.3.4 Food hygiene practice among caregivers .....	59
4.3.5 Environmental Hygiene Observation around the household.....	60
4.3.6 Child Morbidity .....	61
4.4 Nutrition status among children 6-59 months.....	63
4.4.1 Child's age and sex.....	63
4.4.2 Prevalence of wasting, underweight and stunting .....	63

4.5 The association between caregivers' hygiene and sanitation knowledge, practices and nutrition status of children 6-59 months .....	67
4.5.1 Caregivers' Hygiene and Sanitation knowledge versus children's nutrition status .....	67
4.5.2 Caregivers' Hygiene and Sanitation practice versus children's nutrition status .....	69
<b>CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>73</b>
5.0 Introduction .....	73
5.1 Discussion .....	73
5.1.1 Caregivers' socio-demographic characteristics .....	73
5.1.2 Caregivers' WASH knowledge .....	73
5.1.3 Caregivers' WASH practices.....	75
5.1.4 Nutrition status of children 6-59 months.....	77
5.1.5 Summary of findings .....	79
5.2 Conclusions .....	80
5.3 Recommendations .....	81
5.3.1 Recommendations for practice .....	81
5.3.2 Recommendation for Policy .....	81
5.3.3 Recommendations for further research.....	82
<b>REFERENCES.....</b>	<b>83</b>
<b>APPENDICES.....</b>	<b>91</b>
Appendix I: Informed consent form.....	91
Appendix II: Questionnaire .....	93
Appendix III: Focus Group Discussion (FGD) guide for CHVs and caregivers .....	99
Appendix IV: Key Informant Interview (KII) guide for CHEW, Health Centre Incharge and Nutritionist Incharge.....	100
Appendix V: Map of the study area .....	101
Appendix VI: Graduate School Proposal Approval.....	102

Appendix VII: KUERC Permit ..... 103  
Appendix VIII: NACOSTI Permit ..... 104  
Appendix IX: Kiambu County Permit ..... 105

## LIST OF TABLES

Table 4. 1 Cluster areas in Kiandutu Informal Settlement.....	40
Table 4. 2 Demographic characteristics of the respondents .....	41
Table 4. 3 Caregivers' knowledge on Water treatment, WASH related Diseases and Importance of hand-wash.....	45
Table 4. 4 Caregivers' knowledge on Diarrhoea prevention methods and symptoms of worm infestation.....	47
Table 4. 5 Water Storage in the Household .....	52
Table 4. 6 Child's excreta and solid waste disposal methods.....	56
Table 4. 7 Child's Handwash practice .....	59
Table 4. 8 Food hygiene practices in the household.....	60
Table 4. 9 Environmental Hygiene around the household.....	61
Table 4. 10 Distribution of age and sex of the children.....	63
Table 4. 11 Prevalence of Wasting (Weight for Height Z scores).....	64
Table 4. 12 Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex .....	65
Table 4. 13 Prevalence of Stunting (Height for Age Z scores).....	66
Table 4. 14 Prevalence of Underweight (Weight for Age Z scores) .....	66
Table 4. 15 Underweight versus WASH knowledge scores .....	68
Table 4. 16 Stunting versus WASH knowledge scores .....	68
Table 4. 17 Wasting versus WASH knowledge scores.....	69
Table 4. 18 Chi-Square results for Caregivers' WASH practice versus Nutritional Status (Underweight) in Children.....	70
Table 4. 19 Chi-Square results for Caregivers' WASH practice versus Nutritional Status (Stunting) in Children.....	73
Table 4. 20 Chi-Square results for Caregivers' WASH practice versus Nutritional Status (Wasting) in Children.....	74

## LIST OF FIGURES

Figure 1.1 Conceptual framework .....	99
Figure 4. 1 Caregivers' level of education.....	42
Figure 4. 2 Caregivers' Occupation.....	42
Figure 4. 3 Respondents Household Monthly Income.....	43
Figure 4. 4 Caregivers WASH knowledge level.....	48
Figure 4. 5 Main source of drinking water in the household .....	49
Figure 4. 6 Water treatment before use in the household .....	50
Figure 4. 7 Method of Water treatment used in the household.....	51
Figure 4. 8 Caregivers' access to a latrine .....	53
Figure 4. 9 Household Latrine ownership.....	54
Figure 4. 10 Household's Type of latrine .....	55
Figure 4. 11 Caregivers handwashing practice .....	57
Figure 4. 12 Caregivers' Critical times for handwashing .....	58
Figure 4. 13 Child's morbidity within the last 2 weeks .....	62
Figure 4. 14 Diseases reported among the children.....	62
Figure 4.15 Nutrition status among children 6-59 months in Kiandutu Informal Settlement.....	67

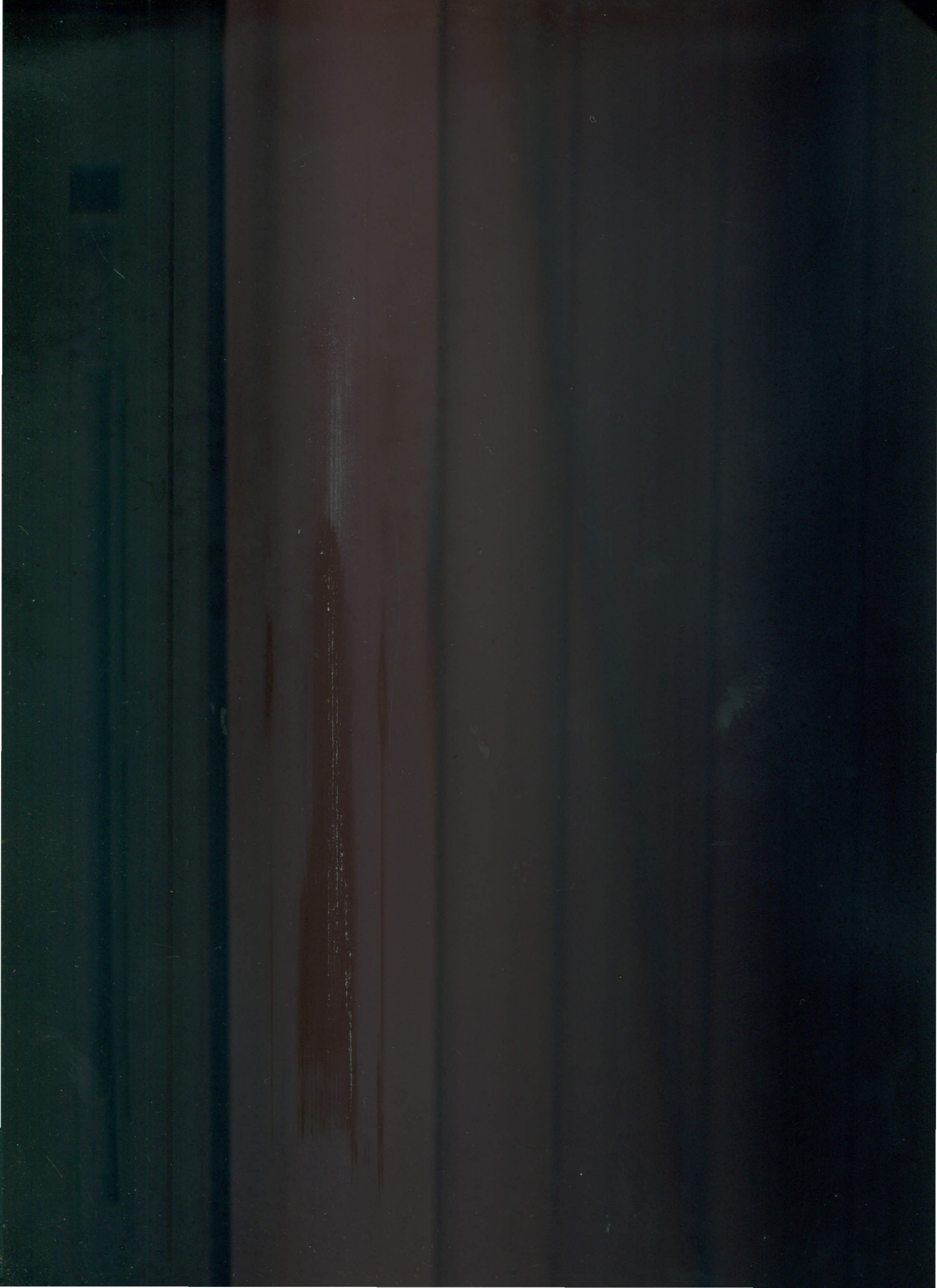
## ABBREVIATIONS AND ACRONYMS

<b>CHEW</b>	Community Health Extension Worker
<b>CHV</b>	Community Health Volunteer
<b>DHIS</b>	District Health Information System
<b>EED</b>	Environment Enteric Dysfunction
<b>ENA</b>	Emergency Nutrition Assessment
<b>FGD</b>	Focused Group Discussion
<b>GAM</b>	Global Acute Malnutrition
<b>H/A</b>	Height for Age
<b>KDHS</b>	Kenya Demographic Health Survey
<b>KII</b>	Key Informant Interview
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>KUERC</b>	Kenyatta University Ethics Review Committee
<b>NACOSTI</b>	National Commission for Science, Technology and Innovation
<b>MOH</b>	Ministry of Health
<b>MUAC</b>	Middle Upper Arm Circumference
<b>SD</b>	Standard Deviation
<b>SDG</b>	Sustainable Development Goals
<b>SPSS</b>	Statistical Package for Social Sciences
<b>SMART</b>	Standardization Monitoring and Assessment of Relief and Transitions
<b>UNICEF</b>	United Nations Children Fund
<b>W/A</b>	Weight for Age
<b>W/H</b>	Weight for Height
<b>WASH</b>	Water, Sanitation and Hygiene
<b>WHO</b>	World Health Organization

**OPERATIONAL DEFINITION OF TERMS**

- Caregiver** : Referred to a family member or a paid helper who looks after the child.
- Conditions** : The study addressed two conditions that is knowledge and practices in Water Sanitation and Hygiene (WASH).
- Height for age:** This is an indicator for chronic undernutrition indicated by stunting or low height-for age. H/A measure is below -2SD of the reference median population value.
- Hygiene practice:** Practices in handwashing, food hygiene and environmental hygiene that prevent disease causing pathogens from being exposed to human beings in households.
- Nutritional status:** Was defined as child's anthropometric indices such as weight for age z-score, weight for height z-score and height for age z-score. The cut off points used were: -2SD z score was considered as mild malnutrition, <-2SD z-score as moderate malnutrition and <-3SD z-score as severe malnutrition and z-score >-2SD was considered as normal nutrition status.
- Personal hygiene:** Referred to those protective measures primarily with the responsibility of caregivers which limit the spread of contaminants that cause diarrhea through direct contact with food.
- Sanitation** : Referred to provision and usage of facilities and services that safely dispose of human urine and feces within 2m from the house and lack of open defecation in the surrounding





environment, thereby preventing contamination of the environment.

**WASH knowledge:** Referred to the caregivers' know-how on causes of WASH related diseases, their signs and symptoms, prevention methods, importance of hygiene practices and water treatment methods.

**Weight for Age:** This is an indicator for low weight-for-age which reflects both chronic and acute undernutrition. This measure indicates underweight and the value is below -2SD of the reference median population value.

**Weight for Height:** This is an indicator for acute undernutrition (wasting) occurs when there is low weight-for-height. W/H measure is below -2SD of the reference median population value.

## ABSTRACT

It is estimated that, undernutrition in all its forms accounts for 45% of all deaths of children aged less than five years and contribute to 3.1 million child deaths each year. Poor Water Sanitation and Hygiene (WASH) conditions, primarily through repeated diarrhoea and intestinal nematode infections as poor WASH effects, account for 40–60% of childhood malnutrition. This study sought to describe the caregivers' hygiene and sanitation conditions associated with the nutrition status among children aged 6-59 months in Kiandutu Informal Settlement, Kiambu County. A descriptive cross-sectional study design was used with a sample size of 165 participants. Data was collected using researcher administered questionnaire for the caregivers, observation checklists, KII schedules and FGD guide. Anthropometric data for children aged 6-59 months was also collected using height board for height, salter scale for weight and MUAC tape. Data analysis was done using SPSS whereby Pearson's chi-square tests was used to test associations between caregivers' hygiene and sanitation status and children's nutritional status. The level of significance was set at P value ( $p < 0.05$ ). Bloom Cut off points were used to scale WASH knowledge as either high, moderate or low depending on the scores out of 100 percent. Results are presented in form of graphs and tables. The study established that there was low (88.1%) and moderate (11.9%) knowledge on WASH among caregivers. WASH practices were poor too: only 23.9% got drinking water from piped sources, 61.6% did not treat before drinking, 71.9% did not have access to a latrine and 55% of those who washed hands used water only. The nutritional status was 33.3%, 15.1% and 8.8% for stunting, underweight and wasting respectively. WASH practices such as source of drinking water in households ( $\chi^2=24.033$ ;  $p=0.026$ ;  $df=2$ ) and caregivers' handwashing practice ( $\chi^2=44.459$ ;  $p=<0.001$ ;  $df=1$ ) showed a significant relationship with the child's nutritional status. WASH knowledge had a significant relationship with the nutritional status ( $\chi^2=3.836$ ;  $p=0.036$ ;  $df=1$ ). The study recommends that the county government and any other relevant authority should increase health communication, education and information sharing especially in household to raise the level of WASH knowledge which will in turn improve WASH practice. Further, there should be emphasis on the importance of integrating WASH components in all nutrition programs to help fight malnutrition in children.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background of the study

Children's nutritional status is essential since it determines their health status, development, physical growth, academic performance and general progress in life (Briend et al., 2015). Children less than five years of age are the most susceptible to malnutrition. Childhood malnutrition increases the risk of mortality, infections and morbidity in association with decreased intellectual and cognitive development (Neima et al., 2017). It is approximated that globally, 50.5 million and 150.8 million children less than five years are wasted and stunted respectively (UNICEF/WHO/World Bank, 2018). Close to 4.5 percent of child deaths were attributed to undernutrition with 7.4 percent lives of children being at immediate risk due to severe wasting (UNICEF, 2015).

Undernutrition presents in three forms which are underweight described as low weight for age, wasting described as low weight for height and stunting described as low height for age. Sufficient nutrition in the first two years is crucial for brain development and healthy physical growth. Any deficiencies in nutritional status during this period can have serious implication on intellectual progress, psychological and social abilities, and work productivity in adulthood, as well as result in disease and death (Neima et al., 2017).

Childhood undernutrition is caused directly by inadequate diet and diseases. The underlying causes include poor Water, Sanitation and Hygiene (WASH), household food insecurity, lack of health services, inadequate maternal, childcare and feeding practices. These indirect factors directly influence presence of disease and nutrients intake. Poor state of WASH lead to infectious disease, especially diarrhoea, causing

nutrient malabsorption and poor appetite and consequently undernutrition (Pritchard et al., 2016). Further, susceptibility to infectious diseases is heightened by poor nutrition status creating a continuous cycle of deteriorating nutritional status and aggravating illness (Keusch et al., 2014).

It is estimated that 40 to 60 percent of malnutrition in childhood is attributed to poor WASH conditions, predominantly through frequent diarrhoea episodes and nematode intestinal infections (Merel et al., 2017). Some studies have shown that poor environmental conditions, poor sanitation and hygiene practices and unavailability of accessible, safe drinking water are the principle antecedents of diarrhoea among children under five years of age (Pritchard et al., 2016). Improved water and sanitation conditions decrease stunting especially in a context of high open defecation per square meter and high population density (UNICEF, 2014). Therefore, poor WASH contributes to undernutrition in three ways through introduction of soil transmitted helminthic infections, diarrhoea disease and environmental enteropathy (Keusch et al., 2014). Most programs are now combining both WASH and nutrition interventions to help fight undernutrition.

A study done estimating the effects of sanitation on child nutrition, found that children acute malnutrition and stunting was strongly correlated with lack of proper sanitation, whereby, feacally contaminated environment was linked to chronic undernutrition even in the absence of diarrhoea (Headey, 2016). A study carried out in Tanzania revealed that there was a lower association of stunting with handwashing among children whose caregivers indicated using soap to wash their hands after defecation and before a meal (Mshinda et al., 2018). This corresponded with the results of a cross-sectional study conducted in the Madhya Pradesh whereby child

undernutrition was significantly associated with maternal hygiene practices (Meshrem et al., 2013). A prospective cohort study in rural Bangladesh found that those children who were raised in households with improved water quality, hygiene and sanitation conditions had low levels of parasite infection hence improved environmental enteropathy biomarkers and better growth compared to fellow children brought up in households with unimproved hygiene and sanitation conditions (Lin et al., 2013). Another study from Mali revealed that about 55% of complementary food samples had fecal coliform bacteria and could be the main contributing factor to poor nutritional status and infections among under-five children (Toure et al., 2016).

Children undernutrition and poor WASH conditions coexist in many developing countries where there are high rates of poverty. Informal settlements are associated with poverty, poor sanitation and inadequate clean water. Slum environment is delineated by a wide range of problems that vary in magnitude from one region to another, this include improper excreta, poor solid waste and wastewater management, poor housing conditions; poor drainage systems; insufficient drinking water; lack of proper verm in and vector control; unsafe food and deficient general and personal hygiene (Mukama et al., 2016). Overtime, it has been recognized that poor urban areas may have the highest susceptibility of enteric infection because of the high population density combined with limited infrastructure such as overcrowding, impoverished housing conditions and lack of sanitation facilities and safe water for drinking (UN-Habitat, 2013). In Kenya, the prevalence rate of undernutrition stands at 26, 4, and 11 percent for stunting, wasting, and underweight respectively in children below five years (KDHS, 2014). This shows that malnutrition is still a big challenge among children under-five years. Kiambu County has a prevalence of 15.7, 2.3 and 5.1 percent for stunting, wasting and underweight respectively (KDHS, 2014).

It is therefore under this guidance that this study aimed at establishing the association between caregivers' hygiene and sanitation status with the nutritional status among children 6-59 months living in Kiandutu Informal Settlement, Kiambu County. In this study, we focused on caregiver's sanitation and hygiene knowledge and practices and anthropometric data collection for the children to determine their nutritional status. The study was conducted Kiandutu Informal Settlement, Thika Sub County. The settlement has low socio-economic status and poor WASH conditions. In addition, diarrhoea is the third leading cause of morbidity in Kiandutu Informal Settlement after Pneumonia and Upper Respiratory Diseases (DHIS, 2018). Scanty data had been documented on the malnutrition rates association with WASH hence informed the need for this research.

## **1.2 Problem statement**

Undernutrition in children remains a significant public health problem despite the numerous nutrition specific campaigns and interventions. Around 40 to 60 percent of malnutrition in childhood is attributed to poor WASH conditions predominantly through frequent diarrhoea cases and intestinal nematode infections (Merel et al., 2017). This occurs through the introduction of infectious diseases such as diarrhoea, soil transmitted helminthic infections and environmental enteropathy. All these infections lead to gut dysfunction which in turn affects nutrients absorption into the body leading to poor nutrition status. Informal settlements are associated with poor sanitation, poverty and inadequate clean water. Living is depicted by high population density and limited infrastructure characterized by lack of potable drinking water, poor housing conditions, overcrowding and sanitation facilities (UN-Habitat, 2013). Children living in unsanitary and unhygienic environments may become undernourished even in the absence of intestinal worms or diarrhoea (Mshinda et al.,

2018). Therefore, this informed the need of this study in Kenya in an area with poor WASH conditions and high prevalence for malnutrition, Kiandutu informal settlement being the study area. A previous study conducted in Kiandutu Informal Settlement identified a prevalence of 17.5, 9.9 and 5.5 percent for stunting, wasting and underweight respectively (Chege et al., 2016). In addition to this, an average of 250 cases of diarrhoea and 100 cases of malnutrition among children under five years are reported monthly in Kiandutu Informal Settlement (DHIS, 2018). There is scanty documentation on the association of WASH and children's nutrition status.

### **1.3 Justification of the study**

Improved WASH conditions have higher potential of improving health outcomes due to reduced susceptibility and disease burden together with higher access levels especially in urban slums (Cumming & Cairncross, 2016). Therefore, establishing this association will help in the integration of WASH into nutrition programs and hence fight this menace of malnutrition in children. This will greatly help in achieving the Sustainable Development Goals (SDG) target 2.2 of ending all forms of malnutrition by 2030 and target 3.2 of ending preventable deaths of neonates and under-five children by the year 2030 (UN, 2016). Kiandutu Informal settlement was picked as the study area because of high prevalence of malnutrition in children compared with the national rates especially for wasting.

### **1.4 Research Questions**

This study was guided by the following research questions:

1. What is the level of knowledge on hygiene and sanitation among caregivers of children aged 6-59 months in Kiandutu Informal Settlement?
2. What are the hygiene and sanitation practices among caregivers of children aged 6-59 months in Kiandutu Informal Settlement?

3. What is the nutritional status for children 6-59 months in Kiandutu Informal Settlement?
4. What is the relationship between caregivers' hygiene and sanitation practices and nutritional status of children aged 6-59 months in Kiandutu Informal Settlement?

### 1.5 Study hypothesis

H0<sub>1</sub>: There is no significant association between caregivers' hygiene and sanitation knowledge with the nutritional status among children aged 6-59 months.

H0<sub>2</sub>: There is no significant association between caregivers' hygiene and sanitation practice with the nutritional status among children aged 6-59 months.

### 1.6 Research objectives

#### 1.6.1 Broad objective

The broad objective of the study was: to assess the caregivers' hygiene and sanitation conditions associated with nutritional status among children aged 6-59 months in Kiandutu Informal Settlement, Kiambu County, Kenya.

#### 1.6.2 Specific objectives

The specific objectives of the study were to:

1. Determine the level of knowledge on hygiene and sanitation among the caregivers of children aged 6-59 months in Kiandutu Informal Settlement.
2. Describe the hygiene and sanitation practices among caregivers of children aged 6-59 months in Kiandutu Informal Settlement.
3. Determine the nutritional status of children 6-59 months in Kiandutu Informal Settlement.

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4. Determine relationship between caregivers' hygiene and sanitation practices and nutrition status of children aged 6-59 months in Kiandutu Informal Settlement.

### **1.7 Significance and anticipated output**

This study intends to inform policy makers on reasons for integrating WASH interventions with nutrition interventions especially while addressing malnutrition in informal settlement. This will help in the control of malnutrition in children below five years of age as well as develop regulations that will help improve sanitation and personal hygiene in households. The findings of this study will be important to the Ministry of Health and the County government, in coming up with household education modules to train caregivers of children 6-59 months on proper sanitation and hygiene practices in the household. This will reduce WASH related infections and improve nutrition status of the children.

### **1.8 Limitation of the study**

The study design used was cross sectional hence it did not give trends of hygiene and sanitation practices and children nutritional status.

### **1.9 Delimitation of the study**

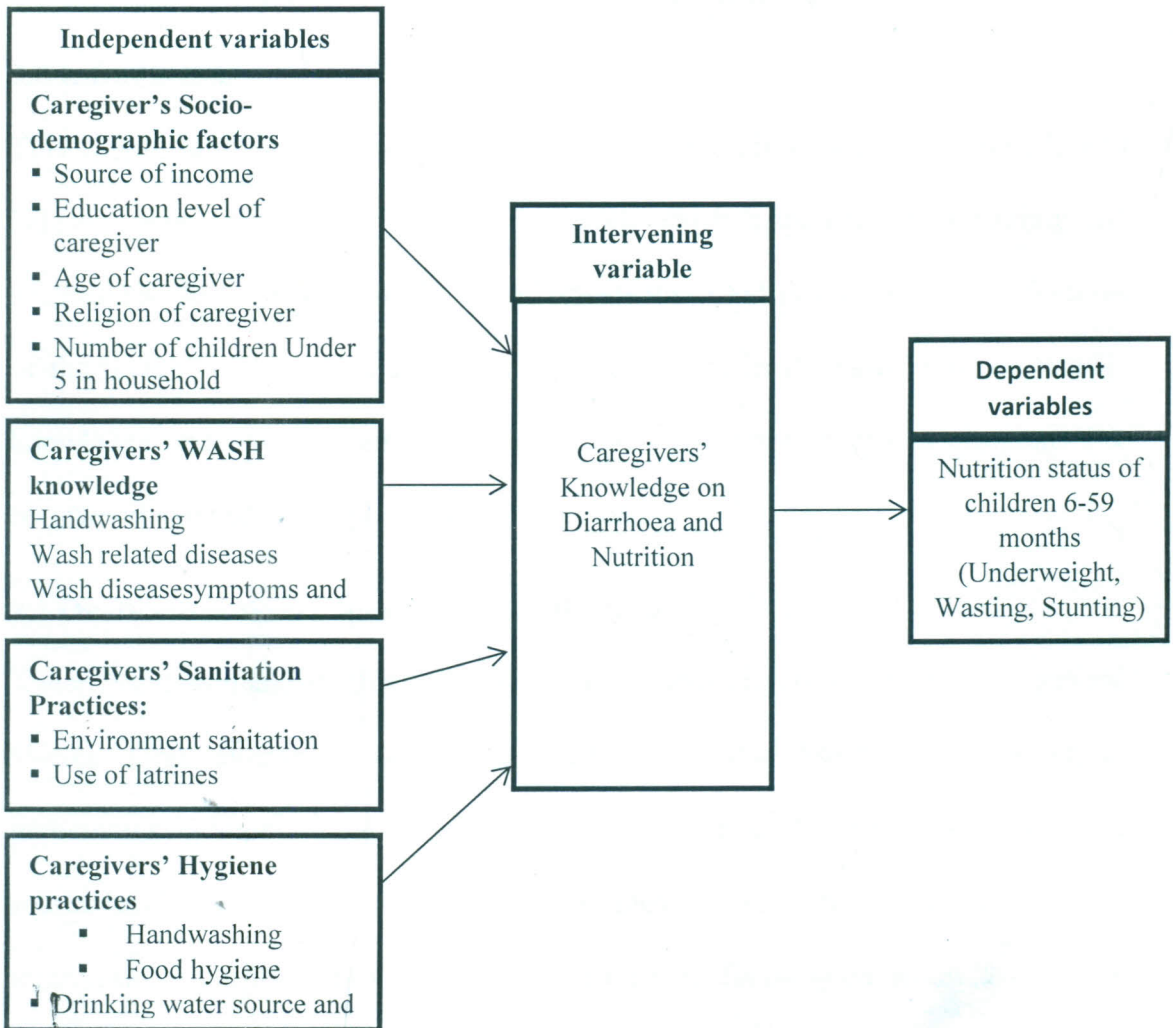
The study focused on caregivers of children aged 6-59 months in Kiandutu Informal Settlement hence the results can only be generalised to areas with similar settings.

### **1.10 Conceptual framework**

The conceptual framework illustrates the relationship between the dependent and independent variables. Children's nutrition status is related to caregivers' socio-demographic factors, hygiene practices, sanitation practices and household water quantity and quality which bring about diarrhoea and helminthic diseases. However,

presence of the right knowledge on nutrition is the modifying factor in prevention of WASH related infections hence good nutrition status among children 6-59 months.

Water, sanitation, and hygiene (WASH) has been linked to all the food and nutrition security framework pillars as proximate or immediate risk factor for malnutrition (Cumming & Cairncross, 2016; Pritchard et al., 2016). Poor knowledge and practices in hygiene and sanitation lead to occurrence of diarrhoea disease. Repeated spells of diarrhoea disease are the most direct route that links poor WASH to undernutrition in children (Cumming & Cairncross, 2016). Hence, it has been recognised that diarrhoea can be both a causing factor and a result of malnutrition. Diarrhoea can decrease dietary intake and reduce nutrient absorption, albeit malnutrition can impair barrier protection and immune function, causing more frequent episodes of diarrhoeal disease (Marshak et al., 2016). Studies show that poor environmental conditions, poor hygiene and sanitation practices and lack of availability of accessible, safe drinking water are the key precedents of diarrhoea in children less than five years (Bhutta et al., 2013; Cumming & Cairncross, 2016). This is illustrated in Figure 1.1 below.



**Source:** Adapted and modified from Cumming and Cairncross (2016) on the linkage of WASH and undernutrition in children

*Figure 1.1 Conceptual framework*

## CHAPTER TWO: LITERATURE REVIEW

### 2.0 Introduction

This chapter discusses the reviews of other related studies globally, regionally and here in Kenya. The review gave a framework which helped in understanding and synthesizing key concepts, methods and approaches used in this study. The findings of the review were used to identify the existing gaps in the association of WASH knowledge and practices among caregivers and nutritional status in children. The review was carried out as per the study objectives.

### 2.1 Overview of Water, Sanitation and Hygiene

Water, Sanitation and Hygiene (WASH) interventions are classified into four general classes. First, availability of an improved source and distribution of water, in particular standpipes or piped water, provided either at the point-of-use-or at the source levels; second, provision of improved means of excreta disposal in sanitation interventions; thirdly, improved hygiene interventions focusing on health and hygiene education; and lastly promotion of healthy behaviours like handwashing (WHO/UNICEF, 2017). Improvements in water quality, sanitation, and handwashing are associated with 15 to 40 percent reductions in the risk of diarrhoea among children below the age of five (Freeman et al., 2017).

Globally, approximately 2.6 billion people are living with deficient sanitation conditions and majority of the poor people in cities living in slum or informal conditions have severe environmental health risks (UNICEF & WHO, 2015). Insufficient drinking water, sanitation and hygiene remain a paramount cause of child death and give rise to a high percentage of the global burden of diseases and malnutrition in children (UNICEF, 2018). Poor WASH conditions have profound effect on human health.

In most developing countries, majority of the residents do not have access to a safe and acceptable form of sanitation and a safe and reliable supply of drinking water at the household level (WHO & UNICEF 2017). It has been estimated globally that more than one-third of the world's population lack sanitation and drinking water supply services within their homes (Cumming et al. 2014). The highly affected regions are the Sub-Saharan Africa and South Asia which account for the highest shortfalls in accessing sanitation services and safe water for consumption (WHO & UNICEF 2015). Results from a systematic study review indicated that less than one in every five people use soap to wash their hands after defecation globally (Freeman et al., 2017).

In Kenya, out of the 40 million inhabitants, 17 million do not have access to clean drinking water (UNICEF, 2015). The population is growing at a faster rate than the infrastructure being built for water and sanitation, hence water scarcity is becoming a more pressing concern. UNICEF states that in Kenya, an estimated 80 percent of patients attending hospital have preventable diseases with almost 50 percent of these illnesses being water, sanitation and hygiene related (UNICEF, 2015).

Lately, more than half of the population in the world live in urban areas, whereby slightly above one-third of them living in informal settlements or slums with these estimate being way higher in low and middle income countries (WHO & UNICEF, 2015). Poor urban areas may have the greatest risk of enteric infection given that there is high population density combined with limited infrastructure characterized by inadequate sanitation facilities and safe drinking water, overcrowding and poor housing conditions (UN-Habitat, 2013).

Slum environment is delineated by a wide range of problems that vary in magnitude from one region to another, this include improper excreta, poor solid waste and wastewater management, poor housing conditions; poor drainage systems; insufficient drinking water; lack of proper vermin and vector control; unsafe food and deficient general and personal hygiene (Mukama et al., 2016). Inadequate water, hygiene and sanitation are critical health concerns particularly for people living in informal settlements, whereby high population densities combined with lack of formal waste management strategies, absent or inadequate sewers and storm drainages, inconsistent and regularly contaminated water supplies increase dwellers' risk of consumption of unsafe drinking water and direct exposure to human faeces (Berendes et al., 2018). This is the case in the study area, Kiandutu Informal Settlement.

## **2.2 Knowledge on Water, Sanitation and Hygiene among caregivers**

WASH interventions during early childhood promote healthy behaviours, decrease the occurrence of conditions such as enteropathy and stunting, and reduce child mortality rates. Knowledge is important since most of the time it precedes practice. A research conducted in the Coast region indicated a knowledge behaviour gap in hand hygiene and latrine use further suggesting that there are other barriers to safe WASH practices, beyond a lack of knowledge (Schlegelmilch et al., 2016). In addition the study also found that 71 percent of respondents understood the importance of hand washing after defecation but only 31 percent actually practiced the same.

In assessing knowledge on diarrhoea as an outcome of poor WASH conditions, a study in Cambodia indicated that about 66% of the caregivers could explain two or more symptoms of diarrhoea. Most (99.4%) of the caregivers could also describe at least one cause of diarrhoea (Mekonnen et al., 2018). A recent study has shown that older caregivers have higher knowledge scores in WASH as opposed to young ones

(Merali et al., 2018). In rural Uganda, a study indicated that young mothers lack nutritional knowledge for young children (Isingoma et al., 2017). Likewise, in Iran, knowledge of diarrhoea in children under five years of age among caregivers was proven to increase significantly in older caregivers (Ghasemi et al., 2013).

Other studies have given findings of higher scores in WASH being linked to greater wealth and education. Higher levels of wealth have been shown to be equated with increased handwashing practices and lower occurrence of diarrhoea (Budhathoki et al., 2016). Moreover, this study also found that caregivers with higher education also had lower incidence of diarrhoea (Budhathoki et al., 2016). In general, the higher the level of education of a mother, the more knowledgeable she is regarding the health status of her children.

There seems to have a knowledge-behaviour gap when it comes to WASH issues. Sometimes knowledge is present but practice becomes difficult. For example, women may have the knowledge that open defecation or use of bags and buckets are linked to poor health outcomes, yet renouncing these practices may be barred by additional more pressing factors within the society that prevent households from accessing safe sanitation, clean water and or products for safe hygiene (Greenfield et al., 2016). A research in Bangladesh revealed that 69 percent of respondents understood the importance of hand washing after defecation while 21 percent actually did so indicating a knowledge-behaviour gaps with hand hygiene (Rabbi & Dey, 2013).

According to research, WASH and health knowledge among caregivers can be an important protective factor in prevention of diarrhoea (George et al., 2014). However, evidence of WASH and health knowledge association with diarrhoea is sometimes mixed whereby some studies suggest that improved behaviour in diarrhoea prevention

is not always linked to high levels of overall WASH and health knowledge (Meraliet al., 2018; Greenfield et al., 2016).

### **2.3 Practices on Water, Sanitation and Hygiene among Caregivers**

Adequate access to safe drinking water, hygiene and sanitation can prevent a large number of infectious diseases including diarrhoeal diseases surrounding a wide range of protozoal, bacterial and viral enteric infections but also other important infectious diseases including respiratory diseases (Murray & Lopez, 2013). Most important, increasing evidence indicates that an essential cause of undernutrition in children is environmental enteropathy, which is a subclinical disorder of the small intestine in young children living in conditions of deficient hygiene and sanitation that is caused by ingestion of faecal bacteria in large quantities (Prüss-Üstün et al., 2015). A study found that environmental enteropathy is majorly caused by exposure in larger quantities of faecal bacteria due to poor hygiene and sanitation condition. It also hypothesized that the primary causal pathway from poor hygiene and sanitation to stunting is environmental enteropathy and not diarrhoea (Prendergast et al., 2015). Environmental enteropathy is characterized by increased permeability, villous atrophy, inflammatory cell infiltrate, crypt hyperplasia and modest malabsorption (Prendergast et al., 2015). These processes cause delay in growth by impairing absorptive and barrier functions of the small intestine mucosa lining.

The most effective method to reduce the spread of infections among children is good hygiene practices, provision of basic toilets and clean water. Three key hygiene practices namely safe treatment and storage of drinking water, using soap to wash hands at critical times along with and disposal of faeces, are the most effective ways in reducing the prevalence of water borne disease. Safe disposal of faeces brings around 30 percent reduction, safe treatment and storage of water at point of use brings

approximately 30 to 50 percent reduction while hand washing with soap has over 40 percent reduction in water borne disease prevalence (WHO, 2018). Therefore in this study WASH practices in the household were grouped into hygiene practices, household sanitation and water source and treatment.

### **2.3.1 Hygiene practices in households**

A cross-sectional study showed that poor hygiene in households was associated with lower Height for Age Z- scores (HAZ), independent of recent morbidity, infant feeding practices, household food security and socioeconomic status in two to five year old children living in Ethiopia (Yisak et al., 2015). Children from the most unhygienic households attained 0.32 lower HAZ adjusted mean compared with children from the cleanest households. Cumulative negative effects of caregivers' poor domestic hygiene and hygiene behaviours was presumed as the evidence of this association at an age when stunting is more complete (Yisak et al., 2015).

More recent studies have also indicated that young children's food is often contaminated with fecal bacteria, particularly when such foods are being stored and given at later times. These studies conducted in peri-urban Bangladeshi and Mali found heavy contamination in infant and young children's food (Islam et al., 2013 & Toure et al., 2016). A study in Kenya found that caregiver feeding was related to 71 percent of all oral contact events for infants between three to nine months (Davis et al., 2018). Therefore, it is not surprising that research has found that food hygiene practices may reduce transmission of diarrhoea-causing pathogens by 15 to 70 percent (Woldt, 2015); proper and hygienic handling of food along with preparation practices including reheating and covering of food can reduce food contamination by microbes (Toure et al. 2016). In addition, most of the childhood diarrhoeal cases are caused by

ingesting certain bacteria, parasites and virus which are spread through food, water and hands. Therefore, food hygiene is paramount when caregivers are preparing food, processing food and feeding the children. Ingestion of faecal-related pathogens from fresh produce contaminated *during either growing, harvesting, marketing, distribution* or household preparation, is a paramount exposure pathway that should be addressed though hygienic handling of food in the household, together with control measures to gain reduction of pathogen within the chain of sanitation from toilet or latrine to the table (WHO, 2018).

Food contamination has been linked with diarrhoeal diseases among children given complementary foods (Rahman et al., 2016). These complementary foods to children may also cause food-borne infections, parasitic infections and environmental enteropathy as a result of unhygienic handling of such foods, including use of unsafe water to wash storage containers, storage of such foods in ambient temperatures, not washing hands with soap when preparing such foods or use of unhygienic kitchen clothes to dry child utensils (Gautum et al., 2017). Most people living in informal settlements do not own cold chains, including refrigeration, since they are not feasible because of limited infrastructure and unaffordability (Gautum et al., 2017). Another study from Mali revealed faecal coliform bacteria in about 55% of complementary food samples and could be the main contributing factor to infections among under-five children and poor nutritional status and (Tour 'e et al., 2016)

With regard to disposal of solid waste, some studies have indicated that garbage disposal close to homes had significant association with high fly densities, and diarrhoea was associated with the presence of flies around the sanitation facilities (Adane et al., 2017). A study done in slum areas in Rwanda showed that acute

diarrhoea had a significant association with the presence of uncollected garbage inside the housing compounds (Uwizeye et al., 2014). Inadequate waste management usually aggravates sanitation problems (UN, 2016). A study conducted in the urban slums of southern India indicated that most (66.1%) of the households did dump garbage outside indiscriminately which is the case with most informal settlements (Nirgude et al., 2014).

### **2.3.2 Handwashing among caregivers**

The hands are central to many of human being's daily activities and infected hands are a common vehicle for the spread of infections. Handwash can help reduce the transfer of pathogens from the hands to the body which mainly occurs through the faecal oral route. A study conducted in Tanzania revealed that caregivers who reported using soap to wash their hands before a meal and after defecation had a lower association with their children being stunted (Ngure et al., 2014). This is consistent with the findings from a cross-sectional study carried out in the Madhya Pradesh whereby child undernutrition was significantly associated with maternal hygiene practices. In the same study, caregivers or mothers reported presence of improved household access to piped water and toilet facility enhanced proper personal hygiene practices (Meshrem et al., 2013). Diarrhoea and other related infections in children can be reduced through increased attempts to enhance hand washing practices for both mothers or caregivers and children thus reduce stunting.

A meta analysis of studies in handwashing conducted in developing countries concluded that risk of diarrhoea can be reduced by 42 percent through proper handwashing practice in the general population (Freeman et al., 2017). An observational study in Bangladesh showed that diarrhoea occurred less often in

households where residents washed hands before preparing food and after defecation. The study suggested that handwashing before food preparation is essential to prevent diarrhoea in children (Gautum et al., 2017). A study conducted in low social-economic class in Nigeria revealed water only as the major handwashing agent (Sharma et al., 2019), unlike the outcomes of a study in a middle class and upper class whereby majority of the caregivers reported been aware of the proper technique of handwashing and also were aware of all the critical times when hands should be washed (Aliyu et al., 2019). Almost all the caregivers in this study washed their hands too after handling faeces (Aliyu et al., 2019).

Similar study conducted in India indicated that, whilst most of the participants knew and reported washing hands before and after meals, 33 percent of the participants perceived that hands should be washed after defecation. In addition, it was observed that few of the participants used plain water wash their hands after defecation (Kuberan et al., 2015). This could be linked to the lack of enough knowledge on the critical times in which one should always wash their hands to kill pathogens. In a different study in Ethiopia indicated that there was a 15 percent reduced risk of stunting among mother or caregivers who reported handwashing practices soap either after defecation or before a meal (Yisak et al., 2015). A study in Bangladesh indicated that majority of the respondents (98.4%) believed in the importance of handwashing in disease prevention (Aliya et al., 2019).

### **2.3.3 Sanitation practices in households**

Adequate sanitation is an important requirement for normal growth. Sanitation refers to proper use of latrines or toilets and proper disposal of child's faeces to prevent faecal contamination including environmental sanitation. A study showed that growth was strongly associated with sanitation than water services. Further, acute

malnutrition and stunting was strongly correlated with lack of proper sanitation, whereby, feacally contaminated environment was linked to chronic undernutrition even in the absence of diarrhoea (Headey, 2016).

Studies in Bangladesh and Kenya indicated that closer proximity of latrines increased risk of transmission of pathogens via flies which contributed to diarrhoeal diseases and increased contamination of tube-well water sources (Escamilla et al., 2013 & Adane et al., 2017). However, approximately 19 percent of the population in Sub-Saharan Africa depend on shared latrines (WHO, 2014). Improved sanitation reduces fly counts in the compound (Pickering et al., 2015)

Contamination of the surrounding environment with human and animal faeces in households that are poor is inescapable. Domestic environment is contaminated by diverse microbes and pathogens through faeces deposited in the open and later carried by human and animal feet to the immediate locality of young children and crawling infants (Headey et al., 2017). Pathogenic *E. coli*, human bacteroidales, rotavirus genes and enterovirus were found in soil samples collected from households that used pit latrines in Tanzania (Ngure et al., 2014).

Safe and correct disposal of child faeces remain a major challenge. Despite the fact that child faeces may have higher loads of pathogen than those of adults, they are often considered innocuous thus not safely disposed (Majorin et al., 2017; Rand et al., 2015). Even caregivers or mothers who can access sanitation facilities regularly do not use them to dispose child faeces (Majorin et al., 2017; Freeman et al., 2017). More than 50 percent of households, in 15 out of 26 locations, reported that the faeces of their youngest child under three years were unsafely disposed off, that is not into a

latrine, and surprisingly the percentage was even lower for the faeces that ended up in an improved latrine (Rand et al., 2015).

Domestic animals, human beings and household pests like rats are the main reservoirs of pathogens on top of their survival in the environment. Food contamination occurs due to direct or indirect contamination from the human, animal or pest reservoir. Animal faeces may be an important contributor to stunting and EED (Headey et al., 2017).

Environmental contamination affects most of the children in their earlier months of life as they start to crawl, walk, explore and put objects in their mouths, this increases the risk of ingesting faecal bacteria from both animal and human sources. It also leads to repeated periods of diarrhoea and intestinal worms, which end up deteriorating the children's nutritional status (Rah et al., 2015). A study in Ethiopia found that acute diarrhoea was significantly associated with the presence of flies and faeces on the floor or around the sanitation facilities. The presence of flies on the floor and around sanitation facilities was presumed to be due to the disposal of garbage and discharge of domestic sewage close to sanitation facilities and inside the housing compound together with poor cleanliness of the sanitation facilities (Adane et al., 2017).

#### **2.3.4 Water source and treatment in households**

Evidence from many low and middle income countries shows that improved water sources are often contaminated with thermo tolerant coliforms or *Escherichia coli* (Bain et al., 2014). Moreover, a systematic meta-analysis of 57 studies revealed that there was a widespread contamination of water with microbes between source and point-of-use (Bain et al., 2014).

Econometric analysis of 26 low-income countries estimated that a 15-minute reduction in walking time to collect water is associated with a 0.26 increase in HAZ, with this effect being stronger among households with sanitation (HAZ, +0.35) compared to those without sanitation (HAZ, +0.21) (Pickering & Davis, 2012). In a cohort study in Peru, diarrhoea prevalence explained 16 percent of the height deficit in children at two years of age, while water and sanitation differences explained 40 percent of height deficit (Vonaesch et al., 2017). Therefore, the primary pathway linking WASH to growth may be highly independent of diarrhoea.

In a different study, two year old children were 1.0 centimetre shorter in areas with worst conditions of water source, storage and sanitation compared to those with best conditions (Vonaesch et al., 2017). Children less than four years of age residing in households with hand washing facilities, improved toilets and good water quality had a HAZ 0.54 greater than children that were not living in such conditions (Lin et al., 2013).

Informal settlements experience regular or even irregular water supplies and mostly rely on community or household septic tanks. Nonetheless, the septic tanks often are undersized or poorly maintained (Mundia, 2013). Most of the residents in an informal settlement do not have access to improved sources of drinking water within their immediate residence. A study conducted in Kibera Slums in Kenya revealed that, only 1.5 percent of participants reported having piped water on premises, either inside the plot or home, and 98.5 percent reported using another improved source of drinking water, mainly public taps (97.6%) and other unimproved sources (Worell et al., 2016).

In a study carried out in India, most of the participants had knowledge on the poor effects quality of water has on health and half of them agreed that more infectious

diseases can be caused by the consumption of unsafe drinking water. Despite the knowledge, 45 percent of the participants were not following any water treatment methods and half of the them felt that water is already clean, hence no further treatment was necessary (Kuberan et al., 2015). The impact of faecal contamination on pipe water and household stored water was discussed in a research establishing the association between the two (Shields et al., 2015). The study found substantive evidence of deterioration of water quality between source and storage. Similarly, prevalence of acute diarrhoea was closely associated with sanitation facilities that are unimproved and poor hygienic conditions among children less than 50 months (Adane et al. 2017). In addition, a non-randomised control trial did report that faecal contamination of drinking water was reduced by improved sanitation (Park et al., 2015).

#### **2.4 Overview of the nutrition status in children**

Nutrition status refers to the physiological state of an individual, which results from the relationship between nutrient requirements and intake combined with the body's ability to digest, absorb and use these nutrients. Moreover, malnutrition is defined as an abnormal physiological condition that is caused by unbalanced, inadequate or excessive consumption of micronutrients and/or macronutrients (Rizwana et al., 2015). Hence, the general term for poor nutrition status is malnutrition. Malnutrition can present in two forms, either undernutrition or overnutrition. This study focused on undernutrition which presents in three forms: stunting, wasting and underweight. Stunting is measured using height for age indices. Stunting is a chronic form of malnutrition which is as a result of long-term nutrient deprivation and usually leads to delayed mental development. Wasting is a form of acute malnutrition which measured using the weight for height indices. Underweight is also a form of acute

malnutrition which is measured using the weight for age indices especially when monitoring the growth pattern of children below five years.

Children's nutritional status is a good indicator of development level and community's potential in the future. The nutritional status of children less than five years of age is of remarkable concern since the early years of life are crucial for ideal growth and development. Stunting and wasting are associated with increased rates of mortality, particularly when both are present in the same child (Briend *et.al*, 2015).

Nutritional deficiencies are still compound problems affecting many infants and young children globally, despite increased attention to nutrition in the past decades (UNICEF, 2015). Undernutrition in all its forms remains unacceptably high in all parts of the world. Globally, it is estimated that 150.8 million and 50.5 million children below the age of five years are stunted and wasted respectively (UNICEF, WHO, WBG, 2017). Approximately, 4.5 percent of child deaths were attributed to undernutrition with 7.4 percent lives of children being at immediate risk due to severe wasting (UNICEF, 2015).

Regionally, in 2018, more than half of all stunted children under five years of age lived in Asia and more than one third lived in Africa. In addition, more than two thirds of all wasted children under five years of age lived in Asia and more than one quarter lived in Africa (UNICEF, WHO, WBG, 2017). Sub-Saharan Africa has a population of over 800 million people with the highest annual population growth rate of 2.7 percent in the world (UNICEF, WHO, WBG, 2017). In this part of the world, over 214 million people (23.8%) suffered from malnutrition within the period 2012 to 2014 (Ejide, 2015). Further, the progress in reducing both undernourishment and underweight in children has been limited (FAO, 2015). Specifically, the prevalence of

underweight and of stunting in children aged less than years old in this region is 21 percent and 37 percent, respectively, which is similar to that in developing countries (22% and 37%, respectively) (UNICEF, 2015).

In Kenya, 26 percent of children under five are stunted, 11 percent are underweight and 4 percent are wasted (KDHS, 2014). In the same survey, Kiambu County had a prevalence of 15.7 percent of children under five years being stunted, 2.3 percent being wasted and 5.1 percent being underweight (KDHS, 2014). Down to the study area, Kiandutu Health Centre receives an average of 150 children under five years who are malnourished every month (DHIS, 2018).

### **2.5 Association between WASH conditions among caregivers and nutritional status in children**

WASH affects the nutrition status through repeated bouts of diarrhoea (Marshark et al., 2016), thus making diarrhoea a cause and a consequence of malnutrition. Some studies have shown that poor environmental conditions, poor hygiene and sanitation practices and lack of availability of accessible, safe drinking water are the main causes of diarrhoea among children below five years of age (Pritchard et al., 2016).

A study in Tanzania reported that children living in unsanitary and unhygienic environments may become undernourished even in the absence of diarrhoea or intestinal worms (Mshinda et al., 2018). A child may develop a condition known as environmental enteropathy as a result of repeated ingestion of fecal bacteria, which in turn may overload to the gut and cause malabsorption, poor villi functioning, leaking mucosa and inflammation of gut cells, the conditions that may lead to body faltering. Notably, growing evidence suggests that a key cause of undernutrition in children, especially those living in conditions of poor hygiene and sanitation, is a

subclinical disorder of the small intestine referred to as environmental enteropathy caused by ingestion of faecal bacteria in large quantities (Keusch et al., 2014).

According to the existing research, there are three key pathways in which lack of proper WASH access and practice contribute to poor nutritional status (Bery et al., 2015). The first pathway is through diarrhoea, whereby a continuous cycle exists between undernutrition and diarrhoea. Children with diarrhoea disease tend to eat less and absorb less nutrients from their food, whereas, malnourished children are highly susceptible to diarrhoea when exposed to faecal contamination in the environment. The second pathway is through intestinal worm infestation whereby poor sanitation leads to soil transmitted helminthic infections which cause infections when ingested into the body through contaminated food or water or through contact. These infections affect nutrition status through loss of appetite, malabsorption of nutrients and increased blood loss. The last pathway involves environmental enteropathy, a condition of the gut caused by persistent and prolonged exposure to enteric pathogens as a result of ingestion of faecal bacteria and living in poor conditions of WASH (Crane et al., 2015). Children in slums in Nairobi with chronic diarrhoea often do not absorb nutrients from food, contributing to stunting and malnutrition. In addition, exposure to excreta-related pathogens including helminths or worms in early life for a long time, lowers long-term disease immunity and limits cognitive or brain development (Courborn & Hildebrand, 2015).

Poor WASH practices have been reported to contribute to diarrhoea-associated infections, which contribute to 50 percent of undernutrition among under-five children globally (USAID, 2015). A study in Tanzania found that children who had diarrhoea associated infections for the past two weeks before the survey date had increased risk of being stunted and underweight compared with those who had not.

This could be due to the fact that diarrhoea tends to affect absorption of nutrients by the body because of limited time the food spend in the stomach lowers appetite and whatever little food taken is directed into recovery from the infection (Mshinda et al., 2018). Likewise, undernutrition may prolong duration and frequency of diarrhoea and worsen the overall health condition of the child (Ngure et al., 2014). It has also been estimated that improved WASH practices may rescue up to 45 percent of child deaths a year globally that are due to undernutrition (WHO, 2018). Stunting has been linked to unsanitary conditions, and it affects almost one quarter of children under-five globally through several mechanisms which include helminth infections, repeated diarrhoea and environmental enteric dysfunction (Daniel et al., 2016; UNICEF/WHO/World Bank, 2018; Keusch et al., 2014; Crane et al., 2015)

Approximately 2.4 million annual deaths due to diarrhoea, subsequent malnutrition and 6.6 percent of the global disease burden and disability are attributed to poor WASH conditions (Pruss-ustun et al., 2014). Most of this burden of disease affects children in low income countries. According to some researchers, poor conditions of WASH account for as much as 50 percent of childhood and maternal underweight, mostly through the well described synergy between undernutrition and diarrheal diseases, whereby one increases vulnerability to the other (UNICEF, WHO, WBG, 2018). Meta-analyses conducted on 140 demographic and health surveys indicated that much of the excess stunting in India is attributed to open defecation. The research also showed that high population density contributes to high levels of open defecation, hence children are more likely to be predisposed to infections from faeces (Spears 2013). The chance of occurrence of diarrhoea is high in children with malnutrition (Budhathoki et al., 2016).

A study indicated that stunting was attributed to unimproved sanitation at the community level in rural villages, inspite of the child's household use of an improved toilet. In addition, controlling the data for all factors that may impact a child's height, results from a study in Viet Nam among five year old children indicated that the use of unimproved latrines in rural villages contributed to 3.7 cm difference in height compared with healthy children living in villages where everybody practiced improved sanitation, (Quattri & Smets, 2014).

Positive nutrition results are dependent of nutrition actions and WASH interventions. Unsafe sanitation and hygiene practices with inadequate access to clean water increases rates of undernutrition through increased risk of severe infectious diseases. Recent research suggests that children's nutritional status is adversely affected by unhygienic living conditions, compared to diarrhoea disease (Chambers et al., 2014). However, a researcher studied the effect of improved hygiene, sanitation and water quality practices on acute malnutrition in 4,322 children below the age of five and found an association in a comprehensive review including seven WASH interventions (Dangour et al., 2013). Therefore, it is possible that improved WASH practices serves as a means of improving child nutritional status through reduction in diarrhoea associated infections and other WASH-related infections.

## **2.6 Summary of Literature Review**

Undernutrition is not only determined by nutrient intake but also by nutrient loss. Poor wash conditions lead to exposure to faecal-oral contamination which in turn brings about the three pathways for gut infections affecting the nutrition status of children. Poor WASH conditions have been directly linked to stunting which remains a significant malnutrition problem. In most instances, knowledge precedes practice

and literature review has shown when the two lapse then a problem is established. Lack of the adequate knowledge in WASH among caregivers impedes proper practice exposing the children to WASH-related illness which in turn affect their nutrition status. Informal settlements are characterised by overcrowding, low social economic levels and poor hygiene facilities hence the caregivers' hygiene and sanitation practices in households should be evaluated to help inform the control of high diarrhoea incidences in children under five years of age which lead to undernutrition.

## **CHAPTER THREE: MATERIALS AND METHODS**

### **3.0 Introduction**

The chapter describes the methods used in the study. It discusses the study design, variables, study area, target population, sample and sampling procedures, data collection, data analysis and ethical considerations in this study.

### **3.1 Study design**

The study adopted a descriptive cross-sectional study design in households with children aged 6-59 months. The design involves collection of data at a point in time. The study design was appropriate in collecting and describing the study variables. The design allowed for collection of extensive data for the study variables within a short time.

### **3.2 Study variables**

#### **3.2.1 Dependent variable**

The dependent study variable in the study was the nutrition status of children 6-59 months. The nutrition status was measured by weight for age Z scores indicating underweight, weight for height Z scores indicating wasting, height for age Z scores indicating stunting, and presence or absence of oedema.

#### **3.2.2 Independent variables**

Independent variables included socio-demographic factors of both caregivers and children, WASH knowledge among caregivers, hygiene and sanitation practices among caregivers. Socio-demographic factors of caregivers and children included age of the caregiver (in years), age of the child (in months), sex of the caregiver and child, relationship of the caregiver with the child, level of education of the caregiver, caregiver's source of income, caregivers religious affiliation, the average monthly

income in the household and number of children under five years in the household. Caregivers' WASH knowledge levels was assessed through a set of questions which included drinking water treatment methods, diseases that can be acquired through consumption of contaminated water, importance of handwash, prevention of diarrhoea disease, symptoms and prevention of worm infection. The answers given were scored and classified as low, moderate and high. Hygiene practices included handwashing methods and times, food hygiene during preparation to consumption to storage, environmental hygiene around the household, caregiver's personal hygiene practices, disposal of solid waste in the household, source of drinking water, treatment of drinking water before consumption in the household and storage methods. Sanitation practices addressed the handling and disposal of faeces in the household including the use of latrines/toilets and safe disposal of faeces (both adult and child faeces).

### **3.3 Study location**

The study was conducted in Kiandutu Informal Settlement in Kiambu County. The settlement falls in the larger Kamenu Ward, Thika Sub County. Population size for Kiandutu households was estimated to be 5000 (KNBS, 2009). The settlement is divided into ten villages namely: Mosque, Mtatu A, Mtatu B, Biashara, Stage Wariah, Centre Base A, Centre Base B, Mukinduri, Molo and Kianjau. Most residents here are casual labourers who rely on industries in Thika Sub County. Kiandutu informal Settlement records an average of 250 cases of diarrhoea and 100 cases of malnutrition among children under five on a monthly basis (DHIS, 2018). Further, a study conducted here identified a prevalence of 17.5 percent, 9.9 percent and 5.5 percent for stunting, wasting and underweight respectively (Chege et al., 2016). The prevalence is higher than that estimated for Kiambu County, a prevalence of 15.7 percent, 2.3 percent and 5.1 percent for stunting, wasting and underweight respectively (KDHS,

2014). Diarrhoea disease was ranked as the second cause of morbidity in children below five years in the settlement after respiratory diseases (DHIS, 2018). The high occurrence of diarrhoea disease is an indicator of poor WASH conditions in the slum.

### **3.4 Target Population**

The study was targeting caregivers and their children aged 6-59 months in a household whereby if there were more than one child aged 6-59 months the youngest was considered.

### **3.5 Inclusion criteria**

The study included all households with children aged 6-59 months in Kiandutu Informal Settlement, had lived in Kiandutu in the last six months and was willing to participate in the study.

### **3.6 Exclusion criteria**

The study excluded all households where the child was physically challenged, hence difficult to take anthropometric measurements.

### **3.7 Sampling technique**

Multi- stage sampling was used to select the primary respondents of the study. This sampling technique involves use of various stages to get to the respondent. First, cluster sampling method was used whereby the ten villages in Kiandutu formed 10 clusters. Second, systematic random sampling was then used to select households with children 6-59 months in each cluster. A list of all households with children 6-59 months was obtained from the sub county administration. The research first randomly selected the first participant in each cluster, then visited every 30<sup>th</sup> participant. The estimated number of households in Kiandutu informal Settlement was 5000 in the 2009 census (KNBS, 2009). This was divided with the desired sample size that was

165, to yield a sampling interval of 30. Every 30<sup>th</sup> household was visited, starting with a randomly selected number between 1 and 30 using simple random sampling. Number 12 was selected and each 30<sup>th</sup> household in that cluster was chosen as a study unit. Thirdly, purposive sampling was used to select key informant interview participants who were the Community Health Extension Worker (CHEW) working in Kiandutu, Nutritionist in-charge and facility in-charge at Kiandutu Health Centre. Community Health Volunteers (CHVs) and caregivers who were not selected as study units were purposively selected for the focused group discussion.

### 3.8 Sample size determination

The sample size was calculated using Fishers et al.1998 formula since the population for children aged 0-5 years is above 10,000.

Hence,

$$n = Z^2 pq / d^2$$

Where;

n = desired sample

Z = Standard normal deviate at the required confidence level 95% which is 1.96

p = the prevalence of underweight will be used since it serves as a compound measure that captures both stunting and wasting (11%) (KDHS, 2014)

$$q = 1-p (1-0.11=0.89)$$

d = the degree of accuracy (0.05)

$$= \frac{1.96^2 \times 0.11 \times 0.89}{0.05^2}$$

$$= 150 + 15 (10\% \text{ non-response}) = 165$$

The study had 165 respondents from households with children 6-59 months.

### **3.9 Data Collection Instruments**

#### **3.9.1 Household Questionnaire**

A researcher administered questionnaire (Appendix II) was used to collect data from the caregivers. The questionnaire was divided into five sections. Section A gathered information on socio-demographic characteristics including age of the caregiver and the child, sex of both caregiver and child, level of household income, occupation of the caregiver, level of education of the caregiver and the religion of the caregiver. Section B collected information on the WASH knowledge among the caregivers which included water treatment methods, disease caused by consumption of contaminated water, importance of handwash, signs and symptoms of worm infections and prevention of worm infections and diarrhoea. Section C elicited information on WASH practices which included source, storage and treatment of drinking water, household sanitation, handwashing practice, food hygiene and environmental hygiene. Section D gathered information on Child's morbidity which assessed diarrhoea prevalence. Finally section E gained information of the nutritional status among the children whereby we took the anthropometric measurements of height, weight and Mid-Upper Arm Circumference (MUAC).

#### **3.9.2 Focus Group Discussion (FGD) Guide**

Focused Group Discussion involves an organized discussion with a selected group of individuals to gain information about their views and experiences with a topic. An FGD guide (Appendix III) was used to gather information from the Community Health Volunteers (CHVs) and caregivers whereby we gathered information on household hygiene and sanitation practices, barriers to sanitation and personal hygiene in households, knowledge on undernutrition, link between poor WASH and sanitation and any training information on WASH in households as well as the

common diseases suffered by children in the study area. Four FGDs were conducted, one with the CHVs and three with the caregivers who were not selected as study units.

### **3.9.3 Key Informant Interview (KII) Guide**

The KII guide (Appendix IV) was used to collect experts' opinion from the Community Health Extension Worker (CHEW), nutritionist in-charge and the facility in-charge- Kiandutu Health Centre. The information elicited here included WASH messages disseminated to households, barriers to proper WASH conditions in Kiandutu, linkage between WASH and nutritional status, trainings on WASH, common diseases suffered by children in the study area and link between WASH and nutrition status among children.

### **3.10 Pretesting of the Data Collection Tools**

Pretesting was done in Umoja settlements in Thika Sub County which has the same characteristics as the study area. We used 16 households which represented ten percent of the sample size. This was done to establish accuracy and clarity of questions as well as establish the length of the interview. This provided an opportunity for training of research assistants as well as modification and inclusion of missed items.

### **3.11 Validity and Reliability of Data Collection Tools**

#### **3.11.1 Validity**

Validity was achieved through the pretesting of the tools used in data collection. Content validity of the questionnaires was established through expert review of the tools by my supervisors from Kenyatta University. The anthropometric data was collected using a salter scale and height board. They were pre-tested to ascertain the degree of both the intra and inter observer error. Standardization was done through the

use of WHO validated questionnaires.

### **3.11.2 Reliability**

Reliability was achieved through the test-retest method whereby the tools were administered to a sample of the population, then later readministered after two weeks to the same sample then the results subjected to a Cronbach's Alpha test to check for correlation of the two data sets. The data yielded a correlation coefficient of 0.87 (0.77 – 0.96; 95% CI) between the two sets of data. A Cronbach's alpha of 0.7 and above was considered as acceptable (Blaxter et al., 2010).

### **3.12 Data collection techniques**

The study included both quantitative and qualitative methods of data collection. On the quantitative dimension researcher administered questionnaires, direct observation and observational checklist were used. FGD guide and KII guide were used to collect qualitative data.

#### **3.12.1 Demographic and Socio-economic Data**

Demographic and socio-economic characteristics of the study participants was collected using a semi structured questionnaire through face to face interviews to collect data on age of the caregiver and the child, sex of both caregiver and child, level of household income, occupation of the caregiver, level of education of the caregiver and the religion of the caregiver.

#### **3.12.2 Knowledge on WASH among the caregivers**

Face to face interviews were used to assess the caregivers' knowledge using semi structured questionnaires. The respondents were assessed on water treatment methods, disease caused by consumption of contaminated water, importance of handwash, signs and symptoms of worm infections and prevention of worm infections and diarrhoea.

### **3.12.3 WASH Practices among the caregivers**

Here we used both face to face interviews with semi structured questionnaires and observation checklists. The practices were divided into source, storage and treatment of drinking water, household sanitation, handwashing practice, food hygiene and environmental hygiene. With regard to drinking water we assessed the source, treatment, treatment methods, presence of storage containers and their hygiene status. Household sanitation included access to a latrine, latrine ownership, type of latrine, child's excreta disposal methods and solid waste disposal methods. With regard to handwashing practice, we collected information on the handwashing practice itself among the caregivers and the children too, what used to wash the hands and if they wash during the critical times. Food hygiene was assessed in terms of where the food is prepared, reheating of food before giving the child, storage of food, separation of raw and cooked food and cleaning of fruits and vegetables before consumption. Finally environmental hygiene was assessed through the use of an observation checklist whereby we checked if there were flies, smell, faeces, blocked drains and uncontrolled open dumpsite around the house.

### **3.12.4 Nutritional status among the children**

Anthropometric data of children 6-59 months was collected to determine their nutritional status. This was done using a salter scale for the weight with accuracy of 0.1 kg and height boards measured the height of the children with an accuracy of 0.1cm. MUAC tape was also used to check wasting. Assessment of oedema was also done whereby the researcher gently applied pressure on both feet of the children with the thumbs, those who showed the print of thumbs after three seconds were considered to have oedema.

### 3.12.5 Qualitative Data

Qualitative data was used for data triangulation. Key Informant Interviews (KII) were used to obtain opinions from CHEW in-charge of Kiandutu Settlement, Nutritionist in-charge and the health centre facility in-charge. We gathered information on the following aspects: WASH messages disseminated to households, barriers to proper WASH conditions in Kiandutu, linkage between WASH and nutritional status, trainings on WASH and the common diseases suffered by children in the study area. Focus Group Discussion (FGD) was also conducted with the CHVs and caregivers. The following aspects were discussed: household hygiene and sanitation practices, barriers to sanitation and personal hygiene in households, knowledge on undernutrition, link between poor WASH and sanitation and any training information on WASH in households as well as the common diseases suffered by children in the study area.

### 3.13 Data analysis

The data collected from questionnaires was cleaned and coded before being entered into the Statistical Package for Social Sciences (SPSS Version 20) computer software programme for analysis. Bloom Cut Off points were used to measure the knowledge and practice in sanitation and hygiene. To determine knowledge levels on WASH, respondents were asked a set of seven questions, whereby a response was considered to be correct if the answer provided was "Yes". One point was given for every correct response adding up to 45 points in total. The points were later converted to percentage whereby: less than 50% was low knowledge, between 50% and 75% was moderate knowledge and 75% and above was high knowledge (Nair, 2014). The questions focused on WASH related disease causation, disease symptoms and disease prevention. Chi-square test of independence was used to establish associations

between caregiver's hygiene and sanitation practices with the nutrition status of children 6-59 months. Chi square test is used to when testing association of two categorical variables which in this case apply to the study variables being compared. The level of significance was set a p value being less than 0.05. Anthropometric data was analyzed using WHO cut off to explain the nutrition status. The indices of interest were Weight for Height Z scores indicating wasting, Height for Age Z scores indicating stunting and Weight for Age Z scores indicating underweight. ENA for SMART was used to analyze the anthropometric data. A Z score of between -2 SD and -3SD was categorized as moderately malnourished while less than -3 SD reflected severe malnutrition. MUAC cut of above 135mm reflected well-nourished children, between 125mm and 135mm reflected mild malnutrition, 125 mm to 115mm reflected moderate malnutrition while less than 115mm reflected severe malnutrition. Qualitative data from FGDs and KIIs was typed and the common views captured, coded and organized to themes before generalizations was made. Results were described using statistics such as means, percentages, frequencies, ranges and standard deviation

### **3.14 Logistical and Ethical Consideration**

Kenyatta University Graduate School approved the proposal. Ethical approval was sought from the Kenyatta University Ethics and Review Committee (KUERC). Research permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI). Research approval was also sought from the Kiambu County Research Office. Permission was sort from the local authority at Kiandutu Informal Settlement. Participants signed an informed consent letter which after signing was detached from the questionnaire for purposes of confidentiality and anonymity of the respondents. This allowed the information provided to be used

mainly for purposes of research and not to conceal their identification or recognition of the subjects at any point. Information obtained from the study was treated with confidentiality and no names were used to identify the participants in the study for privacy purposes. Verbal consent was obtained at the beginning of the FGDs and KIIs.

## CHAPTER FOUR: RESULTS

### 4.0 Introduction

This section presents results obtained for the independent and dependent variables in the study. A detailed analysis of the data, interpretation and explanation of the results with regard to the objectives is given. The chapter is organised as follows: socio-demographic characteristics of the respondents, caregivers' knowledge on WASH, caregivers' WASH practices, nutrition status of children and the association between caregivers' WASH knowledge and practice with the child's nutritional status.

### 4.1 Socio-demographic characteristics of the respondents

The study had an expected sample size of 165 respondents. Out of the 165 questionnaires used, 159 questionnaires were complete and hence used for analysis giving a response rate of 96 percent. Six questionnaires were incomplete thus discarded.

Data was collected within the ten villages being sampled as a cluster each. Data was collected as shown in Table 4.1 per each cluster. Data was collected among caregivers of children 6-59 months who gave consent.

*Table 4. 1 Cluster areas in Kiandutu Informal Settlement*

Village	N	%
Mosque	16	10.1
Mtatu A	16	10.1
Mtatu B	17	10.7
Biashara	16	10.1
StageWariah	16	10.1
Centrebase A	16	10.1
Centrbase B	16	10.1
Mukinduri	15	9.4
Molo	16	10.1
Kianjau	15	9.4
<b>Total</b>	<b>159</b>	<b>100.0</b>

#### 4.1.1 Demographic Characteristics of the caregivers

##### 4.1.1.1 Age, Sex and Religion distribution of caregivers

Table 4.2 displays the above demographic characteristics of the caregivers. The mean age of the caregivers was  $26.99 \pm 6.903$  years with the youngest and oldest caregiver being 18 and 57 years respectively. Most of the caregivers (60.4%) were between the ages of 20-29 years while the age bracket of equal and above 50 years had the least number of respondents (1.2%). Most of the caregivers were female (98.7%) with males being 1.3%.

Majority (96.9%) of the respondents were the mothers to the children, whilst the rest were either father (1.2%) or employed nanny (1.9%). According to the study results, 78.6% of the caregivers were Christians, 20.8% were Muslims and 0.6% did not have any religious affiliation.

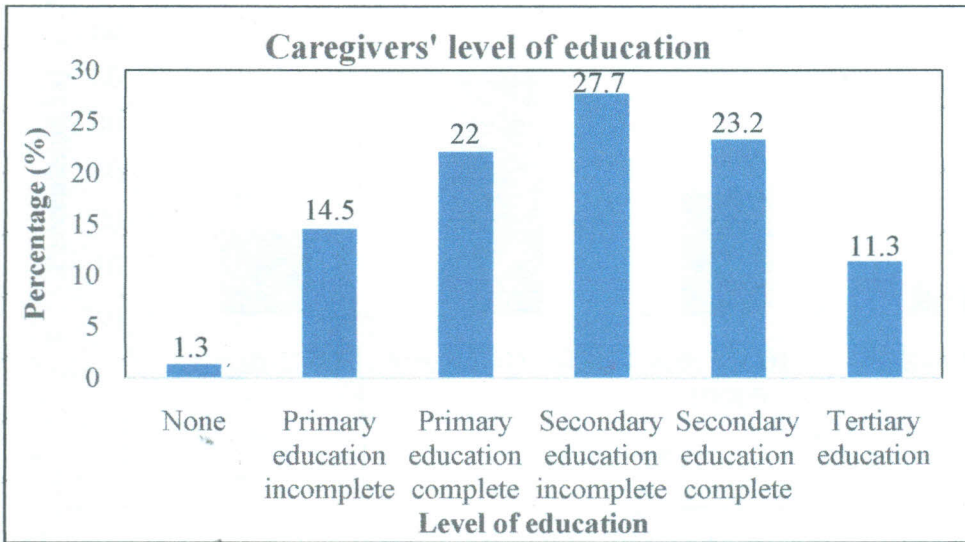
*Table 4. 2 Demographic characteristics of the respondents*

Characteristic	N=159	
	N	%
<b>Sex</b>		
Male	2	1.3
Female	157	98.7
<b>Age</b>		
≤ 19 years	14	8.8
20-29 years	96	60.4
30-39 years	44	27.7
40-49 years	3	1.9
≥ 50 years	2	1.2
<b>Relationship of the respondent to the child</b>		
Mother	154	96.9
Father	2	1.2
Employed nanny	3	1.9
<b>Caregivers' religion</b>		
Christian	125	78.6
Muslim	33	20.8
None	1	.6
<b>Total</b>	<b>159</b>	<b>100.0</b>

#### 4.1.1.2 Education Level and Occupation of the respondents

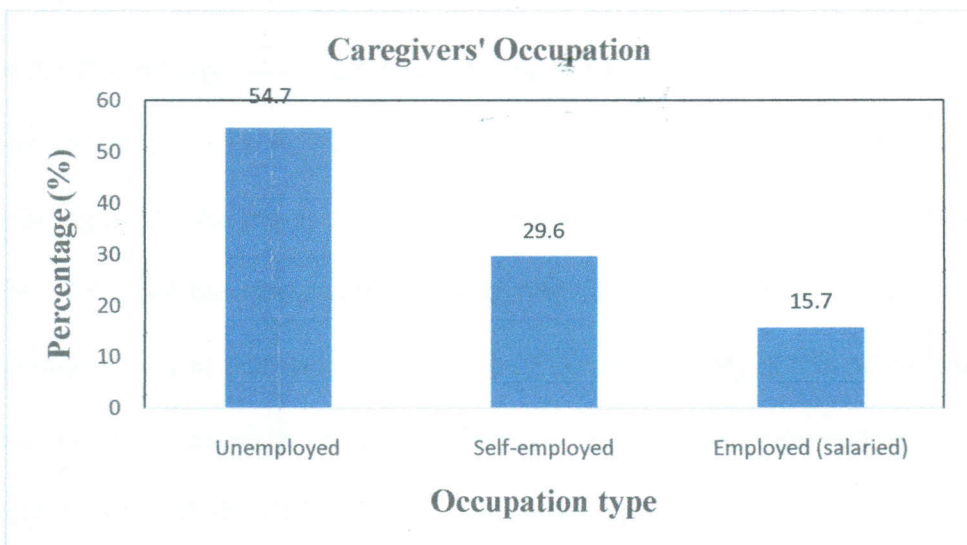
Education level is a key determinant of the type of employment one gets which in turn influence the income level of an individual.

As shown in Figure 4.1, only 23.2% had completed secondary education. Those who had no education were few (1.3%) and only 11.3% had attained tertiary education.



**Figure 4. 1 Caregivers' level of education**

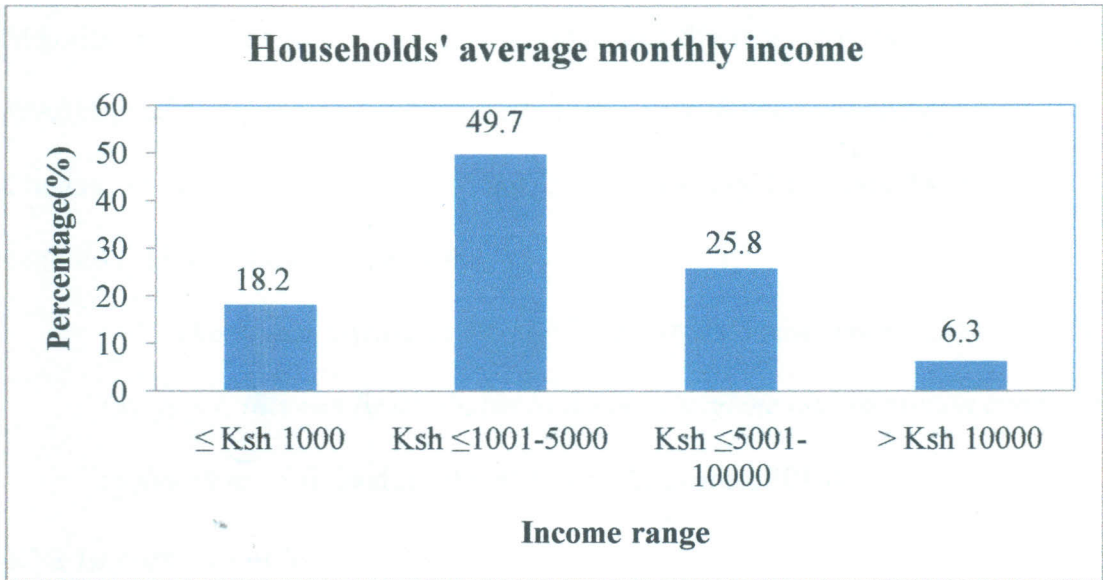
Analysis of the respondents occupation revealed that slightly above half (54.7) of the respondents were unemployed which replicates the low socio class in the informal settlement. This is illustrated in figure 4.2.



**Figure 4. 2 Caregivers' Occupation**

### 4.1.1.3 Household Monthly Income

As illustrated in figure 4.3, most (49.7%) of the households had a monthly income of between Ksh 1001 to Ksh 5000. Only 6.3% of the households had a monthly income above Ksh 10000 while 18.2% had an average monthly income below Ksh 1000.



*Figure 4. 3 Respondents Household Monthly Income*

## 4.2 Level of knowledge on WASH among the caregivers

Table 4.3 shows the variables that were assessed to test the level of knowledge on WASH among the caregivers.

### 4.2.1 Knowledge on water treatment methods

As shown in Table 4.3, most (60.3%) of the caregivers reported that they knew of boiling as the main water treatment method before consumption. This was followed by 36.6% of the caregivers who reported on knowledge of water treatment using chemical and in this case, “water guard”. Approximately, 2.6% of the caregivers did not know of any water treatment methods. This was also recorded in the focus group discussion with the CHVs whereby one reported:

*“...Most of the caregivers here do not treat their water before consumption claiming that the water has a clear colour hence cannot be contaminated....”*

(CHV, 2018).

#### **4.2.2 Diseases that can be transmitted by poor WASH conditions**

Majority (69.2%) of the respondents reported that diarrhoea can be caused by poor WASH conditions whilst 23.3% indicated that poor WASH conditions could cause Cholera. Only 5% did not know of any disease that can be caused by poor WASH condition. This is shown in Table 4.3.

*“...Diarrhoea disease is the highly reported disease among children below five years, this can be attributed to the poor hygiene and sanitation conditions in this slum...”* (Kiandutu Health Centre In-charge, 2018).

#### **4.2.3 Importance of handwashing**

Handwashing is a critical practice in WASH hence the knowledge on its importance was crucial. The results of this study revealed that most (74.2%) of the caregivers reported that people wash hands to prevent diseases. In addition, 25.2% of the caregivers said that people wash hands to kill germs, 14.1% believed the importance of handwashing was cleanliness. This is as illustrated in Table 4.3. One of the caregivers reported in the FGD:

*“...we wash our hands to kill germs but most of the time the hands look clean so we only wash when the dirt is visible to minimize on water usage...”*

(Caregiver, 2018).

**Table 4.3 Caregivers' knowledge on Water treatment, WASH related Diseases and Importance of hand-wash**

Characteristic	N= Varied with the answers given		
	n(multiple responses)	%	% of cases(multiple responses)
<b>Water treatment methods known</b>			
None	2	0.9	1.3
Treat with chemical	82	36.6	51.6
Boiling	135	60.3	84.9
Distilling	3	1.3	1.9
Don't know	2	0.9	1.3
<b>Total</b>	<b>224</b>	<b>100.0</b>	<b>140.9</b>
<b>Diseases that can be acquired due to contaminated environment</b>			
Diarrhoea	110	38.5	69.2
Ring worm	1	0.3	0.6
Cholera	108	37.8	67.9
Typhoid	59	20.6	37.1
Don't know	8	2.8	5.0
<b>Total</b>	<b>286</b>	<b>100.0</b>	<b>140.9</b>
<b>Importance of handwash</b>			
Prevent disease	120	58.3	75.5
Smell nice	3	1.5	1.9
Cleanliness	29	14.1	18.2
Kill germs	52	25.2	32.7
Don't know	2	1.0	1.3
<b>Total</b>	<b>206</b>	<b>100.0</b>	<b>129.6</b>

#### 4.2.4 Prevention of diarrhoea disease

Table 4.4 shows results on knowledge of prevention of diarrhoea disease and symptoms of worm infestation in children. Diarrhoea disease is a major indicator of poor wash condition. Majority (31.7%) of the caregivers reported that washing hands before eating would prevent diarrhoea disease. Only 2.9% of the respondents did not know of any diarrhoea prevention method. One of the caregivers reported in the FGD

that:

*“...Diarrhoea disease can only be prevented if we wash our hands after visiting the toilet, other activities like covering food and keeping the environment clean cannot prevent diarrhoea from occurring...”* (Caregiver, 2018).

#### **4.2.5 Symptoms of worm infestation in children**

Most of the worm infestations in children are due to infections caused by poor WASH conditions in the environment they live in. Most (26.2%) of the caregivers reported scratching and itchy skin as the major symptom, this was followed by lack of appetite with 11.6% of the respondents and diarrhoea disease being reported by 10.2%. persistent hunger, worms in stool, stomach pains and swollen stomachs had responses of 9.9%, 9.2%, 8.8% and 8.2% respectively. Some symptoms like body weakness, weight loss and brownish hair were reported by very few respondents with percentage scores of 5.1%, 3.4% and 2.7% respectively. 4.8% of the caregivers did not know of any symptoms of worm infestation in children.

*“...most of the mothers/caregivers will report of worm infestation if their children experience diarrhoea symptoms and stop feeding because of lack of appetite...”* (CHV, 2018).

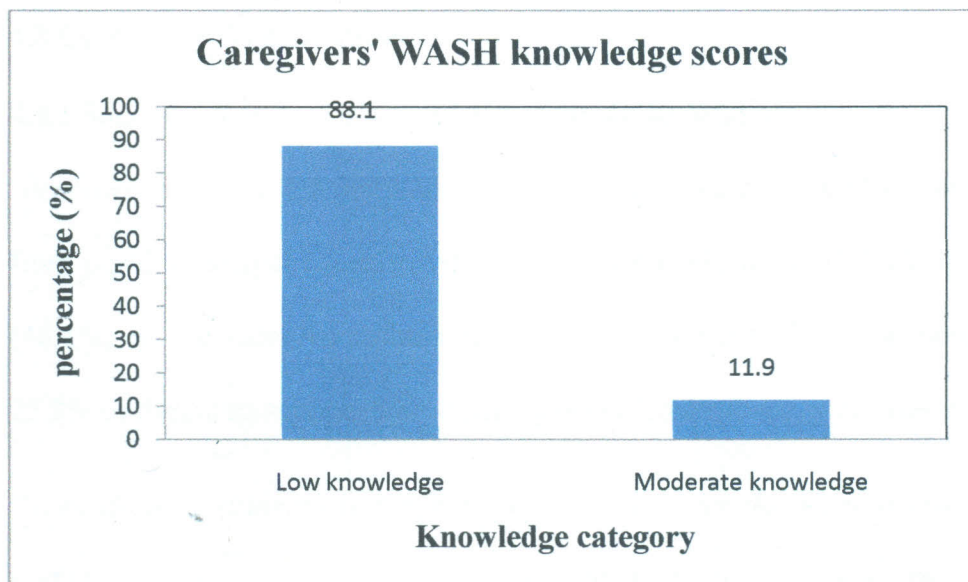
*Table 4. 4 Caregivers' knowledge on Diarrhoea prevention methods and symptoms of worm infestation*

Characteristic	N= Varied with the answers given		
	n(multiple responses)	%	%of cases(multiple responses)
<b>Diarrhoea prevention</b>			
Washing hands before eating	110	31.7	69.2
Eating clean food/fruits	53	15.3	33.3
Drinking safe clean water	49	14.1	30.8
Boiling drinking water	43	12.4	27.0
Using latrines	5	1.4	3.1
Covering food	1	0.3	0.6
Keeping nails short	9	2.6	5.7
Washing hands after toilet	54	15.6	34.0
Clean environment	13	3.7	8.2
Don't know	10	2.9	6.3
<b>Total</b>	<b>347</b>	<b>100.0</b>	<b>218.2</b>
<b>Symptoms of worm infestation</b>			
Swollen stomach	24	8.2	15.1
Body weakness	15	5.1	9.4
Diarrhoea	30	10.2	18.9
Stomach pain	26	8.8	16.4
Scratching/itchy skin	77	26.2	48.4
Lack of appetite	34	11.6	21.4
Persistent hunger	29	9.9	18.2
Weight loss	10	3.4	6.3
Brownish hair	8	2.7	5.0
Worms in stool	27	9.2	17.0
Don't know	14	4.8	8.8
<b>Total</b>	<b>294</b>	<b>100.0</b>	<b>184.9</b>

#### 4.2.6 Caregivers' WASH knowledge level

As shown in figure 4.4, the mean score of WASH knowledge among all the respondents (N=159) was  $28.86 \pm 9.410$ . The score category was grouped into: less than 50% was low knowledge, between 50% and 75% was moderate knowledge and

75% and above was high knowledge. This showed that knowledge on WASH among the respondents in the study area was very poor where 88% of the caregivers having low knowledge level. None of the respondents had high knowledge on WASH.



**Figure 4. 4 Caregivers' WASH Knowledge level**

The poor knowledge outcome was also evident as reported by the FGD and KII discussants:

*"... We have not received a formal training on the WASH knowledge so we are only keen with the basic hygiene practices that are taught in health education forums which are not comprehensive like while awaiting to see a doctor in the hospital..."* (CHV, 2018).

*"...Caregivers in this region might not be very well knowledgeable in hygiene and sanitation facts since we have not yet managed to have a comprehensive approach in raising awareness, especially at the household level. In addition not all will be willing to visit health facilities to seek treatment for ailments like diarrhoea due to lack of money..."* (CHEW, 2018).

“...my children drink boiled water only when they have diarrhoea disease, otherwise we don't waste the cooking energy on boiling treating water since we don't see any negative effects with water that is not boiled...”(Caregiver, 2018).

### 4.3 Caregivers' WASH Practices

#### 4.3.1 Source, Storage and Treatment of Drinking Water

As shown in Figure 4.5, only 23.9% of the caregivers collected their drinking water from piped municipal councils, which is an improved source of drinking water. Most (46.5%) of the caregivers obtained their drinking water from the borehole, while 25.8% of the caregivers get their drinking water from private water vendors.

“...we do fetch drinking water from the borehole since the water is always available and cheap unlike the piped water which is only found in a few plots and expensive...” (Caregiver, 2018).

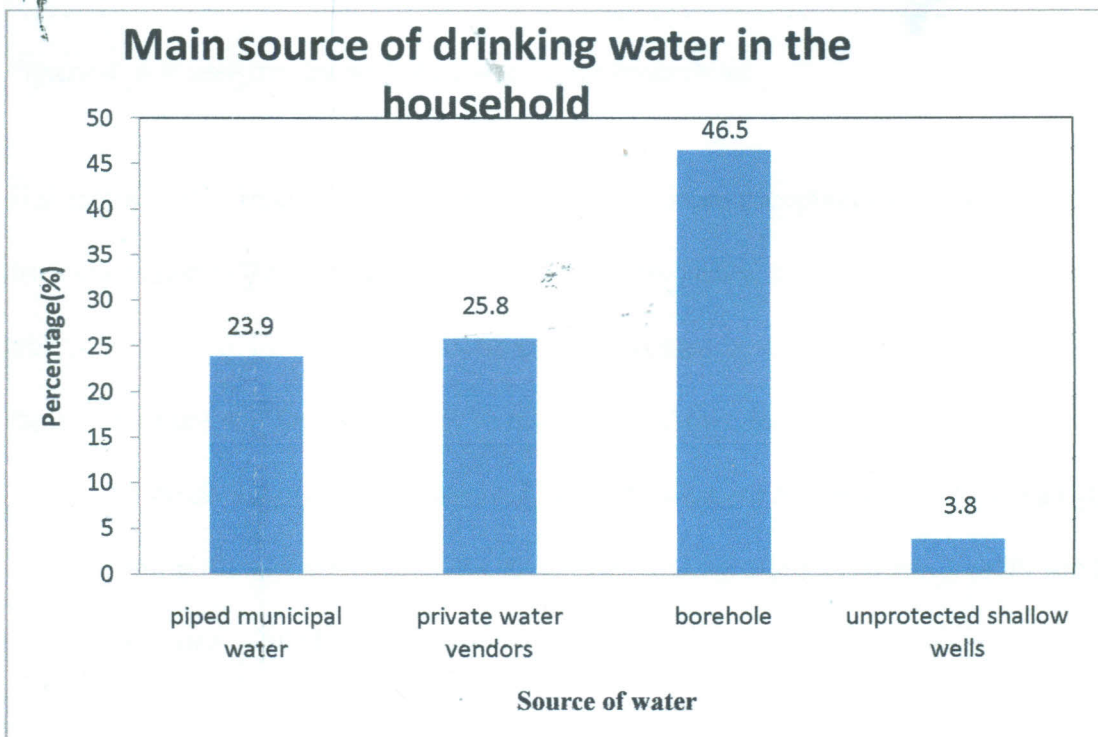
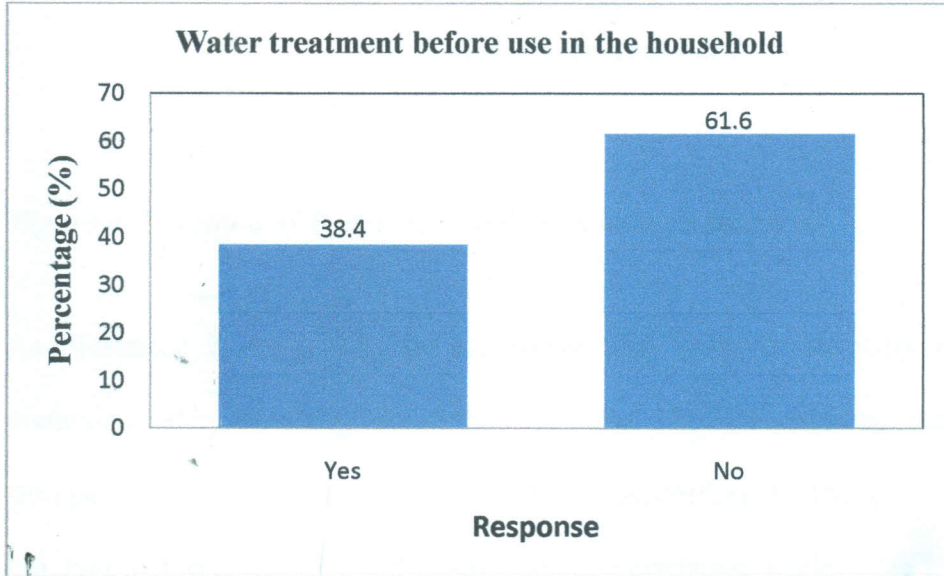


Figure 4. 5 Main source of drinking water in the household

As illustrated in Figure 4.6, it was noted that 61.6% of the caregivers did not treat drinking water in their households before use and only 38.4% of the caregivers treated their drinking water before using in the household.

*“...we only boil water when a child is having diarrhoea...”*

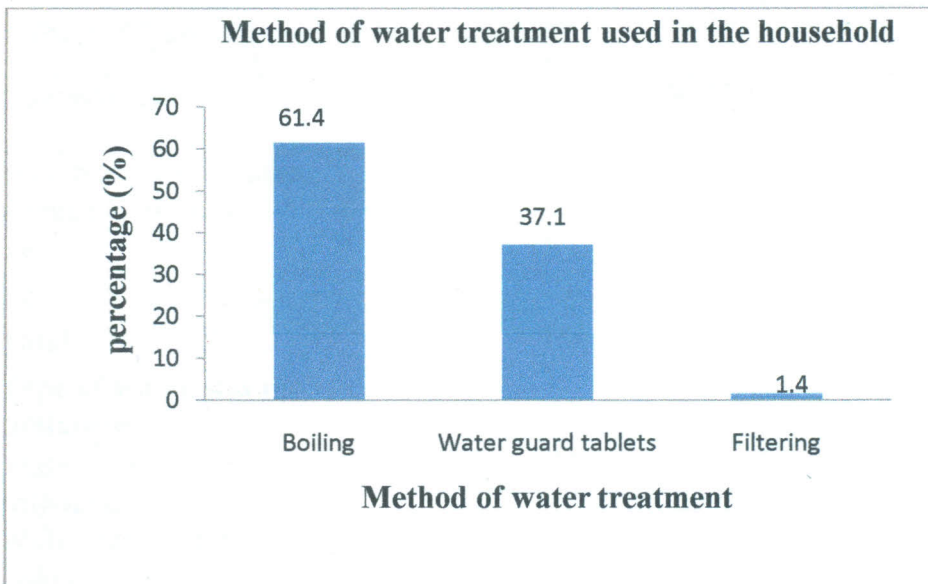
(Caregiver, 2018).



**Figure 4. 6 Water treatment before use in the household**

The major water treatment methods reported by those caregivers who treated their drinking water were boiling with 61.4% of them using this method. Water guard tablets were used by 37.1% while filtering was used by 1.4% of the caregivers as shown in Figure 4.7. One of the CHVs also reported this during the FGD:

*“...we do supply water guard tablets to households but most caregivers prefer boiling the water claiming the tablets are adding unpleasant smell and taste to the water...”*(CHV, 2018).



**Figure 4. 7 Method of Water treatment used in the household**

As illustrated in table 4.5, the researcher also observed drinking water storage methods used by the caregivers in the household. This is because the method of water storage can lead to contamination of water. According to the study results, most (94.3%) of the caregivers had a water storage container while 5.7% did not have a water storage container. Among those who had a water storage container only 46.3% of the containers were narrow necked with a cover. Others, 25% had a wide open mouth with a cover, 15.3% had a wide open mouth and without a cover and 13.4% had a narrow neck without a cover. It was noted that most (97.3%) of the water storage containers were made of plastic material while only 2.7% were made of metal. This was reinstated during the FGD:

*“...we use plastic containers to fetch and store drinking water since they are the most readily available...” (Caregiver, 2018).*

In terms of sanitary condition of the water storage container, 85.3% of the containers were clean while 14.7% of the containers were dirty.

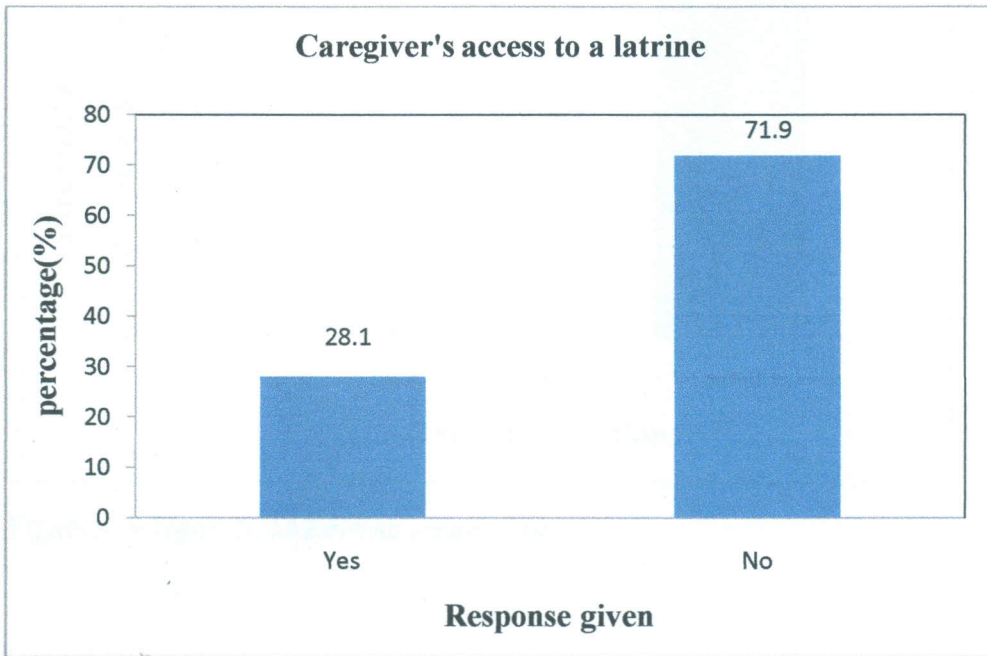
*Table 4. 5 Water Storage in the Household*

Characteristic	N=159	
	n	%
<b>Presence of water storage container</b>		
Yes	150	94.3
No	9	5.7
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Type of water storage container</b>		
Wide open mouth without cover	23	15.3
Wide open mouth with Cover	36	25
Narrow neck without cover	20	13.4
Narrow neck with cover	71	46.3
<b>Total</b>	<b>150</b>	<b>100.0</b>
<b>Material used to make the container</b>		
Metal	4	2.7
Plastic	146	97.3
Clay	0	0
<b>Total</b>	<b>150</b>	<b>100.0</b>
<b>Sanitary state of the container</b>		
Good	128	85.3
Bad	22	14.7
<b>Total</b>	<b>150</b>	<b>100.0</b>

#### 4.3.2 Household Sanitation

With regard to household sanitation practices, the researcher was interested in assessing if the caregivers had access to latrine facilities, the type, child excreta disposal and solid waste disposal methods.

As shown in figure 4.8, a higher number of the caregivers (71.9%) did not have access to a latrine with only 28.1% lacking access to a latrine.



**Figure 4. 8 Caregivers' access to a latrine**

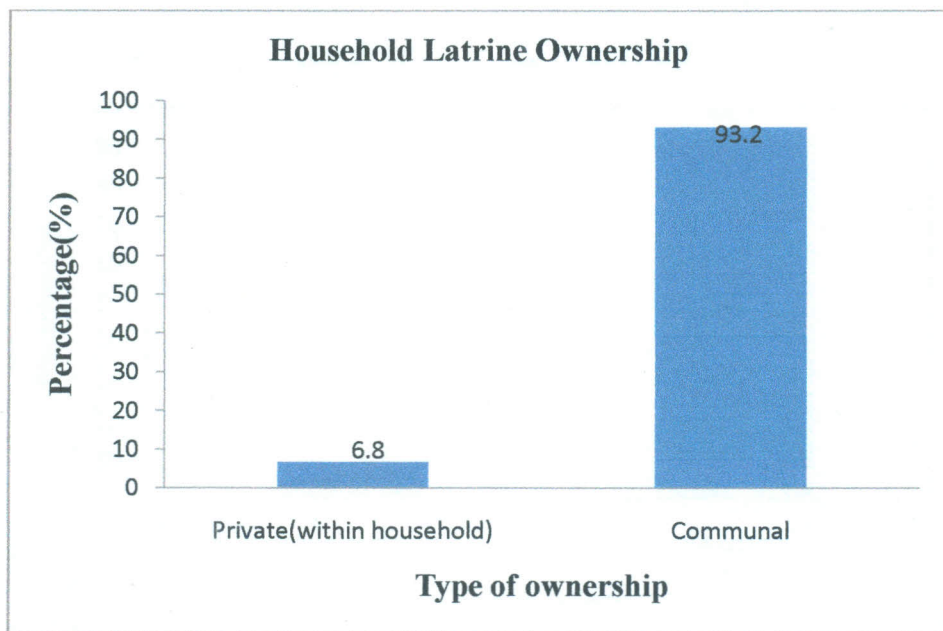
The following was reported by the CHEW during the KII:

*"...most of the residents here do not have access to a latrine that is why as you walk around you will see feces on the ground and smelly corners. This is because most of the households are temporary especially in the innermost parts of the slum..."* (CHEW, 2018).

As shown in figure 4.9, most (93.2%) were communally owned and 6.8% were privately owned within the household. This was also mentioned by the CHV in the

FGD:

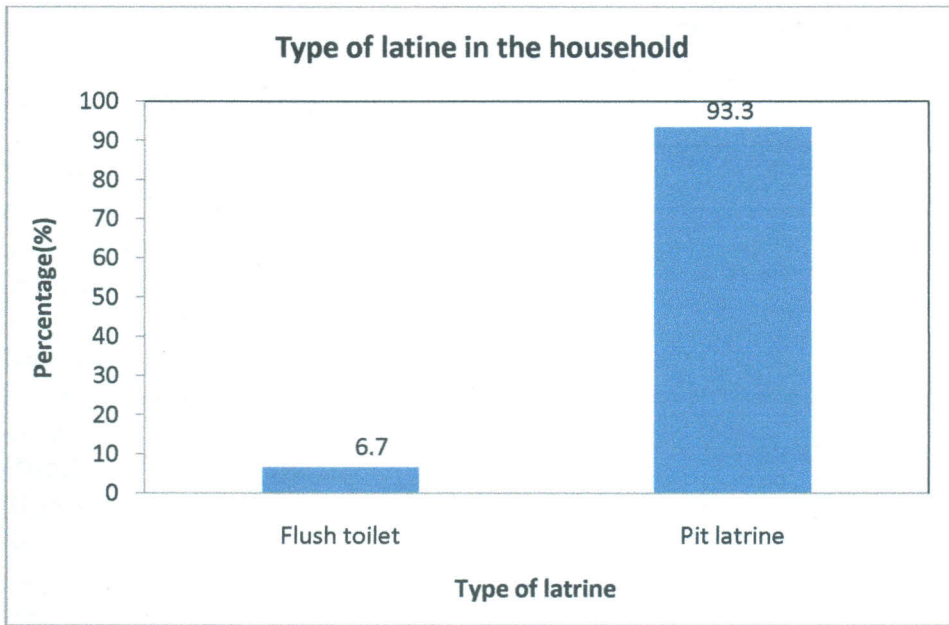
*"...latrines are built at the entrance of a plot so that all households can share as part of minimizing the space for household units construction..."* (CHV, 2018).



**Figure 4.9 Household Latrine ownership**

In addition to the ownership, the researcher noted that the highest percentage of this latrines were not improved. The available latrine types as shown in figure 4.10 were: Pit latrines with 93.3% of the caregivers using such type and a flush toilet which was owned by 6.7% of the caregivers. The use of unimproved latrine was expected since the living standards are low being an informal settlement and they are easier to construct especially for communal sharing. One of the CHVs in the FGD reported:

*“...It is cheaper to construct a simple pit latrine as opposed to a Ventilation Improved Pit (VIP) latrine so most landlords opt for that option...”* (CHV, 2018).



**Figure 4. 10 Household's Type of latrine**

The table 4.6 shows the child excreta and solid waste disposal methods. Most of the children (69.8%) relieve themselves on the ground with only 3.8% of the children relieved themselves in the latrine. Most of the caregivers dispose their child's excreta especially the diapers in the refuse pit and open ground respectively each with a response rate of 35.2%, 18.2% of the caregivers dispose the child's excreta into the latrine especially excreta in water for the washed linen. Some caregivers (11.3%) dispose the child's excreta in the bushes around their households. With regard to solid waste disposal, only 10.1% of the caregivers disposed their solid waste in covered dustbins. A caregiver mentioned that:

*"...Diapers are very expensive for us, we use napkins for the first year then when the children walk we don't use anything to cover them so they just defecate on the ground. When we clean the napkins, despite the water having the feces, we disposal the dirty water in the open on the grass..."* (Caregiver, 2018).

*Table 4. 6 Child's excreta and solid waste disposal methods*

Characteristic	N=159	
	n	%
<b>Where does your child relieve him/herself</b>		
In the diaper	18	11.3
In the napkin	24	15.1
On the ground	111	69.8
In the latrine	6	3.8
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Child's excreta disposal</b>		
Refuse pit	56	35.2
Latrine	29	18.2
Bushes	18	11.3
Open ground	56	35.2
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Solid waste disposal in the house</b>		
Uncovered dustbin	56	35.2
Covered dustbin	16	10.1
Communal dustbin	45	28.3
Open ground	42	26.4
<b>Total</b>	<b>159</b>	<b>100.0</b>

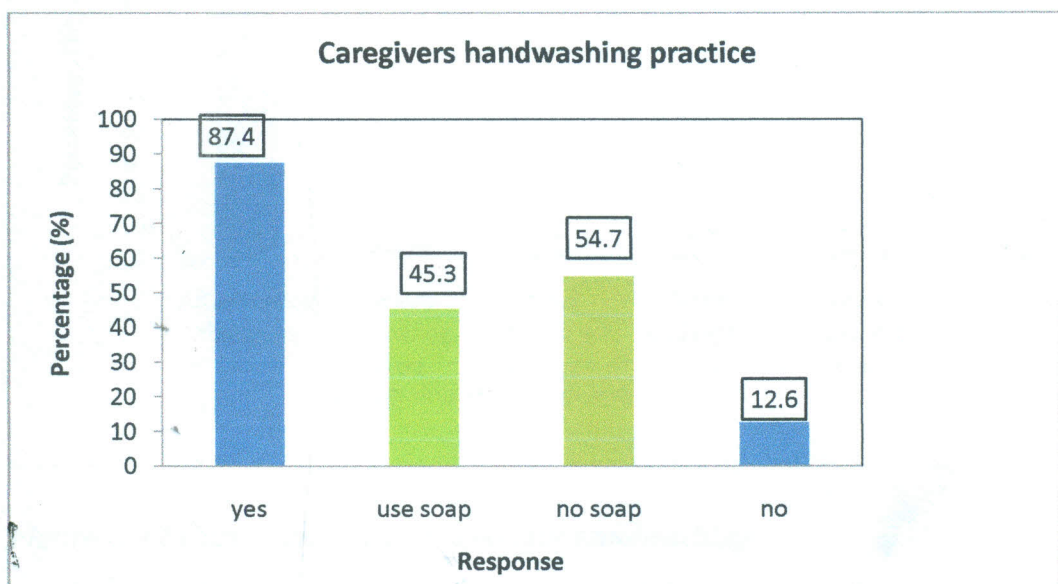
#### 4.3.3. Handwashing Practice among the Caregivers

Handwashing practice is one of the major interventions towards prevention of WASH morbidity. As shown in figure 4.11, the study revealed that only 12.6% of the caregivers did not practice handwash their hands. Most (87.4%) of the caregivers practiced handwash with slightly above half (54.7%) of them washing their hands without soap. In support of this it was key to note that only 8.2% of the caregivers' households had a functional handwashing sink while 91.8% of the caregivers' households did not have a functional handwashing sink. Out of the 8.2% households with a functional handwashing sink, slightly above half (53.8%) of the sinks had soap while 46.2% of the sinks did not have a soap. This was also evident during the FGDs with the caregivers:

“... we rarely use soap to wash our hands, we just use water on a basin and the hands are clean. Plus it is time consuming washing hands with soap...”

(Caregiver, 2018).

“...I rarely wash my hands, we don't have a nearby source of water hence we minimize on usage of the little stock we have...” (Caregiver, 2018).

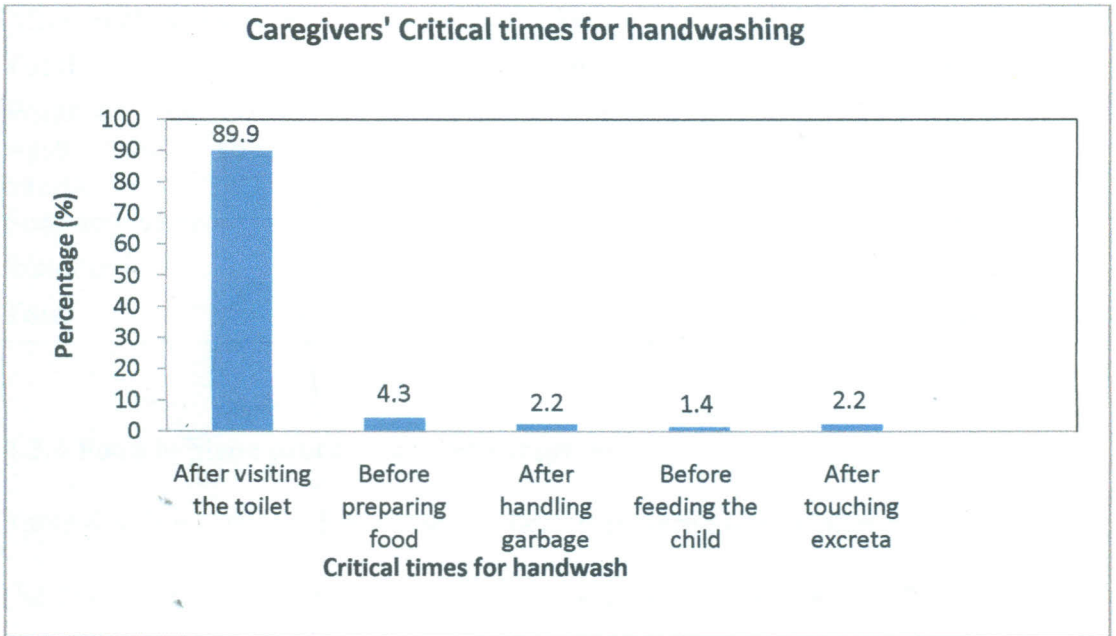


**Figure 4. 11 Caregivers handwashing practice**

As illustrated in figure 4.12, among those caregivers who reported practicing hand wash, a larger group (89.9%) washed their hands after visiting the toilet. Other critical times that were reported were before preparing food, after handling garbage, after touching baby's excreta and before feeding the baby which had percentage respondents of 4.3%, 2.2%, 2.2% and 1.4% respectively. The CHEW and one of the CHVs reported that:

“...most of the caregivers will report of obtaining germs from the toilet, so they tend to wash their hands after using the toilet...” (CHEW, 2018).

“...we advise all households to have leaky tins for washing hands near the latrine, the practice has not been fully embraced but most of them will have a basin outside the house with water where they wash their hands after visiting the toilet...”(CHV, 2018).



**Figure 4. 12 Caregivers' Critical times for handwashing**

As illustrated in table 4.7, the study results also revealed that 47.8% of the caregivers wash their child's hands after visiting the toilet while 40.3% of the caregivers wash their child's hand before feeding. Only 11.9% of the caregivers washed their child's hands after touching excreta. This was also reported in the FGD as follows:

“...I only wipe my child's hands if they are visibly dirty especially when he is feeding himself...” (Caregiver, 2018).

Highest number of caregivers (59.7%) reported using water only to wash their hands only while 40.3% of the caregivers reported using soap and water to wash their child's hands.

**Table 4. 7 Child's Handwash practice**

Characteristic	N=159	
	n	%
<b>When do you wash your child's hands</b>		
After visiting toilet	76	47.8
Before feeding	64	40.3
After touching excreta	19	11.9
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>What do you use to wash the child's hands</b>		
Soap and water	64	40.3
Water only	95	59.7
<b>Total</b>	<b>159</b>	<b>100.0</b>

#### 4.3.4 Food hygiene practice among caregivers

Table 4.8 shows the food hygiene practices that were assessed during the study. Most (52.2%) of the caregivers prepared their food on the floor with only 47.8% of the caregivers preparing the food on the table. The study revealed that almost half (50.9%) of the caregivers reheated food before giving their children while 49.1% of the caregivers did not reheat food before giving their children. Although majority of the caregivers reported reheating food, one of the caregivers said the following in the FGD:

*"...reheating food is costly and we want to minimize the cost of buying paraffin so often, hence I don't reheat food after storage..."* (Caregiver, 2018).

The study also showed that 52.2% of the caregivers stored their food covered in a container at room temperature while 47.8% of the caregivers stored their food in an uncovered container at room temperature. Nearly all (91.8%) of the caregivers

separated raw and cooked food and slightly above half (50.3%) of the caregivers did not clean their fruits and vegetables before consuming.

**Table 4. 8 Food hygiene practices in the household**

Characteristic	N=159	
	n	%
<b>Place of food preparation</b>		
On the table	76	47.8
On the floor	83	52.2
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Reheating of food before giving the child</b>		
Yes	81	50.9
No	78	49.1
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Storage of food</b>		
In an uncovered container at room temperature	76	47.8
In a covered container at room temperature	83	52.2
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Separation of raw and cooked food</b>		
Yes	146	91.8
No	13	8.2
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Cleaning of fruits and vegetables before consuming</b>		
Yes	79	49.7
No	80	50.3
<b>Total</b>	<b>159</b>	<b>100.0</b>

#### 4.3.5 Environmental Hygiene Observation around the household

As shown in Table 4.9, nearly all (92.5%) households had a foul smell around them due to open drains which were observed in 56.6% of all households visited by the research assistants. Presence of flies was also observed in 63.5% of all the households that were visited. Key to note also, feaces were observed around the household in 78% of all households that were visited and only 22% of the households did not have feaces on the grounds. In addition, 86.2% of the households had open uncontrolled

dumping around or near their households with only 13.8% of the households having a controlled dumping site. The following was reported during one of the KII:

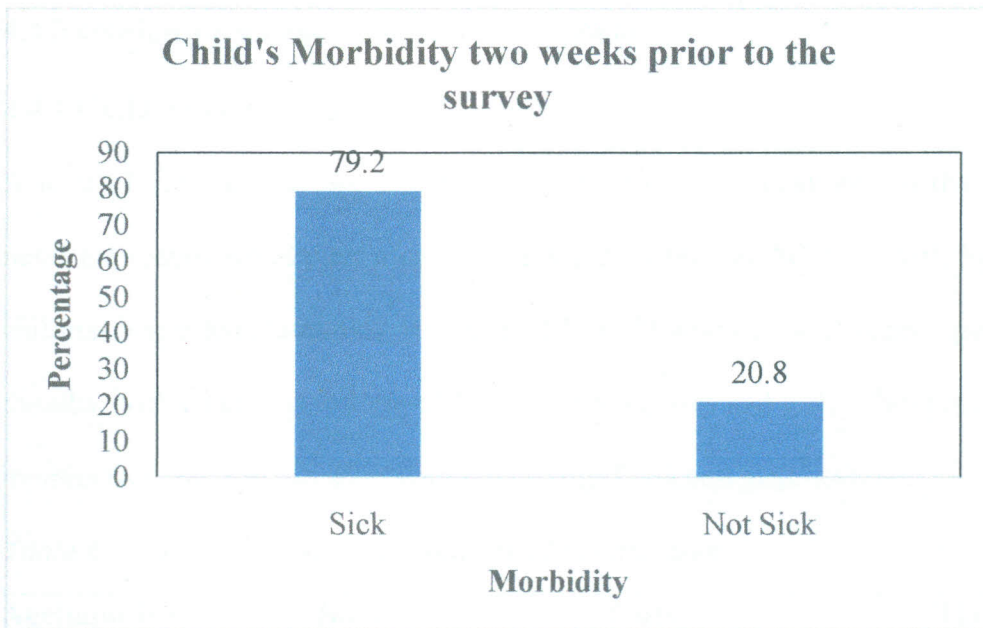
*“...The environment in Kiandutu is a mess. People throw household waste anywhere, children defecate on the ground and the area does not have a sewer line. This results in bad smell and a lot of flies in areas where open dumping is being practiced. Since children play on the same grounds then they experience a lot of diarrhoea...”* (CHEW, 2018).

**Table 4. 9 Environmental Hygiene around the household**

Characteristic	N=159	
	n	%
<b>Smell</b>		
Yes	147	92.5
No	12	7.5
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Flies</b>		
Yes	101	63.5
No	58	36.5
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Feaces around the house</b>		
Yes	35	22.0
No	124	78.0
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Uncontrolled open dump site</b>		
Yes	137	86.2
No	22	13.8
<b>Total</b>	<b>159</b>	<b>100.0</b>
<b>Blocked drain</b>		
Yes	69	43.4
No	90	56.6
<b>Total</b>	<b>159</b>	<b>100.0</b>

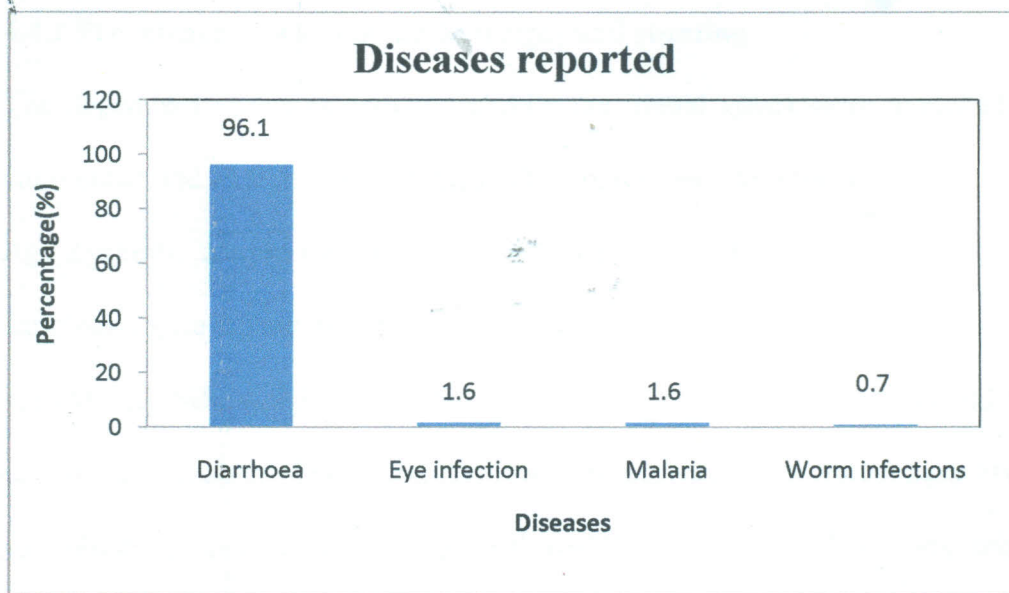
#### 4.3.6 Child Morbidity

Child morbidity was paramount to assess among the children since poor WASH conditions can cause various diseases. Environmental enteropathy is one of the main pathway to poor nutritional status among children. As shown in figure 4.13, the study results indicated that 79.2% of the children were sick two weeks prior to the survey.



*Figure 4. 13 Child's morbidity within the last 2 weeks*

Out of the various diseases reported by the caregivers, diarrhoea disease had the most number of responses scoring 96.1%, eye infection and malaria had 1.6% responses while worm infection had 0.7% responses. This is as illustrated in figure 4.14.



*Figure 4. 14 Diseases reported among the children*

#### 4.4 Nutrition status among children 6-59 months

##### 4.4.1 Child's age and sex

A total of 159 children were included in the study. As illustrated in the table 4.10, male and female sexes were almost equally represented in the study with 50.9% of the children being female and 49.1% male. Most (21.4%) of the children aged 12 to 17 months, with equal distribution of 10.7% for both boys and girls. Those aged 48 to 59 months were the least (8.2%), with boys being 3.8% and girls 4.4%.

*Table 4. 10 Distribution of age and sex of the children*

Age(months) versus Sex	Boys		Girls		Total	
	n	%	n	%	n	%
6-8	13	8.2	7	4.4	20	12.6
9-11	13	8.2	15	9.4	28	17.6
12-17	17	10.7	17	10.7	34	21.4
18-23	16	10.1	11	6.9	27	17.0
24-35	6	3.8	12	7.5	18	11.3
36-47	7	4.4	12	7.5	19	11.9
48-59	6	3.8	7	4.4	13	8.2
<b>Total</b>	<b>78</b>	<b>49.1</b>	<b>81</b>	<b>50.9</b>	<b>159</b>	<b>100.0</b>

##### 4.4.2 Prevalence of wasting, underweight and stunting

The dependent variables showing child's nutritional status were modelled both as continuous and categorical variables. The continuous variables included Height-for-Age Z scores, Weight-for-Height Z scores and Weight-for-Age Z scores. Categorical variables capturing stunting (height-for-age Z scores), wasting (Weight-for-Height Z scores) and underweight (Weight-for-Age Z scores) levels were generated from the continuous variables. The categories representing nutritional status were overweight and obese ( $\geq +2SD$  Z scores), normal ( $> -2SD$  to  $< +2SD$  Z scores), moderately malnourished ( $\leq -2SD$  to  $> -3SD$  Z scores), and severely malnourished ( $< -3SD$  Z scores). Global Acute Malnutrition (GAM) ( $< -2SD$  Z scores) corresponded to moderately malnourished and severely malnourished cases in each of the three indices

(Height-for-Age Z scores, Weight-for-Height Z scores and Weight-for-Age Z scores).

The confidence intervals of the results presented below were wide due to the relatively small sample size within the age categories.

#### 4.4.2.1 Prevalence of Global Acute Malnutrition (Weight for Height Z scores)

The total percentage of children aged 6-59 months old category who were wasted was 8.8% (CI 5.3-14.2) with 9.0% (CI 4.4-17.4) being male and 8.6% (CI 4.2-16.8) being girls. Majority (91.2%) of the children aged 6-59 months old were normal. Prevalence of moderate and severe malnutrition among children aged 6-59 months old was 5.0% (CI 2.6-9.6) and 3.8% (CI 1.7-8.0) respectively. The distribution of wasting in different age-groups and sex was as illustrated in Table 4.11. Majority (2.5%) of children who were moderately wasted were aged 24 to 35 months, while those who were severely wasted aged 6 to 8 months.

*Table 4. 11 Prevalence of Wasting (Weight for Height Z scores)*

Child's characteristic	Percentage below -3SD	Weight for Height Z scores		Total
		Percentage between -2SD and -3SD	Percentage between -2SD and 2SD	
<b>Age in months</b>				
6-8	1.3	0.0	11.3	12.6
9-11	0.6	1.9	15.1	17.6
12-17	0.0	0.6	20.8	21.4
18-23	0.0	0.0	17.0	17.0
24-35	0.6	2.5	8.2	11.3
36-47	0.6	0.0	11.3	11.9
48-59	0.6	0.0	7.5	8.2
<b>Sex</b>				
Male	3.8	7.7	44.7	49.1
Female	0.0	6.2	46.5	50.9
<b>Total</b>	<b>3.8</b>	<b>5.0</b>	<b>91.2</b>	<b>100.0</b>

Based on the MUAC cut-off measurements, which is a more accurate tool of estimating wasting in children. The results did not vary with the results estimated by the Weight for Height Z scores as shown in Table 4.12.

**Table 4. 12 Prevalence of acute malnutrition based on MUAC cut off's (and/or oedema) and by sex**

	All n = 159	Boys n = 78	Girls n = 81
<b>Prevalence of global acute malnutrition</b> ( $\leq 125$ mm and/or oedema)	(14) 8.8 % (5.3 - 14.2 95% C.I.)	(9) 11.5 % (6.2 - 20.5 95% C.I.)	(5) 6.2 % (2.7 - 13.6 95% C.I.)
<b>Prevalence of moderate malnutrition</b> ( $\leq 125$ mm and $\geq 115$ mm, no oedema)	(11) 6.9 % (3.9 - 12.0 95% C.I.)	(6) 7.7 % (3.6 - 15.8 95% C.I.)	(5) 6.2 % (2.7 - 13.6 95% C.I.)
<b>Prevalence of severe malnutrition</b> ( $< 115$ mm and/or oedema)	(3) 1.9 % (0.6 - 5.4 95% C.I.)	(3) 3.8 % (1.3 - 10.7 95% C.I.)	(0) 0.0 % (0.0 - 4.5 95% C.I.)

#### 4.4.2.2 Prevalence of Stunting (Height for Age Z scores)

Prevalence of stunting in children 6-59 months was 33.3% (CI 26.5- 41.0) with 35.9% (CI 26.1- 47.0) being male and 30.9% (CI 21.9- 41.6) being female. The prevalence of those stunted and severely stunted was 20.8% (CI 15.2- 27.7) and 12.6% (CI 8.3- 18.6). The study revealed that slightly above half (66.7%) of the children were normal. Severe stunting was highly (4.4%) experienced in the age-set of 36 to 47 months while moderate stunting was highest (4.4%) in the age-set 18 to 23 months, as illustrated in Table 4.13.

*Table 4. 13 Prevalence of Stunting (Height for Age Z scores)*

Child's characteristic	Height for Age Z scores			Total
	Percentage below -3SD	Percentage between-2SD and -3SD	Percentage between -2SD and 2SD	
<b>Age in months</b>				
6-8	0.0	2.5	10.1	12.6
9-11	0.0	1.3	16.4	17.6
12-17	1.9	3.8	15.7	21.4
18-23	0.6	4.4	11.9	17.0
24-35	2.5	3.1	5.7	11.3
36-47	4.4	1.9	5.7	11.9
48-59	3.1	3.8	1.3	8.2
<b>Sex</b>				
Male	4.4	13.3	31.4	49.1
Female	8.2	7.5	35.3	50.9
<b>Total</b>	<b>12.6</b>	<b>20.8</b>	<b>66.7</b>	<b>100.0</b>

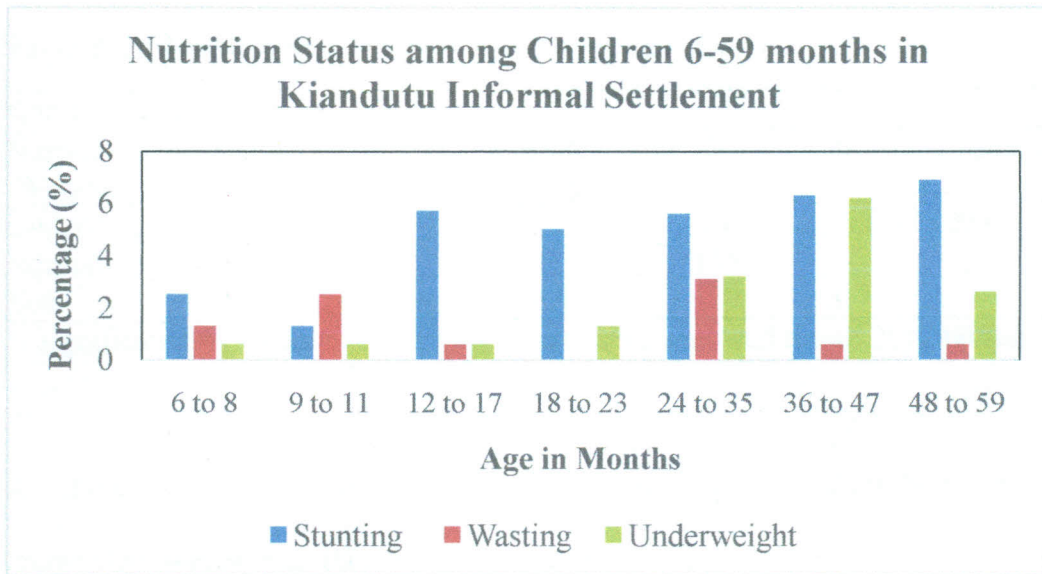
**4.4.2.3 Prevalence of underweight (Weight for Age Z scores)**

The study revealed that the prevalence of underweight among study subjects was 15.1% (CI 10.4- 21.5) with 15.4% (CI 9.0- 25.0) being male and 14.8% (CI 8.7-24.1) being female. Majority (84.9%) of the children 6-59 months were normal. The prevalence of moderate underweight and severe underweight was 8.2% (CI 4.8- 13.5) and 6.9% (CI 3.9-12.0) respectively. Severe and moderate underweight were high between 36 and 47 months with 3.1% each. This is illustrated in Figure 4.14.

*Table 4. 14 Prevalence of Underweight (Weight for Age Z scores)*

Child's characteristic	Weight for Age			Total
	Percentage below -3SD	Percentage between-2SD and -3SD	Percentage between -2SD and 2SD	
<b>Age in months</b>				
6-8	0.0	0.6	11.9	12.6
9-11	0.6	0.0	17.0	17.6
12-17	0.0	0.6	20.8	21.4
18-23	0.0	1.3	15.7	17.0
24-35	1.9	1.3	8.2	11.3
36-47	3.1	3.1	5.7	11.9
48-59	1.3	1.3	5.7	8.2
<b>Sex</b>				
Male	3.8	3.8	41.5	49.1
Female	3.1	4.4	43.4	50.9
<b>Total</b>	<b>6.9</b>	<b>8.2</b>	<b>84.9</b>	<b>100.0</b>

Figure 4.15 illustrates the prevalence of Global Acute Malnutrition, Stunting and Underweight as revealed by the study with respect to the various age groups.



**Figure 4. 13 Nutrition status among children 6-59 months in Kibandutu Informal Settlement**

#### **4.5 The association between caregivers' hygiene and sanitation knowledge, practices and nutrition status of children 6-59 months**

The nutrition status that was cross-tabulated with the knowledge score was weight for age (WAZ) which shows undernutrition and is a representative of both stunting and wasting.

##### **4.5.1 Caregivers' Hygiene and Sanitation knowledge versus children's nutrition status**

The study found that there was moderate and low knowledge category on hygiene and sanitation among the caregivers which were cross-tabulated with the three variables of nutritional status. The results were as follows:

There was a significant association between WASH knowledge score and the children's nutrition status (weight for age) ( $P=0.036$ ;  $df=1$ ). This meant that those

who had low knowledge on WASH were likely to have underweight children. The results are shown in Table 4.15

**Table 4. 15 Underweight versus WASH knowledge scores**

Knowledge score percent					
Nutritional status (Weight for Age)	low knowledge	moderate knowledge	N	Chi-square value	
Underweight	24	0	24	P=0.036*; df=1	
Normal	116	19	135		
Total	140	19	159		

\*: significant ( $P < 0.05$ ); Fisher's Exact Test value was used for all 2by2 tables

As shown in Table 4.16, there was no significant association between WASH knowledge scores and the children's nutritional status (height for age) ( $P = 0.34$ ;  $df=1$ ). This meant that caregivers' knowledge on WASH was not associated with stunting in children.

**Table 4. 166 Stunting versus WASH knowledge scores**

Knowledge score percent					
Nutritional status (Height for Age)	low knowledge	moderate knowledge	N	Chi-square value	
Stunted	48	5	53	P=0.34; df=1	
Normal	92	14	106		
Total	140	19	159		

\*: significant ( $P < 0.05$ ); Fisher's Exact Test value was used for all 2by2 tables

As illustrated in Table 4.17, there was no significant association between WASH knowledge scores and the children's nutritional status (weight for height) ( $P = 0.48$ ;  $df=1$ ). This meant that caregivers' knowledge on WASH was not associated with wasting in children.

**Table 4. 177 Wasting versus WASH knowledge scores**

Knowledge score percent					
Nutritional status (Weight for Height)	low knowledge	moderate knowledge	N	Chi-square value	
Wasted	13	1	14	P=0.48; df=1	
Normal	127	18	145		
Total	140	19	159		

\*: significant ( $P < 0.05$ ); Fisher's Exact Test value was used for all 2by2 tables

In addition, the caregivers' household income level had a significant association with the hygiene and sanitation knowledge score ( $\chi^2=13.792$ ;  $P=0.003$ ;  $df=3$ ). This meant that those who earned less than Ksh. 1000 had low knowledge on hygiene and sanitation. There was no significant association between the caregivers age with their hygiene and knowledge score ( $\chi^2=4.041$ ;  $P=0.400$ ;  $df=4$ ). However, the households income level is the only socio-demographic characteristic that had a significant association with the child's nutritional status ( $\chi^2=10.465$ ;  $P=0.005$ ;  $df=2$ ). The level of knowledge among the caregivers had a significant association with the occurrence of diarrhoea in children ( $P=0.030$ ,  $df=1$ ).

#### **4.5.2 Caregivers' Hygiene and Sanitation practice versus children's nutrition status**

Table 4.18 shows the Chi-square results for the cross-tabulation of caregivers' WASH practices with the children's nutrition status (weight for age). The source of drinking water for the household had a significant association with the child's nutrition status ( $\chi^2=24.033$ ;  $P=0.026$ ;  $df=2$ ). This meant that most of the caregivers who did not get drinking water from an improved source that is the piped water had children were malnourished. Access to a latrine by the caregiver did not have a significant association with the child's nutritional status ( $P=0.517$ ;  $df=1$ ). It is important to note that handwashing practice among the caregivers had a strong significant association

with the child's nutrition status ( $P < 0.001$ ;  $df=1$ ). This meant that most of the caregivers who did not practice handwash had children who had undernutrition. Majority of the caregivers used water only to wash hands without any bactericidal. Just as the level of income had an association with the knowledge on WASH among the caregivers, it also had a significant association with the child's nutrition status ( $\chi^2=10.465$ ;  $p=0.005$ ;  $df=2$ ).

**Table 4. 188 Chi-Square results for Caregivers' WASH practice versus Nutritional Status (Underweight) in Children**

Nutrition status vs:	Underweight	Normal	Chi-square values
<b>Water treatment</b>			
Yes	6	41	P= 0.395; df=1
No	18	94	
<b>Source of drinking water</b>			
piped municipal water	9	43	$\chi^2 = 24.033$ , $df=2$ , P= 0.026*
private water vendors	6	30	
borehole/ unprotected shallow well	9	57	
<b>Access to a latrine</b>			
yes	7	37	P= 0.517; df=1,
no	17	98	
<b>Disposal of child's stool</b>			
in the napkin/diaper	6	36	$\chi^2 = 1.197$ , $df=2$ , P= 0.550
on the ground	18	95	
in the latrine	0	6	
<b>Caregiver handwashing practice</b>			
yes	11	128	P= <0.001*; df=1,
no	13	7	
<b>Child's handwashing practice</b>			
yes	5	38	P= 0.319, df=1,
no	19	97	
<b>Level of income in the household</b>			
< Ksh 1000	10	19	$\chi^2 = 10.465$ , $df=2$ , P= 0.005*
≤Ksh 1001-5000	9	70	
≤Ksh 5001-10000	5	46	

\*: significant ( $P < 0.05$ ); Fisher's Exact Test value was used for all 2by2 tables

As shown in Table 4.19, caregivers' handwashing practice had a significant association with the child's stunting ( $P=0.002$ ;  $df=1$ ). This meant that majority of those caregivers who did not wash hands had stunted children. All the other WASH practices as well as level of income did not have any significant association with the stunting in children.

*Table 4. 19 Chi-Square results for Caregivers' WASH practice versus Nutritional Status (Stunting) in Children*

<b>Nutrition status vs:</b>	<b>Stunted</b>	<b>Normal</b>	<b>Chi-square values</b>
<b>Water treatment</b>			
Yes	13	34	P= 0.213;df=1
No	40	72	
<b>Source of drinking water</b>			
piped municipal water	17	40	$\chi^2 = 2.049$ , $df=3$ , P= 0.562
private water vendors	13	23	
borehole/ unprotected shallow well	23	43	
<b>Access to a latrine</b>			
yes	14	30	P= 0.479;df=1,
no	39	76	
<b>Disposal of child's stool</b>			
in the napkin/diaper	17	25	$\chi^2 = 2.363$ , $df=2$ , P= 0.307
on the ground	33	78	
in the latrine	3	3	
<b>Caregiver handwashing practice</b>			
yes	40	7	P= 0.002*;df=1,
no	13	99	
<b>Child's handwashing practice</b>			
yes	17	26	P= 0.205;df=1,
no	36	80	
<b>Level of income in the household</b>			
<Ksh 1000	15	14	$\chi^2 = 6.034$ , $df=2$ , P= 0.049
≤Ksh 1001-5000	21	58	
≤Ksh 5001-10000	17	34	

\*: significant ( $P < 0.05$ ); Fisher's Exact Test value was used for all 2by2 tables

As shown in Table 4.20, caregivers' handwashing practice had a significant association with wasting in children ( $P=0.003$ ;  $df=1$ ). This meant that most of those caregivers who reported not washing their hands had wasted children. All the other WAS practices as well as the level of income did not have a significant association with wasting in children.

**Table 4. 20 Chi-Square results for Caregivers' WASH practice versus Nutritional Status (Wasting) in Children**

<b>Nutrition status vs:</b>	<b>Wasted</b>	<b>Normal</b>	<b>Chi-square values</b>
<b>Water treatment</b>			
Yes	5	42	$P= 0.400$ ; $df=1$
No	9	103	
<b>Source of drinking water</b>			
piped municipal water	8	49	$\chi^2 =3.582$ , $df=2$ , $P= 0.310$
private water vendors	3	33	
borehole/ unprotected shallow well	3	63	
<b>Access to a latrine</b>			
Yes	4	40	$P= 0.577$ , $df=1$ ,
No	10	105	
<b>Disposal of child's stool</b>			
in the napkin/diaper	4	38	$\chi^2 =0.612$ , $df=2$ , $P= 0.736$
on the ground	10	101	
in the latrine	0	6	
<b>Caregiver handwashing practice</b>			
Yes			$P= 0.003^*$ ; $df=1$ ,
No	8	131	
	6	14	
<b>Child's handwashing practice</b>			
Yes			$P= 0.214$ ; $df=1$ ,
No	2	41	
	12	104	
<b>Level of income in the household</b>			
< Ksh 1000			$\chi^2 =6.537$ , $df=2$ , $P= 0.038$
≤Ksh 1001-5000	6	23	
≤Ksh 5001-10000	4	75	
	4	47	

\*: significant ( $P < 0.05$ ); Fisher's Exact Test value was used for all 2by2 tables

Important to note is that despite diarrhoea morbidity not being significantly associated with the nutrition status among children: underweight ( $\chi^2=7.081$ ,  $P=0.069$ ;  $df=3$ ); stunting ( $P=0.433$ ;  $df=1$ ); wasting ( $P=0.581$ ;  $df=1$ ), more than quarter of those who were undernourished had experienced a diarrhoea episode prior to the survey.

## **CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

### **5.0 Introduction**

The aim of this study was to assess the caregivers' WASH hygiene and sanitation conditions associated with nutrition status of children aged 6-59 months in Kiandutu Informal Settlement. This chapter discusses the study findings in relation to the study objectives as well as how the results compared with other research findings.

### **5.1 Discussion**

#### **5.1.1 Caregivers' socio-demographic characteristics**

The study results showed that most of the caregivers were young which agrees with a study done in the same area (Chege et al., 2016). The study also showed that more than half of the caregivers, who majority were mothers of the children, were unemployed and this could explain the low level of household monthly income levels per household. This findings are in line with a study that reported more female caregivers as opposed to male caregivers arguing that most mothers in most resource-limited settings are either self-employed or stay at home mothers (Aliya et al., 2019). The household monthly income was significantly associated with undernutrition which is in agreement with a study in Kenya that revealed that 36% of children in the lower wealth quantile were undernourished (KNBS et al., 2015).

#### **5.1.2 Caregivers' WASH knowledge**

The study showed that the level of knowledge in WASH in the area was poor with none of the caregivers scoring high knowledge. This agrees with a study done in Kenya by UNICEF and the Ministry of Health in Kenya, which found out that most people in rural Kenya and in slums had poor status regarding hygiene (UNICEF,

2015). This would be attributed to the fact that the living standards of people here are low and people concentrate more on earning a living for the day so hygiene and sanitation is not a priority in their day to day life. This low knowledge score could also be attributed to the lack of formal trainings regarding the same which was reported in the FGDs.

Similar to a study conducted by Mekonnen et al. (2018), most of the caregivers could identify atleast one cause of diarrhoea as contaminated environment. Unlike the results of a study conducted by Winter et al. (2019), where the most of the caregivers reported knowledge of drinking clean safe water as the major preventive measure of diarrhoea, majority of the caregivers in this study reported of the knowledge of handwashing practice as the major preventive measure for diarrhoea disease. In addition, the study indicated a significant association between WASH knowledge levels and occurrence of diarrhoea in children, this is similar to a study that found that WASH knowledge levels among caregivers was an important protective in prevention of diarrhoea (George et al., 2014).

The study revealed that age of the caregiver did not have a significant association with the WASH knowledge level, dissimilar to the findings of a study done by Merali et al. (2018) that indicated older caregivers had good knowledge on WASH compared to the young ones. The study indicated that there was a significant association between the household income and the WASH knowledge levels, similar to the findings from Nepal that linked higher scores in WASH to greater wealth (Budhathoki et al., 2016). The study revealed that majority of the caregivers reported disease prevention as one of the importance of handwashing, this is similar to the findings of a study in Nigeria that identified most caregivers having knowledge of prevention of communicable diseases through handwashing (Aigbiremolen et al., 2015).

### 5.1.3 Caregivers' WASH practices

Urban slum dwellers are exposed to poor housing conditions, overcrowding, less educated, low socio-economic status, and inadequate sanitation thus making it difficult to fully implement WASH practices in these areas. This study sought to assess the WASH practices among caregivers of children in Kiandutu Informal Settlement. Good sanitation practices prevent environmental contamination by excreta and also prevent the transmission of pathogens to a new host from faeces of an infected person, thus, avoids diarrhoea and nutritional problems (Freeman et al., 2017).

The study results showed that more than half of the caregivers washed their hands especially after visiting the toilet. However they washed with water only as opposed to using a soap or a bactericidal to help destroy germs. This agrees with a study that observed that few of the respondents used plain water to wash hands after defecation (Sharma et al., 2019). A study in Ethiopia reported that hand-washing using soap significantly reduced diarrhoea prevalence in low-income communities (Hashi et al., 2017). This is a possible explanation as to why method of washing the hands had a significant association with the nutritional status of the children. Majority of the caregivers in this study washed their hands after visiting the latrine which is a critical time and this finding agrees with a study conducted in India (Aliyu et al., 2019).

In this study despite majority of the caregivers having access to a latrine, it was noted that most of the latrines were pit latrines and communal ones within a residential block. It was therefore not surprising that latrine facilities were unimproved, privately owned, and shared among several households. Furthermore, the main reason for this is the insecure tenure in these communities. This contributes to low latrine coverage

thus the communal sharing of latrine facilities leads to poor utilization and maintenance of the same latrines (Isunju et al., 2013). A systematic review report, indicated that households with shared sanitation facilities were poorer than those that did not share (Heijnen et al., 2014). Shared toilet facilities are less hygienic and less accessible than private sanitation facilities according to a report by the Joint Monitoring Programme (JMP) for water supply and sanitation (WHO and UNICEF, 2015). In addition, diarrhoea disease was the most reported disease two weeks prior to the study. A study identified that presence of acute diarrhoea was strongly associated with sharing of a sanitation facility among slum children (Adane et al., 2017). A study in Kisumu on quality of shared sanitation facilities found that they were dirty, and that an increase in the number of households sharing them decreased the quality. Furthermore, pit latrines were of low quality as compared to pour-flush type of sanitation facility with regard to cleanliness (Simiyu et al., 2017). An observation of the hygiene standards of pit latrines in this study showed that they were poor. Reviews conducted by Majorin et al. (2017) and Freeman et al. (2017) found similar findings of child faeces being disposed unsafely with majority of the caregivers disposing on the ground.

In this study, source of drinking water and nutrition status had a significant association. It has been shown that in many low and middle income countries, improved water sources are often contaminated with *Escherichia coli* or thermo tolerant coliforms (Bain et al., 2014; Freeman et al., 2017). In this study, source of drinking water had a significant association with diarrhoea morbidity which also positively influenced the nutrition status. The study identified that more than half of the caregivers did not treat their drinking water before consumption similar findings were reported from India (Kuberan et al., 2015).

The study showed that majority of the households had flies, foul smell and garbage littered around. This could be attributed to the lack of proper disposal of solid waste, which was observed in many cases littered around the household. Findings of a study in India found that, the disposal of garbage close to households was a significant risk factor for high fly densities which in turn associated with acute diarrhoea, if the flies were around sanitary facilities (Collinet-Adler et al., 2015). The study also identified indiscriminate disposal of solid waste in the compounds which could attribute to the flies, similar findings were reported in Ethiopia (Adane et al., 2017). Lack of improved sanitation could increase number of flies in the compound which agrees with a study that found that improved sanitation reduced fly counts (Pickering et al., 2015).

With regard to morbidity in children, more than half of the children were sick two weeks prior to the survey. Diarrhoea disease was the most reported disease of all diseases experienced by the children in the study. Studies show that lack of availability of safe, accessible drinking water, poor hygiene and sanitation practices and poor environmental conditions are the principle causes of diarrhoea among children under five years of age (Bhutta et al., 2013).

#### **5.1.4 Nutrition status of children 6-59 months**

Overall the magnitude of undernutrition was high among children 6-59 months of age based on all the three indices with increasing age: stunting, wasting and underweight. The prevalence was higher than that of the national figure 26, 11 and 4 percent for stunting, underweight and wasting respectively (KDHS, 2014). The stunting prevalence results were similar with the rates identified in a study conducted in Korogocho slums determining feeding practices and high prevalence of malnutrition

in urban slums child care centres that indicated 33.3 percent of the children were stunted (Ivan et al., 2016). However, the study prevalence disagrees with the prevalence revealed by a similar study in the informal settlement among children living with HIV/AIDS by Chege et al., (2016), that gave a prevalence of 17.5, 5.5 and 9.9 percent for stunting, underweight and wasting respectively. In this study, more boys were undernourished than girls in all the studied nutrition indicators, that is stunting, wasting and underweight, and this is in agreement with a study done in Kwale County and Zambia (Ndemwa et al., 2017; Katepa-Bwalya et al., 2015).

Infection has a major role in the etiology of undernutrition because of lower appetite, increased requirements and high energy expenditure, nutrient loss, disruption of the metabolic equilibrium and utilization of nutrients. More than half of the children in this study had suffered a disease two weeks prior to the study. Key to note is that of this diseases the most reported was diarrhoea. More than quarter of the malnourished children had diarrhoea two weeks prior to the data collection which agrees with a study done in Ethiopia (Merel et al., 2017). The high prevalence of undernutrition could be linked to the high morbidity especially in diarrhoea a WASH related disease and the poor WASH conditions in the area. Diarrhoea is highly interlinked with malnutrition and is one of the main causes of under-nutrition in children less than five years of age (WHO, 2018). This can also be emphasized by the environmental enteric dysfunction, in children living in poor WASH conditions, which leads to poor nutrient absorption in their bodies. A study conducted in Tanzania concluded that unsanitary and unhygienic conditions led to undernutrition which agrees with this study (Mshinda et al., 2018)

### 5.1.5 Summary of findings

Most of the caregivers were aged between 20-29 years and majority were mothers of the children. Majority had were secondary school dropouts which would have attributed to most being stay at home mothers. The average monthly income was between Ksh 1000 to Ksh 5000 for most households.

With regard to the level of knowledge levels of caregivers on WASH, the study found the mean knowledge score being on the lower level. The various aspects assessed were importance of handwashing, causes, symptoms and prevention of WASH related diseases. Most of the caregivers had low knowledge on WASH which can highly influence their practice.

The study also sought to establish the WASH practices among the caregivers, it was found that by most of the caregivers practiced Handwash especially after visiting latrines but unfortunately most of them used only water hence the issue of destroying germs is questionable. Majority of the caregivers collected their water from the piped water systems in a timeframe of between 10 to 15 minutes, but most did not treat the water before use with the perception that it is safe for consumption. Observations on the environmental hygiene around the households revealed that there were a lot of sewer water flowing, open dumps and flies within the environment hence contributing to the poor WASH conditions in the area. Most of the caregivers had an access to a latrine majority of them being pit latrines shared among households. Majority of the caregivers too dumped their solid waste in open dumps around their households which was also observed in the environmental hygiene assessment.

With regard to the nutrition status of the children, the prevalence for stunting, underweight, and wasting was 33.1%, 15.1% and 8.8% respectively. Boys were more

undernourished than girls. The child's nutrition status was significantly associated with the caregivers' WASH knowledge scores, water treatment in households, type of latrine used, method of solid waste disposal, handwashing practice and what was used to wash the hands.

## 5.2 Conclusions

All the caregivers had low knowledge score in WASH, hence the need to increase the knowledge levels.

The hygiene and sanitation practices among the caregivers were poor which can be linked with the low and moderate knowledge level in WASH. More than half of the caregivers did not treat drinking water before consumption, majority did not have access to a latrine, most caregivers disposed their child's feces on the ground, the accessible latrines were shared and most of the solid waste was dumped indiscriminately in the compound.

The nutrition status prevalence levels of the children were high and above the Kiambu County and National prevalence hence indicating malnutrition a major public health concern in Kiandutu Informal Settlement. Undernutrition among children below five years in slum areas is influenced by many different factors in which hygiene and sanitation is prevalent.

Poor hygiene and sanitation conditions lead to high prevalence of infections like diarrhoea disease which can result in poor growth through decreased absorption of nutrients and increased requirements thereby contributing to general protein energy malnutrition. Significant associations were established in this study between children nutrition status and the Caregivers' WASH knowledge and practice. The WASH practices that had a significant association with children's nutrition status underweight

were source of drinking water and caregiver's handwashing practice. Caregivers' hand washing practice had a significant association with all the three variables for nutrition status, that is, underweight, stunting and wasting. Level of income in the household as a socio-economic variable also proved significant with the underweight as a nutrition status variable.

### **5.3 Recommendations**

#### **5.3.1 Recommendations for practice**

The study gives the following recommendations:

1. The National and County governments should roll out fully participatory WASH awareness campaigns in areas with poor WASH conditions to raise the low WASH knowledge.
2. The County governments should initiate and monitor community based programs especially in terms of provision of infrastructure supporting WASH especially in informal settlements like: provision of latrines, affordable piped water.
3. Health Care Workers in the County governments should educate caregivers on the linkage between WASH and poor nutrition status

#### **5.3.2 Recommendation for Policy**

All policies addressing malnutrition should incorporate WASH components in all nutrition programs in the community since the study already showed a linkage between the two.

### **5.3.3 Recommendations for further research**

Further studies should be conducted using a longitudinal study design to investigate whether improving WASH conditions is an effective measure in reducing malnutrition in children 6-59 months.

Similar study can also be conducted on the early breastfeeding days of a baby to establish if WASH can have an effect on the nutrition status of the child during this stage.

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## APPENDICES

### **Appendix I: Informed consent form**

My name is Peris Mwangi. I am a Master student from Kenyatta University. I am conducting a research on caregiver's sanitation and personal hygiene association with undernutrition among children 6-59 months in Kiandutu Informal Settlement, Kiambu County. The main objective is to assess knowledge and practice of proper sanitation and personal hygiene among caregivers of children 6-59 months. The information will be used by the Ministry of Health to improve nutrition status of children with regards to improved WASH in all regions of Kenya. This informed consent is for caregivers of children in Kiandutu Informal Settlement, and who we are inviting to participate in research. Your participation is entirely voluntary. There may be some words that you do not understand; Please ask me to stop as we go through the information and I will take time to explain. If you have any questions you can ask me. Hygiene is one of the key areas that make a healthy community. We believe you can help us by telling us what you know about sanitation and hygiene practices in reference to children's health and safety.

### **Procedures to be followed:**

#### **Care and Protection of research participants:**

Participation in this study may either require that you fill out a questionnaire which will be provided or it can be read to you and you can say out loud the answer you want me to write down. If you do not wish to answer any of the questions included in the questionnaire, you may skip and move on to the next question. The information recorded is confidential and your name will not be included in the forms. Only a number will identify you and no one else except me and my research assistants will have access to the information. In case of any uncomfortable questions, you have the right to refuse participation in this study. Please remember that participation in the study is voluntary. You may also ask questions related to the study anytime. You may refuse to respond to any questions and you may stop the interview at any time. You may also stop being in the study at any time without any consequences.

#### **Discomforts and risks:**

There is a risk that you may share some personal or confidential information by chance or that you may feel uncomfortable talking about some topics. However, we do not wish for this to happen. If this happens you may refuse to answer or skip these questions if you choose. You may also stop the interview at any time. The interview may take approximately 15-30 minutes of your time.

#### **Benefits**

There will be no direct benefit to you but your participation is likely to help us find out more about local household food hygiene practices and may also assist the Ministry of Health learn how to improve household sanitation and hygiene status and in turn help reduce the high rates of malnutrition in children 6-59 months in our Communities and the country at large.

#### **Confidentiality of research participants:**

The interview will be conducted with confidentiality. Any information about you will have a number instead of your name and only the researchers will have this information. Nothing you tell us today will be shared with anybody outside the research team, and nothing will be attributed to your name. Your participation in this

research is also entirely voluntary. It is your choice whether you participate or not, and the choice you make will not have a bearing on your job or any work-related evaluations or reports. You may change your mind later and stop participating even if you had agreed earlier.

**Community considerations:**

The research being done may draw attention, and if you participate you may be asked questions by other people in the community. We will not be sharing information about you to anyone out of the research team. The information collected will be private even though the study is based on health of the public or community at large.

**Contact information:**

If you have any questions you may contact my Supervisors, Dr.Oyore on 0722335878 or Dr.Njogu on 0722862052 or the Kenyatta University Ethical review committee secretariat on [kuerc@ku.ac.ke](mailto:kuerc@ku.ac.ke).

**Participant's statement:** The above information regarding my participation in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time.

Name of participant

Signature

Date

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Investigators statement:** I, the undersigned, have explained to the volunteer in a language he/she understands the procedures to be followed in the study.

Name of Investigator

Signature

Date

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Appendix II: Questionnaire

### Questionnaire tool for caregivers

#### SECTION 1: TOOL IDENTIFICATION DETAILS

Q No	Questionnaire number	
Q101	SUB-COUNTY	
Q107	Date of Interview	
Q108	Time interview started	
Q109	Time interview ended	

#### SECTION 2: BACKGROUND INFORMATION OF RESPONDENT

Q201	Does this household have a child 6-59 months?	[1] Yes [2] No	If 2 end interview
Q202	How many children are below 5 years?	_____	
Q203	How old is the youngest child?(in months)	_____	
Q204	Sex of the youngest child	[1] Male [2] Female	
Q205	What is your relationship with the child?	[1] Mother [2] Father [3] Caregiver [4] Other (specify).....	
Q206	Sex	[1] Male [2] Female	
Q207	Age(years)	[1] 0 – 19 years [2] 20 – 29 years [3] 30 – 39 years [4] 40 – 49 years [5] Above 50 years	
Q208	What is the highest level of education completed?	[1] None [2] Primary education incomplete [3] Primary education complete [4] Secondary education incomplete [5] Secondary education complete [6] Tertiary education	
Q209	What is your main economic activity (occupation)	[1] Unemployed [2] Self-employed [3] Employed [4] Other (specify).....	
Q210	What is the average monthly income of this household?	[1] Below Ksh. 10,000 [2] Ksh. 10,001- 25,000 [3] Ksh. 25,001 – 50,000 [4] Above Ksh. 50,000	

Q211	What is your religion?	[1] Christian [2] Muslim [3] Traditional [4] None [5] Other (specify).....	
<b>SECTION 3: KNOWLEDGE ON WASH</b>			
Q301	What water treatment methods do you know of?	[1] None [2] Treat with chemical [3] Boiling [4] Distilling	
Q302	What diseases can one get by taking dirty water dirty water	[1] Diarrhoea [2] Scabies [3] Ring worms [4] Cholera	
Q303	Why is it important to wash hands?	[1] Prevent disease [2] Smell nice [3] Cleanliness [4] Others (specify).....	
Q304	How can diarrhoea be prevented in children below 5 years? (Circle all mentioned)	[1] Washing hands before eating [2] Eating clean food/fruits [3] Drinking safe/clean water [4] Boiling drinking water [5] Using latrines [6] Covering food [7] Keeping nails short [8] Washing hands after toilet [9] Clean environment	
Q305	What are the symptoms of worm infestation in children? (Circle all mentioned)	[1] Swollen stomach [2] Body Weakness [3] Diarrhoea [4] Stomach pain/ache [5] Scratching/Itchy skin [6] Lack of appetite [7] Persistent hunger [8] Weight loss [9] Brownish hair [10] Worms seen in stool.....	
Q306	How can we prevent worm infestation in children? (Circle all mentioned)	[1] Avoid eating soil [2] Avoid eating dirty food [3] Drink boiled water [4] Wash hands before eating [5] Wash hands after using toilet [6] Wash hands before cooking	

		[7] Cut nails [8] Eat well cooked food [9] Use latrines [10] Other: (Specify).....	
<b>Q307</b>	Can poor sanitation and hygiene affect the nutrition status of children?	[1] Yes [2] No	

**SECTION 4: CHILD MORBIDITY**

<b>Q401</b>	Has the last born child suffered any disease in the last 2 weeks? ( <b>confirm from the mother/child booklet</b> )	[1] Yes [2] No	
<b>Q402</b>	If yes, which disease (Multiple answers allowed)	[1] Diarrhoea diseases [2] Typhoid related fevers [3] Eye infections [4] Malaria [5] Worm infections [6] Skin infections [7] Others specify	
<b>Q403</b>	Has the child been immunized against rotavirus?(ask for those who mention diarrhoea)		

**SECTION 5: HYGIENE AND SANITATION PRACTICES WATER SOURCE AND TREATMENT**

<b>Q501</b>	What is the main source of water in your household?	[1] Piped municipal water [2] Private water vendors [3] Borehole [4] Unprotected shallow wells [5] Other (specify) .....	
<b>Q502</b>	What time does it take to reach the water source?	[1] < 5 minutes [2] 5-15minutes [3] >15 minutes	
<b>Q503</b>	Do you treat the water before use?	[1] Yes [2] No	
<b>Q504</b>	What methods do you use to treat water for drinking?	[1] Boiling [2] Water-guard tablets [3] Filtering [4] Other (specify).....	
<b>Q505</b>	What type of container do you use for storing water for	[1] Wide open mouth without cover	

	drinking especially for the child? (observe)	[2] Wide open mouth with cover [3] Narrow neck without cover [4] Narrow neck with cover	
Q506	Do you have a water storage container?	[1] Yes [2] No	
Q507	What is the type of container storing the water?	[1] Metal [2] Plastic [3] Other	
Q508	Where is the water container stored?	[1] Inside the house [2] Outside the house	
Q509	What is the container's sanitary state?	[1] Clean [2] Dirty	
Q510	Is the water storage container also being used to store any other material?	[1] Yes [2] No	
Q511	Is the water container covered with lid?	[1] Yes [2] No	
Q512	Do other people other than the family members access the storage container and the surrounding	[1] Yes [2] No	
Q513	What is the sanitary state of the receptacles that may be used to draw water from the container?	[1] Clean [2] Dirty	
Q514	Is the water storage container used for storing any other liquid/material?	[1] Yes [2] No	
<b>HOUSEHOLDSANITATION</b>			
Q515	Does the household have an access to a latrine/toilet?	[1] Yes [2] No	
Q516	Is the latrine/toilet?	[1] Private [2] Communal(within a plot) [3] Commercial	
Q517	Where does your child relieve him/herself more often?	[1] In the diaper [2] In the napkin [3] On the ground [4] In the latrine	

		[5]Other (specify).....	
<b>Q518</b>	How do you dispose your child's excreta?	[1] Refuse pit [2] Drainage line [3] Bushes [4]Other (specify).....	
<b>Q519</b>	How do you dispose solid waste in the household?	[1] Uncovered dustbin [2] Covered dustbin [3] Communal dustbin [4] Open ground [5]Other (specific).....	
<b>HANDWASHING</b>			
<b>Q520</b>	Do you have a functional hand washing sink in this household? (observe)	[1] Yes [2] No	
<b>Q521</b>	Does the hand washing facility have soap?	[1] Yes [2] No	
<b>Q522</b>	When do you wash your hands?(multiple answers allowed)	[1] After visiting the toilet [2] Before preparing food [3] After handling garbage [4] Before feeding the child [5] After touching excreta [6]Others (specify).....	
<b>Q523</b>	When do you wash your child's hands? (multiple answers allowed)	[1] After visiting the toilet [2] Before feeding [3] After touching excreta [4]Others (specify).....	
<b>Q524</b>	What do you use to wash hands?	[1] Soap and water [2] Water only [3] Ash and water [4]Other (specify).....	
<b>FOOD HYGIENE</b>			
<b>Q525</b>	Where do you prepare your food?	[1] On the table [2] On the floor	
<b>Q526</b>	Do you re-heat the stored food before giving the child?	[1] Yes [2] No	
<b>Q527</b>	How do you store your child's food?	[1] In an uncovered container at room temperature [2] In a covered container at room temperature [3] In a refrigerator with a covered container [4] In a refrigerator with an uncovered container [5]Other (specify).....	

<b>Q528</b>	Do you separate raw and cooked food during storage?	[1] Yes [2] No	
<b>Q531</b>	Do you thoroughly clean fruits and vegetables before consuming?	[1] Yes [2] No	
<b>ENVIRONMENTAL HYGIENE OBSERVATION</b>			
<b>Q532</b>	Observe general cleanliness around the house	Smell	[1] Yes [2] No
		Flies	[1] Yes [2] No
		Feaces around the house	[1] Yes [2] No
		Blocked drain	[1] Yes [2] No
		Uncontrolled open dump site	[1] Yes [2] No

**ANTHROPOMETRIC DATA**

Height \_\_\_\_\_ **cm**  
 Weight \_\_\_\_\_ **kgs**  
 Muac \_\_\_\_\_ **cm**  
 Does the child have oedema? [1] Yes  
 [2] No

**THANK YOU VERY MUCH FOR YOUR TIME**

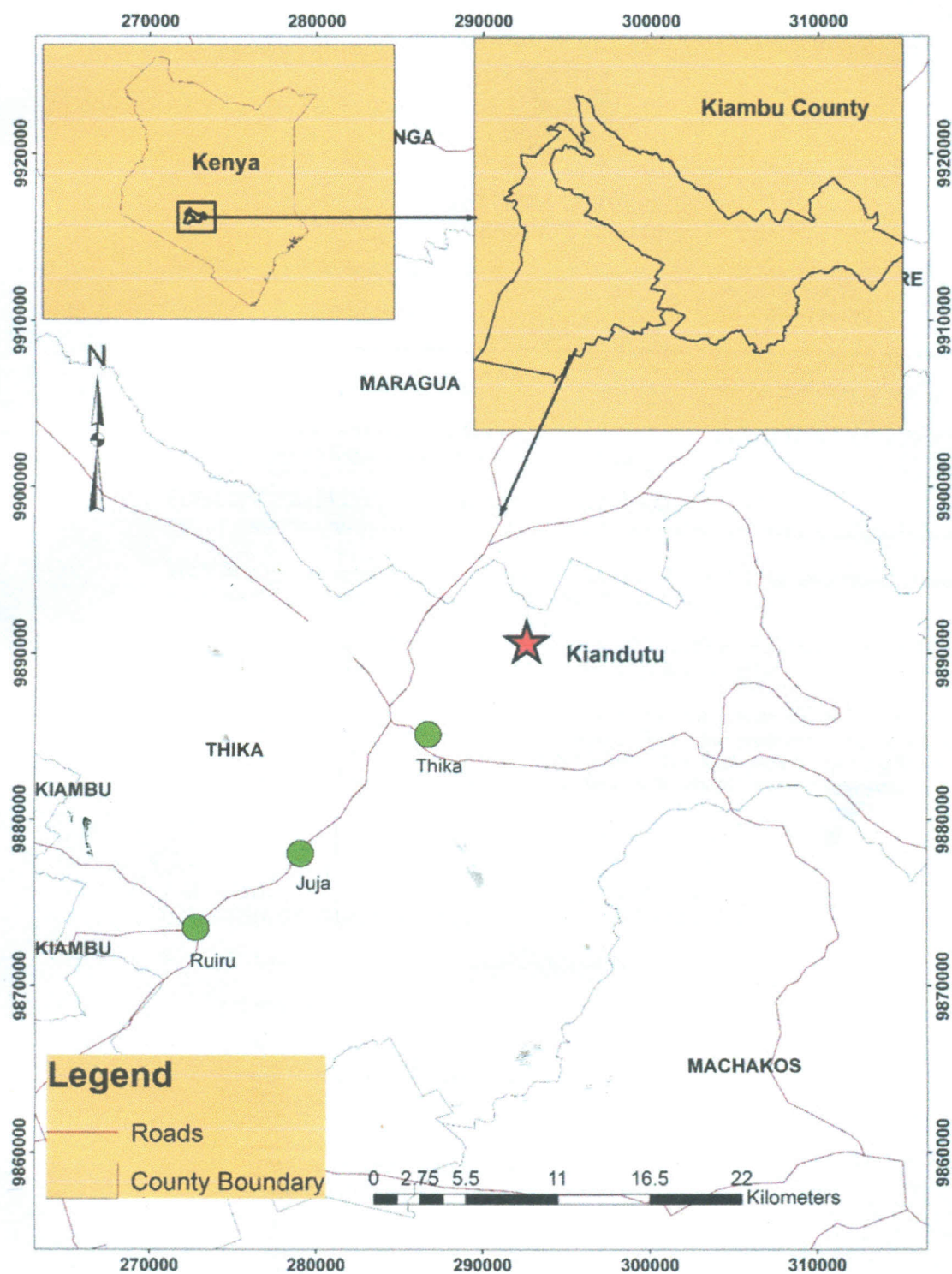
**Appendix III: Focus Group Discussion (FGD) guide for CHVs and caregivers**

1. Which safe sanitation and hygiene practices do you know?
2. What are the common sanitation and hygiene practices in households among the caregivers in this community?
3. What are the barriers to proper caregiver's sanitation and personal hygiene in households?
4. When do you say a child is undernourished?(Probe for the various types of undernutrition)
5. Can poor sanitation and hygiene lead to undernutrition in children? (Probe on the relationship)
6. Have you ever been trained on sanitation and hygiene practices in households? (probe contents of the training if any)
7. What are the common diseases that children 6-59 months suffer from in Kiandutu Informal Settlement?

**Appendix IV: Key Informant Interview (KII) guide for CHEW, Health Centre Incharge and Nutritionist Incharge**

1. Do you spread messages on proper sanitation and personal hygiene in households?  
(Probe on the messages and where disseminated)
2. Do caregivers in Kiandutu Settlement practice proper sanitation and hygiene practices?
3. What could be the barriers to proper sanitation and hygiene in households in Kiandutu Informal Settlement?
4. Do you think poor sanitation and hygiene in households can be linked to undernutrition in children 6-59 months in Kiandutu Informal Settlement?
5. Have you ever been trained on proper sanitation and hygiene practices in households?(probe contents of the training if any)
6. What are the common diseases that children 6-59 months suffer from in Kiandutu Informal Settlement?

Appendix V: Map of the study area



## Appendix VI: Graduate School Proposal Approval



### KENYATTA UNIVERSITY GRADUATE SCHOOL

E-mail: [dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)

P.O. Box 43844, 00100

Website: [www.ku.ac.ke](http://www.ku.ac.ke)

NAIROBI, KENYA

Tel. 020-8704150

#### Internal Memo

FROM: Dean, Graduate School

DATE: 29<sup>th</sup> May, 2018

TO: Ms. Peris Wanjiku Mwangi  
C/o Department of Community Health

REF: Q57/27406/2014

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge receipt of your Research Proposal after fulfilling recommendations raised by the Graduate School Board of 9<sup>th</sup> May, 2018.

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

JULIA GITU

FOR: DEAN, GRADUATE SCHOOL

CC. Chairman, Department of Community Health

#### Supervisors:

1. Dr. John Paul Oyore  
C/o Department of Community Health  
Kenyatta University
2. Dr. Eunice Njogu  
C/o Department of Food, Nutrition & Dietetics  
Kenyatta University

## Appendix VII: KUERC Permit



KENYATTA UNIVERSITY  
ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575  
Email: [kuerc.chairman@ku.ac.ke](mailto:kuerc.chairman@ku.ac.ke)  
[kuerc.secretary@ku.ac.ke](mailto:kuerc.secretary@ku.ac.ke)  
Website: [www.ku.ac.ke](http://www.ku.ac.ke)

P. O. Box 43844,  
Nairobi, 00100  
Tel: 8710901/12

Our Ref: KU/ERC/ APPROVAL/VOL.1 (191)

Date: 16<sup>th</sup> August, 2018

Peris Wanjiku Mwangi  
P.O Box 43844-00100  
NAIROBI

Dear Peris,

APPLICATION NUMBER: PKU/861/1926 "CAREGIVERS HYGIENE AND SANITATION STATUS ASSOCIATED WITH NUTRITIOUS AMONG CHILDREN 6-59 MONTHS IN KIANDUTU INFORMAL SETTLEMENTS KIAMBU COUNTY, KENYA"

### 1. IDENTIFICATION OF PROTOCOL

The application before the committee is with a research topic "Caregivers Hygiene And Sanitation Status Associated With Nutritious Among Children 6-59 Months In Kiandutu Informal Settlements Kiambu County Kenya" received on 25<sup>th</sup> June, 2018 and discussed on 14<sup>th</sup> August, 2018.

### 2. APPLICANT

Peris Wanjiku Mwangi

### 3. SITE

Kiandutu Informal Settlements Kiambu County, Kenya

### 4. DECISION

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines and **APPROVED** that the research may proceed for a period of **ONE** year from **14<sup>th</sup> August, 2018**.

Appendix VIII: NACOSTI Permit

**THIS IS TO CERTIFY THAT:**  
**MU. PERIE MANGOKU HIRAYOTI**  
**of KENYATTA UNIVERSITY, 43044-100**  
**NARDBI has been permitted to conduct**  
**research in Kiambu County**

**on the topic: CAREGIVERS' HYGIENE**  
**AND SANITATION STATUS ASSOCIATED**  
**WITH NUTRITION STATUS AMONG**  
**CHILDREN 6-59 MONTHS IN KIANDUYU**  
**INFORMAL SETTLEMENTS, NYAMBUU**  
**COUNTY, KENYA**

**for the period ending:**  
**13th September, 2018**

**Permit No : NACOSTI/P/28/35018/25125**  
**Date Of Issue : 18th September, 2018**  
**Fee Received :Ksh 1000**



  
Applicant's  
Signature

  
Director General  
National Commission for Science,  
Technology & Innovation

## Appendix IX: Kiambu County Permit

COUNTY GOVERNMENT OF KIAMBU  
DEPARTMENT OF HEALTH SERVICES

All correspondence should be addressed to HEAD  
HRDU – HEALTH DEPARTMENT  
Email address: [mndiritu@gmail.com](mailto:mndiritu@gmail.com)  
[mkwasa@hvc.com](mailto:mkwasa@hvc.com)  
Tel. Nos: 0721641516  
0721974633



HEALTH RESEARCH AND DEVELOPMENT  
UNIT  
P. O. BOX 2344 – 00900  
KIAMBU

---

 Ref No: KBU/HRDU/GEN/VOL 1/57

 Date: 27<sup>th</sup> September 2018

TO WHOM IT MAY CONCERN

 RE: CLEARANCE TO CONDUCT RESEARCH IN KIAMBU COUNTY

Kindly note that we have received a request by Ms. Peris Wanjiku Mwangi of Kenyatta University to carry out research in Kiambu County, the research topic being on "Caregivers Hygiene And Sanitation Status Associated With Nutrition Among Children 6-59 months in Kiandutu Informal Settlements, Kiambu county, Kenya "

We have duly inspected her documents and found that she has been cleared by the NACOSTI to carry out the research for a period ending **13<sup>th</sup> September 2019**. She thus does not need any further clearance with another regulatory body in order to conduct research within the county of Kiambu.

However, it is incumbent upon the institution where she is carrying out research to ensure that she receives adequate supervision during the process of conducting the research. This note also accords her the duty to provide a feedback on her research to the county at the conclusion of her research.

DR. KWASA MAGOMA  
FOR: HEAD, HEALTH RESEARCH DEVELOPMENT UNIT  
KIAMBU COUNTY